

**A STUDY OF THE APPRAISAL OF MATHEMATICS
TEACHERS IN GHANA**

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**Thesis submitted to the University of London
For the Degree of Ph.D.
1997**

**University of London
Institute of Education
Mathematical Sciences**



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ABSTRACT

Teacher appraisal may provide opportunities for teachers to improve the quality of their teaching, thereby increasing the quality of pupil learning. Literature on teacher appraisal in Ghana indicates that the appraisal system is designed to serve both formative and summative purposes. The ability of the appraisal system to provide opportunities for mathematics teachers to develop professionally is the subject of this study.

The study aims to:

- a) identify the nature and purposes of Teacher Appraisal in Ghana (TAG);
- b) examine the validity of existing methods of TAG specifically by:
 - i ... examining the potential of the appraisal system to help mathematics teachers improve their teaching of mathematics;
 - ii... finding which variables are significantly related to Ghanaian secondary mathematics teachers' views of teacher appraisal in Ghana and its ability to help them improve their teaching of mathematics
- c) identify the implications of any changes in the existing teacher appraisal systems for Ghana's educational policies.

441 secondary mathematics teachers participated. 193 of these teach the subject at the junior secondary level and 248 teach it at the senior secondary level. In addition, 44 Ghana Education Service officials (and 6 heads of secondary schools) who appraise mathematics teachers were sampled. Questionnaires and interviews were used to collect teachers' and appraisers' perceptions of the appraisal system. Additionally, some appraisers were observed while at work. The results of the study showed that many education officials in Ghana who appraise mathematics teachers, and who are required to 'help' mathematics teachers improve their work, have little or no training in secondary school mathematics teaching or its appraisal.

Regarding mathematics teachers' perception of the appraisal system, highly significant negative correlations were found *between* their perceived professional support *and* rank and professional status at the senior secondary level; whereas relatively weak positive correlations were found *between* perceived support *and* last appraisal session and rank at the junior secondary level. Thus, the results indicated a dramatic difference between junior secondary and senior secondary mathematics teachers in their perceptions about the potential of the teacher appraisal system in Ghana to help them improve their teaching of mathematics. Senior secondary mathematics teachers were generally more pessimistic about the potential of the appraisal system to help them improve their work

than their junior secondary counterparts.

Putting the results at the junior secondary and senior secondary levels together, the study found professional status to be the single most important determinant of teachers' attitude to teacher appraisal in Ghana as a formative process. The above differences between junior secondary and senior secondary respondents thus reflected the differences in the two groups of teachers' academic and professional qualifications in mathematics.

The findings of the study lead to the conclusion that the teacher appraisal system in Ghana cannot, in its present form, provide opportunities for mathematics teachers to develop professionally. The implications of the findings are discussed.

ACKNOWLEDGEMENTS

I am very grateful to my supervisors Professors Alison Wolf and Richard Noss for the interest they showed in my work and the invaluable help, advice and encouragement they gave me throughout the course.

I acknowledge the co-operation of all those who assisted me in this study, particularly the Directors of Education, the headmasters/mistresses and the mathematics teachers who took part in the study.

Finally, I am deeply grateful to my family for supporting me in various ways throughout my studies and for the sacrifices they made to make the successful completion of this study possible.

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CHAPTER 1

AN OVERVIEW OF THE STUDY

1.1 Introduction

Ghana, once known as the Gold Coast, is a former British Colony on the West Coast of Africa. Located on the Gulf of Guinea, Ghana is bordered by three Francophone countries: Cote d'Ivoire (Ivory Coast) and Burkina Faso (Upper Volta) on the west, Burkina Faso (Upper Volta) on the north, and Togo on the east. The country occupies an area of about 240,000 square kilometres (which is slightly smaller than the UK) and has a population of about 15 million. Like all the other countries who were once under British rule, Ghana inherited, at the time she gained independence from British rule in 1957, an education system built on the British model of education. Since then, several steps have been taken, without much success, to make education more functional to serve Ghanaian development aspirations. Indeed, various Ghanaian governments have tacitly supported educational practices which are in close conformity with educational developments in the United Kingdom. However, there is one area where the Ghanaian system appears to differ conspicuously from the British system. This is the area of teacher appraisal, which is the subject of the present study.

Teacher appraisal, may be defined as the attempt by self and/or others to analyse and assess a range of professional knowledge, skills, and attitudes which are relevant to the performance of a teacher's role within an institution or agency (Andreson , Powel & Smith, 1987). Teacher appraisal can be both retrospective and prospective, looking back at what has or has not been achieved, taking stock of the present and then planning some pathways which will help the individual teacher's professional development as well as (her/his) professional 'accountability'. Used in the above context, teacher appraisal becomes synonymous with teacher evaluation, which also involves stock-taking and recommendations for improvements. Throughout this thesis the two words (i.e. appraisal and evaluation) are used interchangeably and they mean almost the same thing. In this chapter, I will present an overview of the study.

1.2 The Problem

Teachers form the most important (and perhaps the most expensive) resource in education, therefore there is no gainsaying that any educational system is as good as the

teachers in it. It follows that the main way of improving the quality of learning that takes place in any educational system is to improve the quality of teaching in that system. One way of improving the quality of teaching is by providing teachers with the opportunity to develop professionally through the process of appraisal. Yet the literature on TAG suggests that the appraisal process rarely does improve teaching quality. In the light of the 'reduction' in education in Ghana, this observation has serious implications for the implementation of the innovation in the Ghanaian education system.

Ghana is currently implementing a new system of education which aims to make the latter both cost-effective and accessible to all Ghanaian children of school going age. The programme took off in 1987. Although the period of university education has been extended from three to four years, pre-university education has been shortened from 17 to 13 years: six years primary schooling; three of junior secondary; and four years of senior secondary : the 6-3-4 system. Thus in an attempt to improve the access to basic education in Ghana, the Ghanaian government has reduced the 'quantity' of pre university education and increased that of university education. Considering that only 25 percent of pupils who go through the 6-3-4 system will gain admission to either the universities or any of the other tertiary institutions such as the polytechnics and teacher training colleges (National Report, 1990), for the majority of Ghanaian children, the formal education they are to receive for 13 years or less - only 50 percent of pupils from the junior secondary school will gain admission to senior secondary schools (National Report, op. cit.) - should be of a quality that will adequately prepare them for adult life.

The importance of school mathematics in the development of science and technology has been stressed by various Ghanaian governments, and as shown in chapter 2, mathematics now determines every Ghanaian child's social destination. If indeed every Ghanaian child is to be given the opportunity to participate fully in mathematics education at least at the basic education level, then the teaching of mathematics in Ghanaian schools must be improved. One way of achieving this goal, is by concentrating efforts on the process by which mathematics teachers are appraised in order to find out ways in which that the appraisal process can help mathematics teachers to improve their work. As part of the education reforms, changes are claimed to have been made in the appraisal system to enhance its ability to help teachers to improve their work (Gokah, 1993). The present study looks at how well the appraisal system is in fact 'working', and constitutes a small step in that direction.

The study concentrates on the appraisal of teachers of mathematics in Ghanaian secondary schools where mathematics is found most difficult both to teach and to learn (Boakye & Oxenham, 1982) and where very little research has been done by others, albeit a review of the literature shows some studies on the supervision of school teachers in Ghana as well as in other countries. It seeks to examine the validity of the teacher appraisal system in Ghana and to identify some of the factors that are relevant to Ghanaian secondary mathematics teachers' perceptions of the validity of TAG as a formative process.

1.3 Aims of the Study

The study aims to:

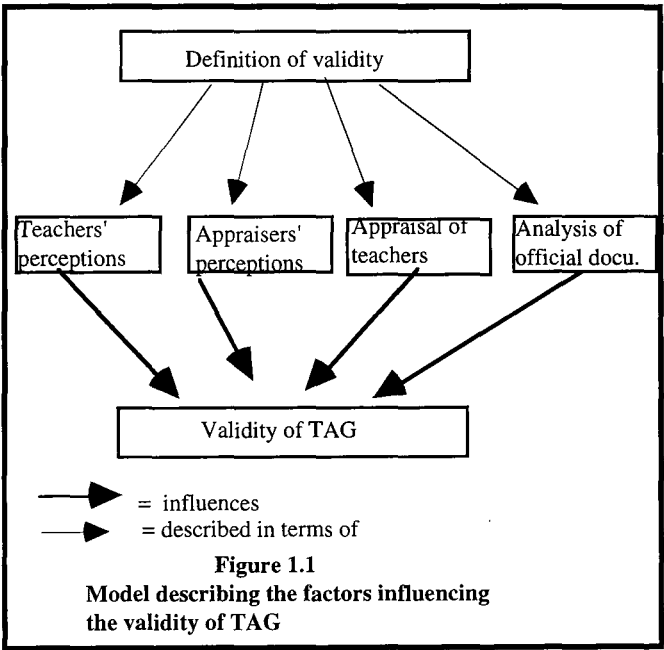
- a) identify the nature and purposes of Teacher Appraisal in Ghana (TAG);
- b) examine the validity of existing methods of TAG specifically by:
 - i ... examining the potential of the appraisal system to help mathematics teachers improve their teaching of mathematics;
 - ii... finding which variables are significantly related to Ghanaian secondary mathematics teachers' views of teacher appraisal in Ghana and its ability to help them improve their teaching of mathematics
- c) identify the implications of any changes in the existing teacher appraisal system for Ghana's educational policies.

Bailey (1981) has argued that what an institution requires from its staff will generally depend on the goals of that institution and that appraisal can be a powerful tool for establishing the institution's vision and encouraging staff towards its achievement. He argues further that if institutional aims are to be followed, then the appraisal scheme should establish the degree to which these aims need to be followed. Relating this to the present study, it is important to establish the nature and purposes of the teacher appraisal system(s) in Ghana before one can comment on the procedures that are employed in pursuance of those purposes. Having identified the purposes of the appraisal system, one can then go on to look at the instrument and procedures used in pursuance of the goals of the system to see how valid they are.

In examining the validity of the instruments and procedures that are used to further the goals of teacher appraisal in Ghana, the following definition of validity will be used. That is, *validity* is the extent to which the goals of appraisal system are likely to be achieved taking into consideration what goes on by way of appraisal as well as the

perceptions of all the parties involved in the appraisal process.

As the present study is about the potential of the teacher appraisal process to help mathematics teachers improve their teaching of mathematics, it included in the validity judgement, the perceptions of both mathematics teachers and their appraisers of the appraisal system’s potential to help the former improve their work. Additionally, validity was measured in terms of the degree of match or mismatch between what valid appraisal of mathematics teachers might include and how Ghanaian secondary mathematics teachers are actually appraised. Other relevant evidence such as the analysis of official documents on teacher appraisal also informed the final conclusions about the validity of the teacher appraisal system in Ghana. The factors taken into account in arriving at the conclusions about the system’s validity are presented in model (Figure 1.1) below.



Many authors (e.g. Scriven, 1990) have highlighted the difficulty in making obvious how teacher appraisal can be reliably and validly measured. Some of the reasons for the difficulty are the differences that usually exist between the perceptions of appraisal schemes held by the different parties involved. Indeed, previous research (e.g. Wise et. al., 1984) suggests that productive teacher appraisal requires not only good relationship between teachers and their appraisers, but an understanding and acceptance of the appraisal process. One of the major influences on appraisee-appraiser relationship is the demand and expectations placed on them by the appraisal process. It

is therefore important, in a study like the present one, to ascertain and compare the views, about the appraisal scheme, of teachers and their appraisers in order to see if the above relationship can be explained in terms of the similarities and/or differences in their perceptions. The present study therefore compares appraisers' perceptions of one of the outcomes of appraisal - promotion - with those of appraisees and examines the degree of match or mismatch between the two sets of perceptions and how this can affect mathematics teachers' perceptions of the appraisal system's potential to help them improve their work.

In addition to examining the validity of the appraisal system from mathematics teachers' and their appraisers' points of view, the study also identifies a number of variables which are significantly related to mathematics teachers' views of the appraisal system and its potential to help them improve their work. Using teachers' perceptions of the system's potential to help them improve their work (i.e. their perceived support from the organisation which appraises them - the Ghana Education Service) as the main dependent variable (see below), a number of hypotheses were formulated and tested using certain teacher characteristics and other variables as the independent variables. The hypotheses were thus used to examine the validity of the teacher appraisal process from the point of view of different categories of mathematics teachers at the two different levels of education considered in the present study namely, junior secondary and senior secondary levels.

A major advantage of using the hypotheses is that they helped to identify which groups of teachers see the appraisal system in a positive light and which groups see it in a negative light. Thus, to the extent that teachers' perceived validity of the appraisal system influences ways of finding a 'solution' to the problem of helping teachers to improve their teaching of mathematics, the hypotheses might help identify and indicate what sort of changes would be most productive at different levels of the system. Consequently, the hypotheses form a major part of the present study.

1.4 Dependent Variable

The main dependent variable used in the formulation of the hypotheses was perceived organisational or professional support, which I describe below. I also describe below why this variable was chosen for the present study.

Literature on teacher evaluation in Ghana (e.g. Bame 1991; Gokah, 1993) suggests that, a single system of teacher appraisal is used for both of the two most frequently

cited primary purposes of personnel appraisal, namely accountability and professional growth. These two purposes are discussed in detail in chapter 3 and it suffices to say that the accountability (or summative) dimension reflects the need to determine whether a professional is competent in order to ensure that services delivered are safe and effective (e.g. Stiggins & Duke, 1988) whereas the professional growth (or formative) dimension reflects the need for development of the individual (e.g. Latham & Wexley, 1982).

Writers like Nuttall (1986) have argued that summative and formative purposes of appraisal can co-exist within the same scheme. Fullan (1991) has also noted that "combining individual and institutional development has its tensions, but the message.... should be abundantly clear. You cannot have one without the other" (p.349).

Yet McGreal (1988) argued that multiple purposes of evaluation can be successfully met with a single evaluation system *only* when the system is viewed as one component of a larger mission: that of furthering the goals of the organisation. If the dynamic relationship between the individual and the organisation is healthy, then what is good for the organisation must also be good for the individual, and vice versa. Indeed, Getzel and Guba (1957), in their classical model of social behaviour and the administrative process, described this dynamic relationship as one that fuses the prevailing interests of the institution with those of the individual:

Since the goals of the social system must be carried out, it is obviously necessary to make explicit the roles and expectations required to achieve the goals. And, since the roles and expectations will be implemented by flesh - and - blood people with needs to be met, the personalities and dispositions of these people must be taken into account (Getzel and Guba ,op cit., pp 437-438, my emphasis)

Such an orientation enhances the ability of both the individual and the institution to achieve desired goals and consequently encourages a satisfying state of affairs within the organisation and among its respective employees (Little, 1993; March & Simons 1993).

If teacher appraisal is to provide a meaningful solution to the problem of helping teachers to improve their work, then it is imperative that Ghanaian teachers see the Ghana Education Service in the light described above. This is why the concept of perceived organisational support is central to the present study. It must be emphasised further that in any system of appraisal, even if a single purpose is identified, those involved may see the purpose differently - senior management, for example may see it

in terms of their need to ‘manage’ staff whatever the purpose of the appraisal is, whilst junior staff in their hierarchies may see it more in terms of their own personal development. These differences may be exacerbated when a single system is used for the dual purposes (of appraisal) as the literature suggests is the case in Ghana.

In such circumstances, and in view of the limited resources available to the Ghana Education Service, it is important to identify which teacher characteristics (and other variables) are significantly related to teachers' perceptions of the appraisal process. Hence the importance of considering teachers' *perceived validity* of the teacher appraisal system in Ghana.

The question then is, to what extent is the present teacher appraisal system in Ghana achieving the dual purpose of helping teachers to improve their work and at the same time making judgements on their work for summative purposes? The present study assessed how well the dual role is being performed by the system.

1.5 Issues informing the hypotheses

To gain clear insights into the appraisal of mathematics teachers in Ghana as well as find out which teacher variables are significantly related to mathematics teachers' perceived support, a number of working hypotheses were formulated. These hypotheses were based on some of the issues which teacher appraisal ought to address. In other words, they were based on some of the gaps in the literature on teacher appraisal which need filling. The hypotheses are discussed in detail in chapter 5 and will only be listed here:

The impact of performance appraisal on individual and organisational effectiveness has been the subject of a number of studies in appraisal (e.g. Larson & Callan, 1990). One important issue which has been investigated in previous appraisal studies is whether employees' perceived impact of appraisal depends on whether or not they have actually experienced the appraisal process (see Graen, 1976, for example). An equally important issue that follows from the last one is what the implications of any relationship between one's perceived impact of performance appraisal and one's experience of the appraisal process are. It was considered relevant to investigate the above relationship and its implication(s) in the present study. This is because any differences between the perceived impact of teacher appraisal in Ghana of mathematics teachers who have been appraised and that of those who have not been appraised can help describe the teacher appraisal system in Ghana. There is no gainsaying that it is

only when the system has been (reasonably) accurately described that one can infer whether or not it can actually help mathematics teachers improve their work.

Another issue which is of great importance in performance appraisal is the relationship between the appraiser and appraisee. This relationship can influence the perceptions of both appraisers and appraisees of the appraisal process. The differences in the perceptions of the appraisal process of both appraisers and appraisees can in turn influence the latter's perceived impact of the appraisal process. It is thus suggested that one's perceived impact of an appraisal system may not only depend on whether or not one has gone through the experience of being appraised, but on the relationship between one and one's appraiser. With regard to the present study, it is reasonable to suggest that a teacher's perceived impact of the appraisal system could be influenced by who appraises the teacher generally, and who last appraised her or him in particular. Here too, any relationship between teachers' perceptions (of the appraisal process) and their *last appraisal experience* can help describe the teacher appraisal system in Ghana.

A third issue, which relates more to summative appraisal than to formative appraisal is that of the level of training appraisers receive to enable them meet the required 'standards' in summative appraisals. It is suggested, as far as the present study is concerned, that the level of training teachers receive for the above purpose can also influence their perception of the appraisal process. As in the case of the above issues, the differences between the perceptions of teachers who have received training to enable them meet summative appraisal criteria and those of their 'non-trained' counterparts can throw some light on summative appraisals in the Ghana Education Service. It follows that the relationship between teachers' *rank* in the GES and their perceptions of the appraisal system can also throw some light on (summative) teacher appraisals in Ghana, since the training teachers receive might help them clear the promotion bar.

Some other important issues which the literature on teacher appraisal in particular has been rather silent on include the influence of teachers' experience (both in quantitative and qualitative terms) on their perceptions of teacher appraisal systems. This is in spite of the fact that a good number of studies have looked at the relationship between *experience* and '*expertise*' (see Berliner, 1986, for example). It was considered relevant, in the present study, to investigate the relationship between teachers' mathematics teaching experience as well as their academic/professional qualifications in mathematics and their perceptions of the teacher appraisal system in Ghana. Any relationship between the above variables can not only help shed some light on the appraisal system, it can help determine how mathematics teachers might be helped to improve their teaching of mathematics.

Finally, the issue of gender differences in mathematics education has attracted much interest both within and outside the mathematics education community. Yet it appears that very little attention has been paid to the relationship between gender and perceptions of appraisal in teacher appraisal studies. The present study therefore attempted to fill this important gap. This is because such a relationship might help explain some of the differences that researchers have found between the sexes in various aspects of mathematics teaching and learning.

1.6 Independent Variables

Following the above hypotheses, the seven main independent variables which were used in the empirical analyses were:

1. Experience with appraisal
2. Respondent's last appraiser
3. Training in appraisal
4. Experience in maths teaching
5. Rank of respondent
6. Gender
7. Professional status of respondent

The relevant data about teachers' perceptions were collected through a questionnaire (distributed to secondary mathematics teachers) and interviews. The perceptions of appraisers were also collected through a questionnaire and interviews. Additionally, the work of appraisers was observed. Thus, as mentioned above, conclusions about the validity of the appraisal system were based on the perceptions of both teachers appraisers, how the latter do their work and any other relevant evidence.

1.7 The layout of the thesis

The thesis consists of nine chapters which have been arranged as follows:

Chapter one presents an overview of the study.

Chapter two looks at the historical review of teacher appraisal in Ghana. It also looks at the current education reform programme (ERP) in Ghana and discusses its

significance to the present study .

Chapters three discusses the strengths and weaknesses (and consequently) the validity of teacher appraisal methods. It also touches on the review of the literature on performance appraisal and seeks to establish the rationale for the study.

Chapter four seeks to establish the theoretical framework for evaluating the validity of teacher appraisal in Ghana.

Chapter five looks at the main hypotheses for the study. It discusses certain teacher characteristics and other variables that are relevant to the study.

Chapter six discusses the method employed in the study as well as the pilot study leading to the present study and its implications.

Chapter seven tests the hypotheses formulated in chapter five. It thus examines the relationship between the independent variables of interest and the main dependent variable. It seeks to establish which variables are relevant to Ghanaian mathematics teachers' views of teacher appraisal and its ability to help them improve their teaching of mathematics. In other words, it attempts to identify which factors affect mathematics teachers' perceived validity of the appraisal system.

Chapter eight looks at the validity of the teacher appraisal system in Ghana by drawing on both appraisees' and appraisers' perception of TAG as well as what actually goes on by way of appraisal of mathematics teachers.

Chapter nine presents a summary of the study and draws conclusions based on the findings. It also discusses the contributions and implications of the findings of the study and any recommendations that follow from them.

CHAPTER 2

DEVELOPMENT OF EDUCATION IN GHANA

2.1 Introduction

Education is a word which does not seem to have a universal definition. However, one can argue that, in general, education is a function of any society whether simple or complex, traditional or modern and that any society evolves its own system of education purposely to produce people to play adult roles as useful members of their environment. So, for example, before western schooling was introduced into Ghana, Ghanaians had an indigenous, largely informal and practical form of education by which they trained their youth to fit and function in their society. Yet, the word "education" is increasingly being used in a rather restricted sense to mean formal instruction in European-type schools. The 'educated' in this sense are those who have received or are receiving such instruction. The present review therefore concentrates on formal education in Ghana.

The first recorded European-type school in Ghana (then Gold Coast) was the Portuguese school established in 1529 . This was the real first attempt to help the children to learn how to read and write in Portuguese (McWilliam, 1959). The Portuguese school did not take root and long before the middle of the 16th century, there was no school in the Gold Coast. The 'much awaited' revival came in 1572 when four Catholic Augustinian missionaries arrived at Elmina, on the coast. They at once began work with children, but a few years later were murdered, following an attempt, which had at first seemed successful, to open mission schools along the coast. However, education continued in the Elmina Castle itself, where the Portuguese Vicar ran a school for mulatto children, but even this came to an end in the seizure of the castle by the Protestant Dutch in 1637.

Similar attempts to establish schools in the castles as well as along the coast were made by the Dutch (1640), the Danes (1722) and the English (1751). However, it was the missionaries of the Basel Mission, Wesleyan Mission, the Bremen Mission, the Roman Catholic Mission and the African Episcopal Zion Mission who by their educational activities extended some schooling to the common folks in Ghana.

There is no gainsaying that since the introduction of formal education into Ghana, various governments - (both colonial and post-colonial) have maintained a pattern of education built on the systems of education existing in the countries of the European missionaries who worked in the country. As Antwi (1992) points out, just before the assumption of power by African nationalist governments, the pattern of education in Ghana was similar to that of England. It is hardly surprising therefore that the evolution of education in Ghana shows a stress on English as a language for study in schools as well as a basis for instruction in school subjects at almost every level of education in the country. This is in spite of the fact that at least 80 per cent of Ghanaians can speak one of six selected local languages (Akan, Dagbani, Ewe, Ga, Kasem and Nzima) which are written and have literature (Antwi, *op. cit.*).

As Sackeyfio (1992) argues, the Ghanaian child is continually exposed, albeit, by second-hand means (such as through the use of audio-visual aids) to the aspects of native English environments that will enable him or her to understand words, concepts, and allusions that he or she is bound to encounter in his or her studies. Hence the pervasiveness of school or formal education in the Ghanaian culture. Indeed, in Ghana, to be 'well educated' is to be scholarly! This perhaps explains why many attempts to change the system of education in Ghana have failed.

Indeed, the development of education in Ghana has been characterised by conservatism and resistant to change. The root of this educational conservatism can be traced to the pattern of education developed in the early 19th century which entrenched the academic type of education. As Foster (1965) observed, this type of education had all the social prestige and provided access to the fast growing elite class of clerks, administrators and lawyers who enjoyed substantial incomes. He observed further that by the year 1850, the education system had become obviously dysfunctional, not only because the type of education was not suited to the needs of the country, but the supply of educated Africans in Southern Ghana was outstripping demand for their services.

For over a hundred years, all attempts to change the system had been unsuccessful. Therefore, the system of education inherited by the African government in 1951 - the year which marks the effective end to the colonial period in Ghana - was not any different from the academic type of education that had existed since the beginning of the 19th century. According to Foster:

...all schools at whatever level, had proved remarkably resistant to change and innovation (Foster, *op. cit.*, p.171).

It is not surprising that in 1951, when the country had become internally self-governing, the formal education embarked upon by the first nationalist government through the implementation of the *Accelerated Development Plan for Education* (discussed below) was still academic in nature. However, despite its academic nature the extension of primary education to many Ghanaian children under the Plan, makes the latter an important milestone in the development of education in Ghana (Antwi, op. cit). As McWilliam (1959) points out, one of the most remarkable achievements of the 'joint venture' between the Government and the Missions to carry out the development and expansion of education throughout the country, in the 19th and 20th centuries, was the acceleration in the process of extending primary education to all Ghanaian children of school-going age. The Accelerated Development Plan for Education therefore deserves a little more space here.

In 1943, the then Governor of the Gold Coast, Governor Burns gave an estimate that there were 470,000 children of school-going age, of whom only 90,000 (less than 20%) were attending school. It was then the government policy that progress towards increasing the above percentage should depend on the supply of trained teachers, which in turn depended on money. As McWilliam and Kwamena-Poh (1975) point out, it was hinted in the official Report on the Gold Coast in 1947 that to provide a six-year course of primary education for all children might take twenty-five years. Nevertheless, the new African Government of 1951 determined to accelerate the process and this led to the birth of the Accelerated Development Plan for Education in 1951, which was implemented the following year. The rapid expansion of primary education was thus the most striking feature of the Plan. The Plan established free and compulsory primary and basic education for all children of school-going age and since then, various Ghanaian governments have attempted with varying success, to provide facilities and opportunities for education of children in Ghana.

Fresh attempts to modify the education system started with the Education Act of 1961 and the Kwapong Education Committee of 1966. However, a more serious attempt at reform of the structure and content began in 1974 based on a policy document entitled "New Structure and Content of Education". The purpose was to de-emphasise the teaching of only academic subjects at the pre-tertiary level by the introduction of vocational and technical subjects in the curriculum. Unfortunately, the necessary political will (and stability!) as well as financial resources for the successful implementation of the programme were lacking. By the 1983/84 academic year, the new programme had virtually collapsed. The academic nature of the education system in content, process and product still persisted. Teaching and learning at the basic education level had deteriorated to the extent that the mass of basic education leavers

lacked literacy skills (Fobih, 1995).

A significant number of trained teachers had left the country for Nigeria as a result of Ghana's economic decline and the harsh repressive revolutionary zeal of the military regime. By 1986, the Ghanaian education system had reached a crisis point with drop-out rates, especially at the basic education level in the rural areas, rising at an alarming speed. The then Minister of Education, Dr Abdalla had this to say:

Over the past decade, there has been a sharp deterioration in the quality of education at all levels. There has been a virtual collapse of physical infrastructure, in the provision of buildings, equipment, materials, teaching aids, etc.....The PNDC [Provisional National Defence Council] has [therefore] decided to embark upon a comprehensive programme of educational reforms (Abdalla, 1986, quoted in Asante, 1988).

Thus to arrest the situation, a comprehensive educational reform programme was drawn up for basic, secondary and tertiary levels of the educational system and with financial help from the International Monetary Fund (IMF) and the World Bank, this new system was implemented in 1987.

2.2 The Educational Reform Programme (ERP)

It is perhaps fair to say that, the aims, objectives and content of the new system of education in Ghana (National Report, 1990) are all rooted in one basic principle of relevance. As Rawlings (1989) points out, the overall objective of the new educational reform is to train manpower with the right attitudes and ensure the relevance of national educational programmes to national needs. The system takes cognisance of the present and the future needs of the child and those of the society at large. The new system provides or appears to provide for the expansion of the basic education curriculum to cater for academic, cultural, technical, vocational and commercial subjects. Emphasis is being laid on the study of indigenous languages, science and mathematics to make the students competent in the current world of 'hi-tech' consumer products and services. However, it remains to be seen whether the new educational system can be successfully implemented.

At least, in theory, the current reforms in the Ghanaian education system, constitute the most far reaching aspirations of diversifying and making delivery of education to the population more efficient and productive. The national education system is currently based on the following plan (see Appendix B2):

2.2.1 Pre-school, Nursery and Kindergarten Education

This level of education covers the ages between 3 and 5 years. It is made up of 18 to 24 months of Pre-school education. Education at this level is not compulsory or free. Some of the nurseries are part of the schools in the public sector but the bulk of them are run by private individuals and organisations under the supervision of the Ghana Education Service .

2.2.2 First Cycle (Basic) Education

The national policy on Basic Education stipulates that all children from the age of 6 should receive 6 years primary education and 3 years Junior Secondary Education. The basic education is free and compulsory for all children. As might be expected, mathematics is a compulsory subject in the Junior Secondary School (JSS) curriculum.

2.2.3 Second Cycle Education

Pupils from the Junior Secondary Courses are selected according to their academic capabilities (and their parents' or guardians' financial capabilities) into five terminal courses. These courses which although terminal yet provide access to the tertiary system are:

- (1) General (Arts and Science) Courses;
- (2) Technical courses;
- (3) Commercial courses;
- (4) Agricultural courses; and
- (5) Vocational courses.

Each of these courses leads to the Senior Secondary School Certificate Examination, a somewhat equivalent of the GCE 'O' Level Examination. Each course is of a four year duration and the curriculum has core subjects common to all courses despite their areas of specification. Again, mathematics is one of the core subjects. The Senior Secondary Schools (SSS) have been scheduled to offer two or more programmes.

2.2.4 Tertiary Education.

The tertiary system of Education consists of the existing universities, the polytechnics, diploma awarding institutions, teacher training colleges and other professional institutions. Of particular importance as far as the present study is concerned is teacher education. Indeed, teachers form the key factor in the implementation process throughout the new system of education and the success of the reforms will depend largely on their competence and commitment. Consequently reforms have also been introduced into teacher education. As discussed below, the teacher training programme has been restructured and the academic level for the intake into teacher training colleges has been raised. Initial training college is of post-secondary level with credits in at least four subjects (including in mathematics and English) and at least a pass in one other subject at the Senior Secondary Certificate Examination or at GCE 'O' level as the basic entry qualification. The course structure is such that each trainee is to offer a number of core subjects of which mathematics is one. There is also a mathematics/science bias course for students with 'good' passes in mathematics and the 'sciences'.

The status of mathematics in the Ghanaian school curriculum has made pupil achievement in mathematics an important issue in the Ghanaian education system. This is because every pupil's academic and arguably social 'destination' appears to be determined by their achievement in mathematics. It is important to emphasise at the outset that the issue of whether or not mathematics should be taught to every Ghanaian pupil is not the subject of the present study, but it is equally important to mention that by making a GCE "O" level credit (or its equivalent) in mathematics a prerequisite for admission to tertiary institutions in Ghana, the present Ghanaian government, like their counterparts in other countries, have encouraged its learning. Yet examination results in school mathematics are not very encouraging. For example, in 1987, only 8349 (31.5%) candidates out of a total of 26,503 passed the GCE 'O' level examination in mathematics with credit (WAEC, 1988).

This means that only about 31.5% of secondary school leavers in 1987 could pursue any post-secondary course. In the same year, for the 8967 (33.8%) secondary school leavers who failed mathematics completely, the secondary course would become terminal since no post-secondary institution would admit them. The figures for 1990 (see WAEC, 1992) were slightly better (39.2%, passed with credit and 28.4 % failed) but they, nevertheless, show that the learning of mathematics in Ghanaian secondary schools still leaves a lot to be desired. This is reflected in the fact that very few Ghanaians pursue post-secondary courses in mathematics, and as may be expected, this situation has affected the supply of teachers of mathematics and has always prompted

politicians and educationists alike to highlight the ‘mystification’ of the subject in Ghanaian schools.

Surely, if every Ghanaian child is to be given the opportunity to participate ‘fully’ in mathematics education in order to gain a fair chance of participating in further education (which is apparently the only key to gaining ‘secure’ employment in Ghana), then it is imperative that the teaching of the subject is improved. Of course, the fundamental assumption here is that there is reasonably adequate room for improvement - an assumption which underlies all continuous professional development schemes. In fact, considering that the current reforms have cut the period of pre-university education from 17 years to 13, it is almost a necessity that the teaching of the subject be improved. Furthermore, the problem of ensuring that all Ghanaian pupils are given the opportunity to participate fully in education generally and mathematics education in particular, has been made more difficult by the ‘rush’ which characterised the implementation of the new educational reform in Ghana, which is described in detail in a later section.

Indeed, the swiftness with which this national assignment of great significance was undertaken without adherence to conventional procedures for an educational transformation of such magnitude has been an issue of controversy. An example of the Government’s lack of regard for adequate preparation for the implementation is the odd way in which teachers for the new system were selected. The selection and preparation of teachers for the new system are not the subject of this study. However, it is worth mentioning that the selection of teachers for the junior secondary courses was based solely on teachers’ GCE “O” Level grades in the various subjects. For example, those who had ‘good’ passes in mathematics were selected to teach mathematics, irrespective of the subject(s) they were teaching prior to the reforms (Konadu, 1994).

One view sees the rush as part of the regime's revolutionary zeal for change in transforming the social, political and economic life of the country. Another view, however, suggests that the Government's attitude was motivated by economic expediency, and a desire to satisfy the IMF/World Bank Social Adjustment Conditionality in order to attract the necessary funding for governmental activity. The latter view is based on the Government's departure from the Ghana Education Service's recommended implementation strategies such as a change-over beginning in 1990 at the primary level with the Junior Secondary School (JSS) following 6 years later, and a gradual phasing out of the old basic education by 1999. This would, at least, have ensured that the right calibre of trained teachers, textbooks, teaching materials, new and improved building structures and equipment were made available at the progressive rate

that the Government could support. It would have also ensured an establishment of field study attachment apprenticeship training programmes for both terminal and the continuing students at both the junior and senior secondary levels. Nevertheless, whether by social commitment for change or political and economic expediency, an extremely difficult task has been accomplished. It is now left to Government and other stakeholders in education to ensure that the quality of education in general and of mathematics education in particular is improved well beyond the standard it was just before the reform was introduced. One way of ensuring such improvement is by concentrating reasonable amounts of effort and resources on the process by which teachers, particularly teachers of mathematics receive professional support. This is the process of *teacher appraisal*, which is the subject of the present study. There is no gainsaying that the discussion of teacher appraisal cannot be divorced from that of teacher education and development. The next section therefore looks briefly at the historical development of teacher education in Ghana. This will be followed by a discussion of the historical review of teacher appraisal in Ghana.

2.3 The Development of Teacher Education in Ghana

The general growth of elementary education was inevitably accompanied by a need for teachers. The need was first met by the Monitorial system - in which one 'trained' teacher was in charge of a school and a number of monitors were appointed from among the pupils in the top of a school to help him by being in charge of the "mechanical" teaching work and rote learning in the various classes. This system was later abandoned and the Missions and the Government established training institutions to train teachers for the schools.

The first training college (in Ghana) was established by the Basel Mission in 1848 at Akropong in the Eastern Region. The Basel Mission also established a second teachers' college at Abetifi a few years later. These and the Roman Catholic teachers' college at Bla were the only institutions for teacher education in Ghana until 1909.

In 1909, the Government opened a training college in Accra (the capital) and this became the teacher training centre not only for government teachers but also for all missions who had no teacher training college of their own. The duration of the training course in Accra was two years and it is important to note that the students' performance in their final examination at the end of their training determined the type of certificate awarded them (Hilliard, 1957). There were three classes of certificates: first, second and third. These in turn determined the salaries of the holders (ibid). Although this

was not the first time teachers' salaries had been related to their performance, as shown below, it marked an important phase in the performance related pay era, which took a different form in 1956 - a year before Ghana attained independence.

The trends in Ghana's teacher education seem to follow the same pattern as the various reviews in the education system. For example, with the implementation of the Accelerated Development Plan for Education (ADPE) in 1952, a 2-year Post Middle Certificate B course for teachers was established. As the name suggests, entry requirements for the course were the possession of the Middle School Leaving Certificate and the passing of the entrance examination. Also following the 1961 Education Act and the subsequent increase in school enrolment, teacher education was stepped up. The 2-year course was abolished in that year (i.e. 1961) and was replaced by a 4-year Certificate A course which had been temporarily suspended in 1951. The abolishing of the 2-year Certificate B course meant that the last of the Certificate B courses ended at the end of the 1962-63 school year.

Alongside the 4-year course was a 2-year Certificate A (Post B) course. The former was designed for pupils with the Middle School Leaving Certificate and who passed the entrance examination. The latter course was for Certificate B teachers who were being upgraded to Certificate A status. After the 1966 military take-over, the military government decided to discontinue the Certificate A (Post B) course because it did not consider it financially sound to allow such teachers to do the 2-year Post B course on study leave terms (Ministry of Education, 1967). Certificate B teachers were therefore upgraded through prescribed in-service courses. Meanwhile more training colleges were established and more Middle school leavers were recruited for the 4-year course. For example, the Initial Teacher Training Colleges (ITTC) which numbered 30 in 1957 increased to 83 in 1967 and enrolment rose from 3873 to 15 547 respectively (Kwakwa, 1968).

As mentioned above, the 4-year course has been proscribed. This means that the ITTC's are now all offering 3-year post secondary courses. Of particular importance as far as this study is concerned is the training of mathematics teachers. Ghana has three main programmes of teacher education for mathematics teachers. These are:

a) 3-year post-secondary course in mathematics, science/agricultural science and technical skills. Those who successfully complete this course teach maths, science/agricultural science and technical skills at the JSS level. At the primary school level, where class (and not subject) teaching is done, teachers are required to teach all the subjects in the curriculum. This means that the teaching of mathematics in the

primary schools is done by teachers who may not have any specialist education in mathematics or its teaching.

b) 3-year diploma course in advanced mathematics (an upgrade of the phased out two-year mathematics specialist course) at the University College of Education, Winneba. Products of this course, which is mainly for practising mathematics teachers, teach in senior secondary schools and initial teacher training colleges.

c) Graduate mathematics teachers are trained at the University of Cape Coast (UCC). The duration of the BSc (Maths/Education) course and the BEd(Maths) course is four years and the products also teach at the SSS and ITTCs. As part of the new education reforms, a two-year post diploma course has been introduced at Winneba to upgrade diplomates to the position of graduate teachers. These and UCC graduates as well as those non-professional mathematics graduates from the other Universities who successfully complete the post-graduate certificate in education (PGCE) run by the University of Cape Coast enjoy the same status and conditions of service in the GES. The above categories of mathematics teachers who are teaching the subject at the specified level(s) of education are referred to in this study as "professional mathematics teachers" or simply "professionals".

In addition to these qualified teachers, non-professional graduates (mainly from the two universities - University of Ghana, Legon and University of Science and Technology, Kumasi) with degrees and diplomas in mathematics or courses with substantial mathematical content are employed by the GES *on temporary basis* to teach mathematics at the SSS level. There are also some untrained General Certificate of Education (GCE) "A" holders with passes in "A" level mathematics and/or the 'sciences' as well as those with 'good' passes in GCE "O" level Mathematics who are also hired on *temporary basis* to teach mathematics at the SSS and basic levels respectively. Among this last group are National Service Personnel who are deployed, by law, to teach (the subject among others), particularly at the basic education level.

The National Service Scheme, as Konadu (op. cit.) accurately describes, was instituted by decree in 1973 to offer the youth of Ghana the opportunity to serve the nation wherever their services are needed. Before 1982, the scheme covered only fresh graduates from the university who were required by law to do one year of compulsory service before they could be offered employment. In 1982, the service period was increased to two years, and the scheme was extended to cover all able bodied persons aged between 18 and 40 years. This extension has meant that sixth form leavers as well as products of the polytechnics are also required to do two years national service -

one year immediately after leaving school and another year after completing their courses at any of the universities. These and other professional teachers with fields of specialisation different from mathematics but who nevertheless were teaching the subject at either the JSS or SSS level (or both) at the time of the study are referred to in the latter as "non-professional mathematics teachers" or "non-professionals" for short.

It is important to point out that because of the compulsory status of mathematics in the Ghanaian school curriculum as well as the subject's 'gate-keeper' role in the Ghanaian education system, many non-professional mathematics teachers are teaching the subject especially at the basic education (i.e. primary and junior secondary) level. This 'problem' has been mentioned a number of times in this thesis because it is one of the main issues which decided me to undertake the present study. It seems reasonable to say that these non-professional teachers as well as their professional counterparts would need help to enable them to contribute fully to the new system of education with emphasis on different ways of teaching mathematics. Surely different groups of mathematics teachers (or even different individual teachers) would have different professional development needs as far the teaching of mathematics is concerned. It is therefore imperative that the teacher appraisal system in any education system recognise and identify each individual mathematics teacher's professional needs before any meaningful 'solution' to the above problem can be considered. Hence the importance of teacher appraisal systems in the development of teacher education. The next section looks at the historical review of teacher appraisal in Ghana.

2.4 Teacher Appraisal and Unionism - An Historical Review

It must be admitted from the outset that literature on teacher performance and appraisal in Ghana before and during the colonial era, seems rather sketchy. However, McWilliam and Kwamena-Poh (1975) give a vivid description, of how teachers in Ghana fared in the past, as recorded by a British official, one J.S. Laurie (sent by the British Parliament in 1868 to report on the state of education in the West African settlements) whom they quote at length:

...the teachers are self-possessed and straight forward, and at the same time their inborn softness of manner lends a particular grace to their whole bearing... Notwithstanding that their earnings are sometimes as low as one pound per month, they always contrived to dress well, and surrounded themselves with higher than average luxuries.....At the top of the primary schools, the best pupils compared favourably with pupils in rural schools in England, but lower down the school, things were not so bright. (McWilliam & Kwamena-Poh, 1975, p. 38)

The point here is not so much one of emphasising the use of pupil-performance as an indicator of teacher performance as emphasising the contentment of teachers in spite of the fact that their earnings during that period were low. This picture of teachers' apparent contentment with themselves and their profession tallies with reports of the Directors of Education in the nineteen twenties. An example of such reports is one by Oman (1928) which indicated teachers' keenness with their work and enthusiasm as well as confidence in themselves, despite their relatively low earnings. Now, if the teachers in the past were apparently content with themselves and their profession, how did they react to teacher appraisal?

Here, it seems the picture does not look that rosy. One particular criterion of appraisal which teachers found very difficult to accept (and which many teachers in the UK cannot imagine) was that of pupil-performance under the system of "payment by results". As McWilliam and Kwamena-Poh (op. cit.) report, in 1902 the Board of Education introduced into Ghana this system which had been abandoned in England in 1895. The tension and friction between teachers and inspectors in the schools generally resulting from the system can however be imagined. Under the system, one of the principal aims of an inspector's visit to a school would be to find out by means of an examination whether or not the teachers had been able to make their pupils absorb some facts irrespective of the method used. This was done to enable the inspector allocate grants to the school. The teachers, knowing that their pay depended on an examination of this kind, resented it and, of course, developed resentment for the inspectors as well. The system of "payment by results" therefore "made the teachers and their inspectors enemies instead of workers in the same field" (McWilliam & Kwamena-Poh, op. cit., 1975, p.33).

Similarly, the relationship between teachers and managers, who were and still are usually representatives of the various churches, did not seem to have been any better. One source of the tension between teachers and the churches was the rigid discipline to which the churches subjected the teacher. Up until the middle of the 1970s, they subjected the teacher to very rigid code of conduct based on the code of ethics of the religious denominations.

As might be expected the code which was binding on the mission teachers contained a list of penalties for a number of specified offences. This made life uncomfortable and teaching career insecure for some teachers in the denominational schools throughout the Colonial period until the Erzuah Committee 'changed' the situation for them in 1952 (Hilliard, 1957).

The Erzuah Committee recommended that the teaching service should be unified and that teachers in both government and non-government schools be put on the same salary and pension scales and that the Government should cease to employ a category of teachers as "government teachers". This recommendation was implemented in 1956. The committee went further to make far-reaching proposals on teachers' salaries. Three principles guided the Committee's proposals.

The first of them was that, teachers should command a salary scale higher than that of other persons with similar qualifications and experience in other occupations. While admitting that they were aware that such high recognition as they proposed was not accorded to teachers in most other countries, the Committee believed that the move was necessary "if the country was to develop rapidly and achieve its place among nations" (McWilliam & Kwamena-Poh, *op. cit.*, 1975, p.91). Secondly, it emphasised that the country could only afford the new increases if the general standard of the teachers' work in the schools was "raised considerably" (*ibid.*). Thirdly, the Committee was aware that the successful implementation of the Accelerated Development Plan (mentioned above) depended largely on teachers.

Of particular importance and relevance to the present study is the second principle, namely, that of raising standards so that they commensurate with teachers' salaries. How was this principle achieved or considered to have been achieved, given the fact that the committee's recommendations led to (appreciable?) increases in the starting salaries of the various grades of teachers? It appears nothing new was done with regard to appraisal of teaching to ensure that 'standards' were raised. It was perhaps assumed that having improved the lot of teachers, the latter would respond by working harder, thereby improving standards. Or perhaps the lack of new directives on appraisal was as a result of the chain-reaction which ensued after the implementation of the Committee's recommendations. As Bame (1972) points out, workers in other occupations and professions in Ghana demanded similar improvement in their working conditions which they were also given. Thus, the few years that followed the implementation of the Committee's proposals saw similar salary increases for employees in other occupations. As a matter of fact, in some cases other occupations offered better working conditions and between 1956 and 1960 approximately 3,000 teachers had left the teaching service for alternative jobs outside teaching, resulting in an annual wastage of 8.7 percent.

It was this alarming wastage which led to the Governments' efforts to arrest the problem by proposing the New Deal for Teachers in 1961 (Bame, 1972). The New

Government School Teachers Union formed in 1925 (and later named the National Union of Teachers - NUT) and the Assisted School Teachers Union (ASTU) formed in 1937 by non-Government (mainly missionary) school teachers to protect the interest of its members. The GCTU later became the Ghana National Association of Teachers (GNAT) in 1962 and has remained the single teachers' union catering for the interests of all teachers in pre-university institutions in Ghana (see GNAT, 1981 for detailed discussion of the development of teacher unionism in Ghana).

Admittedly, thousands of teachers, mostly elderly folk, who could not pass the prescribed examinations for promotion to the new grades kept on 'marking time', nevertheless there was hope for teachers who could burn the candle at both ends. That is not to say however, that there were no anomalies in the teaching service at the time. For example, many of the teachers who passed the Senior Teacher and Principal Teacher examinations were drafted into various offices in the Ministry of Education and classified as civil servants with better conditions of service. The office was for the supervisors and the classroom for the supervised. In addition to teachers who were transferred to the office, there were non-teachers employed by the Ministry of Education to supervise teachers' work. Most of these were young university graduates who had no teaching experience.

The dichotomy between classroom teachers and the 'officers' hurt the former. Smarting under this dichotomy many teachers took it into their heads to fight for a teaching service in which teachers would direct the affairs of the teaching profession. This move was clearly a protest against the attitude of the officers and in the end it paid off. The discontent among teachers led to the birth of the Ghana Teaching Service in 1974 which later became the Ghana Education Service (GES) the following year. The most significant change (in the teaching service) as far as the establishment of the GES is concerned is what has happened to the ordinary teacher since 1974 by way of grade and salary, particularly grade.

2.5 The Ghana Education Service (GES)

As mentioned above, the GES was established in 1974 as the Ghana Teaching Service by a decree (NRCD 247) and a year later designated as the Ghana Education Service. "The Service (thus) merged all professional personnel and supporting staff engaged in teaching, management, general administration, supervision, inspection, curriculum and development, planning and budgeting at the pre-university level" (Ministry of Education, 1982, p.6, emphasis added)

It is worth emphasising that the GES is not completely autonomous. Not only are the head of the Service and her/his deputies appointed by the Government on the recommendation of the Minister of Education, the final responsibility of formulating policies and the exercise of control over funding at the pre-university level ultimately rests with the Minister of Education (ibid). Appendix B.3 shows the institutional relationship between the Ministry of Education (MOE) and the GES as well as the directorates in the latter.

The GES is however the body solely responsible for employing and training all teachers at the pre-university levels in Ghana. The hierarchy in the Service from top to bottom is as follows:

1. Director General
2. Deputy Director General
3. Director
4. Assistant Director
5. Principal Superintendent
6. Senior Superintendent
7. Superintendent
8. Assistant Superintendent
9. Certificate 'A' Teacher.

The GES is headed by the Director General (DG) who is the chief professional adviser to the Ministry of Education on professional matters. The DG is assisted by two Deputy Director Generals and other high level personnel who administer and manage education at the national, regional, district and institutional levels.

The DG and her/his deputies are, as mentioned above, appointed by the Head of State on the advice of the Ministry of Education in consultation with the Public Services Commission. Each of the ten regions of the country is headed by a *Regional Director* charged with the detailed administration of pre-university education including financial control and personnel management. Educational matters in all the 110 administrative districts in the country are also managed by *District Directors*. In all there are about 140 Directors (including those at the Headquarters) in the GES. Directors are also appointed by the Head of State on the advice of the Minister of Education in consultation with the Public Service Commission. As shown in Appendix B3, there are seven directorates in the GES. The inspectorate directorate of the Service deals with the supervision and management of teaching and learning in all pre-university

institutions in Ghana.

Assistant Directors are heads and assistant heads of senior secondary schools and initial teacher training colleges and, where appropriate, also heads of departments in the above institutions. A few of them are charged with the inspection and supervision of primary and secondary schools as well as the management of (denominational) Education Units. Assistant Directors are former Principal Superintendents who gave a minimum of three years' 'satisfactory' service in the latter grade and who have been successful at a promotion interview at the end of the satisfactory service.

Principal Superintendents are heads and assistant heads of basic education schools (i.e. primary and junior secondary schools). A good number of them teach in senior secondary schools and initial teacher training colleges with added pastoral duties. Some of them inspect and supervise primary and secondary schools while a small minority of them perform administrative duties at both regional and district levels. Principal Superintendents are former Senior Superintendents who have passed a promotion interview at the end of a minimum of three years' satisfactory service in the latter grade.

Senior Superintendents also teach in basic education, senior secondary and initial teacher training institutions depending on their academic qualifications. Like principal superintendents, some of them inspect and supervise first and second cycle institutions. A few of them are Regional subject organisers who visit and give demonstration lessons in first and second cycle institutions (i.e. basic education and senior secondary schools). Promotion to the grade of senior superintendent is more or less automatic, which means that all superintendents who complete three years of satisfactory service are eligible for promotion to this grade.

Superintendents are charged mainly with teaching in first and second cycle institutions. A few of them engage in inspection of first cycle institutions as well as organising demonstration lessons in first cycle institutions. There are two routes to this grade, one of which is more or less automatic. Teachers who have completed an approved non-graduate professional course or those with recognised university degrees or equivalent in appropriate subjects with approved teaching qualifications are promoted to this grade automatically. The second (non-automatic) route is for teachers with three years' 'satisfactory' service in the grade of Assistant Superintendent. A teacher in this category is required to attend an in-service training course, obtain a satisfactory report at the course, and pass a prescribed examination after the course. Assistant superintendents who do not wish to take the prescribed examination are required to do

four years' satisfactory service and attend at least two prescribed courses.

Assistant Superintendents, like superintendents, have two different routes to their grade. An automatic route is available to Certificate 'A' teachers with GCE "A" Level or its equivalent in 3 subjects and who have in addition done two years' satisfactory service as Cert "A" teachers, or non-teachers with Parts I and II of approved professional qualifications such as Association of Certified and Corporate Accountants (ACCA). The latter are employed by the GES to support business and technical education teachers as demonstrators in first and second cycle institutions. Teachers who follow the non-automatic route must be certificate "A" teachers with three years' satisfactory service and who have both attended a prescribed course and passed a prescribed examination. Cert "A" teachers who do not wish to take the prescribed examination must give five years' satisfactory service and attend prescribed courses before they are promoted to the grade of Assistant Superintendent.

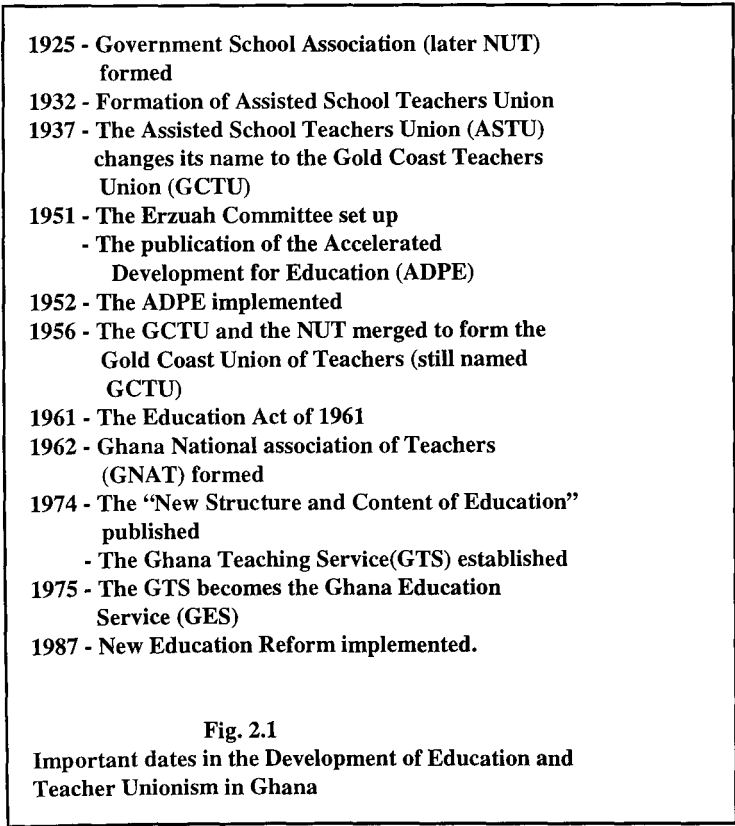
Certificate "A" Teachers, as indicated above, are in the lowest professional grade in the GES. The route to this grade was via the successful completion of either a four-year teacher education course (for ex-middle School Leavers) or a three-year Post-Secondary teacher education course for those with G C E "O" Level passes in at least 4 subjects including English Language and Mathematics. Presently, all the 4-year Post Middle Teacher Training Colleges have been turned into post-secondary institutions. Initial teacher training is therefore of the post-secondary level with "O" Level as the basic entry qualification. Certificate "A" holders teach mainly in Primary and Junior Secondary Schools.

The main significant development that the birth of the GES has brought about is that the ordinary classroom (non-graduate) teacher by showing professional 'competence' can rise to the grade of Assistant Director. This leaves such a teacher with only one career post ahead: that of Director for which a university degree is required. It is worth mentioning, however, that all teachers are required to provide "satisfactory" service in order to earn their promotion (GNAT 1987). One of the duties of the inspectorate division of the GES is therefore to determine, through the appraisal process, which teachers have provided "satisfactory" service and therefore deserve to be promoted. This is the main reason why teacher appraisal systems in Ghana are usually linked with the promotion of teachers in the GES.

2.6 Conclusion

There has been a remarkable series of education reviews in Ghana since the introduction of the Accelerated Development Plan for Education in 1951-2 (see Fig. 2.1 below). The publication of the "New Structure and Content of Education" in 1974 marks a watershed in the educational reform in Ghana. The Junior Secondary School (JSS) which forms an integral part of the latest educational reform (ERP, 1987) is the brain child of the Dzobo Committee which authored the 1974 education programme mentioned above. The Ghana Education Service which was created in 1975 was charged with responsibility of implementing the 1974 reforms, but the economic decline which followed in the late 1970s and the beginning of the 1980s as well as the lack of political will made implementation of the 1974 programme impossible.

By 1986, the education system had sunk to such low levels that it became necessary for a serious attempt to be made to salvage it. A new major educational reform programme was drawn up and is now being implemented. The period for pre-university education has been reduced from 17 years to 13 years. The rationale behind this is to reduce the cost of schooling especially at the basic education level in order to improve access (and quality?) so as to ensure that the majority of Ghanaian children acquire basic education.



Mathematics plays a crucial role in the new system in the sense that a credit pass in it is a prerequisite for admission to nearly all tertiary institutions in Ghana. There is therefore the need for professional development programmes for teachers generally and teachers of mathematics in particular. If indeed every Ghanaian child is to be given the opportunity to participate fully in mathematics education at least at the basic education level, then the teaching of mathematics in Ghanaian schools must be improved. To achieve this goal, there is the need to concentrate efforts on the process by which mathematics teachers are appraised in order to ensure that the appraisal process can help mathematics teachers to improve their work. The next chapter reviews the literature on teacher appraisal as well as other studies in mathematics education which have bearing on the appraisal of mathematics teachers.

CHAPTER THREE

TEACHER APPRAISAL METHODS: A REVIEW OF THE LITERATURE

3.1 Introduction

It must be said from the outset that very little attention has been given to research on the appraisal of the teaching of specific disciplines. Most of the studies on teacher appraisal appear to be silent on any differences that may exist in the way the various subjects in the school curriculum are taught. For example, after a long literature search, no study has come my notice which concentrates on how the work of mathematics teachers is evaluated. This perhaps reflects the observation that many evaluation systems were developed during an earlier educational movement that put more emphasis on the structure of the lesson rather than its content (Grouws, 1994).

Under such circumstances, participants in general teacher evaluations do not have to be particularly knowledgeable in any subject. This solves a logistic problem when, for instance, in the appraisal of mathematics teaching no one is available who has any mathematics expertise. An example would be a school in which the head who has little experience in mathematics and/or its teaching evaluates the work of mathematics teachers. A number of authors have called for changes to be made to the way teachers are evaluated to reflect the changing nature of the teaching and assessment of mathematics. Some of these authors have provided anecdotal account of how mathematics teachers are evaluated particularly in the United States, and have suggested ways in which the evaluation process can be changed for the better.

Despite the calls for a change in the evaluation of mathematics lessons to reflect the current emphasis on constructivist principles in the teaching of mathematics, not much *research* has been done regarding the validity of the evaluation of mathematics teaching. As might be expected, most of the calls for change have come from the United States where, as pointed out below, teacher appraisal systems appear to be more on the summative end of the summative-formative continuum than on the formative end. Even in the UK where teacher appraisal is generally formative - i.e. designed to help improve practice, not much research has been done on the appraisal of teachers of mathematics or indeed teachers of specific subjects. Perhaps the constructivist paradigm has not gained much root to enable researchers to investigate the evaluation of mathematics teaching based on constructivist principles.

For example, Grouws suggests that most lessons (still?) involve the transmission model of teaching whereby, in mathematics for example, students work passively trying to understand the ideas that are held in the teacher's mind. Indeed, this observation was apparently confirmed by the findings of the Third International Mathematics and Science Study (TIMSS, 1996). The study found that in the USA, for example, mathematics lessons were mainly 'teacher-led' rather than 'student-centred'. As Jones (in press) points out, the typical model of mathematics teaching in the USA at the time of the TIMSS was one in which a teacher introduced a mathematical concept or skill, solved some problems involving the concept (or skill) and set pupils work to do independently while the teacher went round to help individual children. Jones provides an interesting example where the teacher actually gave a mathematics formula and told pupils how to use it to solve a mathematics problem : "we find the length of the hypotenuse of a right-angled triangle using $a^2=b^2+c^2$ " (p.3).

The lack of research on the appraisal of mathematics teachers per se, has meant that a greater part of the review of the literature on teacher appraisal in this chapter and elsewhere in this thesis will be on teacher appraisal generally. Nevertheless, there are a number of studies in mathematics education which do have a bearing on the appraisal of mathematics teachers. I will show how these studies bear on teacher appraisal in an attempt to identify the similarities and differences that may exist between mathematics teaching and its appraisal on the one hand and teaching generally and its appraisal on the other hand. In addition to the general review presented in this chapter, studies related to the specific hypotheses formulated and tested in the present study are also reviewed in chapter five. This arrangement leaves enough room for the discussion of the strengths and weaknesses of the various appraisal methods which is the main subject of this chapter. In sum, the chapter provides a review of some of the studies in teacher appraisal and how they relate to mathematics, but the objective is that of discussing the strengths and weaknesses of the various methods of appraisal and how they can affect the validity of the appraisal of mathematics teachers.

Research on teacher evaluation in Ghana is very scanty indeed for various reasons, the main one being the lack of funding for educational research by various Ghanaian governments. Perhaps the situation is similar in many African countries where education policies are informed by educational research done in the advanced countries (Awolomo, 1985). Indeed, Awolomo observed that by 1985, no more than 31 studies of teacher evaluation had been in the whole of Africa. Majority of these studies were done in Nigeria and none in Ghana, albeit three of the studies on Nigeria were done by Ghanaians who had left the country following the near collapse of the Ghanaian economy in the late 1970s and early 1980s. Even in 1990, when the Ghanaian

economy had begun to pick up, not much had been done in educational research. Ghana's national paper on education presented at the UNESCO conference at Geneva stated:

As stated in the previous report, no significant work has been done in educational research mainly due to the fact that the Service had diverted all energies and resources to the implementation of the new educational reforms (National Report, 1990, p. 36).

It is hardly surprising that Bame's (1991) account on teacher evaluation, Gokah's (1993) account on teacher appraisal policies in Ghana, and Nyoagbe's (1993) study on basic education teachers' perception of the impact of the education reforms on their performance are among my main sources of information on teacher appraisal in Ghana.

Duke and Stiggins (1990) have observed that empirical research on the use of teacher appraisal for the purposes of enhancing professional development (which is what the present study concentrates on) is badly lacking. Nevertheless, empirical research and reviews of practice concerning the nature of impact of performance appraisal systems has developed sufficiently in recent years to offer an increasingly clear picture of what 'exemplary' practices look like. Admittedly, one may argue that the findings of educational studies done in other countries cannot be applied unproblematically to the Ghanaian educational setting, yet it is relevant to look at appraisal studies in other countries, especially those in the UK and the USA where there is a large body of research on teacher appraisal. If Antwi's (1992) observation that most of the policy makers in education in Ghana were trained in the UK is valid, then it is important that one looks at development of teacher appraisal particularly in the UK as models used in the latter may eventually find a place in the Ghanaian education system.

3.2 Appraisal Studies in the UK and the USA

Research in the UK (e.g. Turner and Clift, 1988; Wragg, et. al., 1996) provides characterisation of a typical formative appraisal scheme: preparatory activities, followed by data collection, and in turn, feedback and an appraisal interview centred on target-setting and the evaluation of targets set on previous occasions, coupled with an identification of appropriate career development plans and training needs. It must be emphasised, however, that local authorities vary in the style of their training, and the importance they attach to appraisal (Wragg, et.al. op. cit). Nevertheless, appraisal schemes in the UK are almost exclusively formative, geared primarily to identifying

desires for in-service activities or for other kinds of experience that might enhance career development. Some of the studies in the UK are described in detail in later sections of this chapter and elsewhere in this thesis.

Research in the USA paints a rather different picture. As Turner and Clift (*op. cit.*) observe, staff appraisal in the USA has developed mainly along the summative lines as the basis for initial certification of teachers and for renewal of contracts. Recent studies (e.g. Shannon and Boll, 1996) indicate that not only are appraisal schemes in the USA still summative in nature, traditional methods of assessing the knowledge of pre-service teachers such as multiple choice paper-and-pencil tests are still used in some states. On teacher appraisal, Marczely (1992) found that most school districts in Ohio were still using 'trait' and rating methods to evaluate teaching staff even though they claim to value professional growth as a legitimate purpose for teacher evaluation. Heaflele (1992) also refers to the superior-subordinate models of appraisal and argues that such models presuppose a central role for the supervisor in identifying the teacher's performance weaknesses and the development remedies framed by specified performance objectives. Heafele argues further that in such models teachers have little or no control over the appraisal process. The hierarchy of power, Heafele points out, "is affirmed, and the principal, the dispenser of rewards and punishment, possesses it all" (p.337).

It has been mentioned elsewhere in the thesis that many authors advocate a sharp distinction between formative and summative appraisal systems to the point of insisting that organisational members with different roles be given responsibility for the different functions (Duke, 1990; Popham, 1988). Others recognise that while traditional inspectorial models of appraisal are ineffective and should be abolished, it is not practical or sensible to divorce the two functions of teacher appraisal (McLaughlin and Pfeifer, 1988). Most agree however, that intended purposes of appraisal ought to be made explicit and that methods for data collection ought to match the stated purpose (Stiggins and Bridgeford, 1984). This observation seems attractive to education systems where there are not enough resources and time to separate schemes for different purposes. Considering that the teacher appraisal system in Ghana is said to combine summative and formative purposes (Gokah, *op. cit.*), it is important that one pays particular attention to the methods employed in the data collection for teacher evaluation. This is because the validity of any appraisal scheme would depend on both the method of appraisal and the purposes for which the appraisal is intended. It is therefore important to discuss in this review, the strengths and weaknesses of the various methods of appraisal, concentrating on the managerial appraisal method as this appears to be main method used in Ghana. The other two methods that will be

discussed are, self-appraisal and peer appraisal.

3.3 Self - Appraisal

Self-appraisal is a process whereby an individual reviews her or his own area of responsibility and attempts to identify the quality of achievement of aims and objectives, improvement of skills, development of knowledge, effective use of available resources and the results of his or her efforts (Day et al, 1987). Self-appraisal is what most teachers would claim to practice in an informal way. Surely, it would be an unusual teacher who did not reflect on her or his work, whether or not there is a formal appraisal scheme. Indeed, before teacher appraisal became a political and legal matter (in the U.K.), there was quite a positive development in many schools and local authorities of self-appraisal schemes where individual teachers, departments and whole schools took stock of what they were trying to accomplish and how effectively they were achieving their objectives (Turner and Clift, 1988).

Bailey (1981) examined the origins of self assessment and defined the 'concept' as not merely a method, but a comprehensive approach that includes a philosophical attitude and strategies for total approach to instructional development. Also a key developer of the idea of 'self-monitoring', John Elliott, writes:

Self monitoring is the process by which a person becomes aware of his (sic) situation and his own role as an agent in it. Awareness is...the end-in-view of the self monitoring agent. (Elliott, 1978, p.9)

In self-monitoring the teacher becomes aware of the consequences of her or his actions and the extent to which she or he can be held responsible for them by reflecting about her or his practices. Elliott points out further that the best way to improve practice lies not so much in trying to control people's behaviour as in helping them control their own behaviour by becoming more aware of what they are doing. By promoting deeper thinking about what one does, self-appraisal tends to increase understanding of the links between behaviour and outcomes. Self-appraisal can also be a useful way of clarifying those areas an individual wishes to address, and in this way stimulate change and development. Self-appraisal is thus a major vehicle of professional development.

Another important concept in self-appraisal is 'reflection-in-action' (Schon, 1983). Most, if not all teachers often engage in 'reflection-in-action' - a key ingredient of self-appraisal. Indeed, reflection-in-action is a significant means of generating new knowledge, skills and attitudes. As Schon (op cit.) points out, reflection-in-action is a

necessary part of survival in the classroom, for at least initially, it serves to reduce many variables which exist in any given situation, thus empowering teachers to remake and if possible re-order the world in which they live. Reflection-in-action projects a view of professionalism which is endemic to the philosophy of the reflective practitioner. It is a view which considers teaching (and activity in other professions) a practical art, stressing understanding rather than technical skills and takes holistic approach to skills and knowledge involved. This model of professionalism - which provides the basis for self-appraisal, - accepts professional behaviour as self-regulating and minimises the control mechanism, relying on reflection and professional consciousness rather than inspection or validation. It is interesting to note, without digressing from the main issue, that the reflection-in-action approach is also being adopted at teacher training institutions (Furlong et al, 1988; Jaworski, 1993), a factor which may be significant in the future direction of appraisal in schools.

This approach was recommended by the authors of the *Professional Standards for teaching Mathematics* (NCTM, 1991). The document urges teachers to assume more responsibility for both self evaluation and peer evaluation. To become a reflective teacher, one must have the power and support to act on one's reflections. This means that the teacher of mathematics must have sound knowledge of mathematics and its teaching. Limitations in this area can greatly hamper a teacher's ability to evaluate her /himself. For example, Brown and Borko (1992) found in a study of pre-service teachers learning to teach mathematics that limitations in the areas of mathematics content knowledge and pedagogical content knowledge were associated with difficulties in connecting mathematics topics during classroom discussion.

Again, without diverting attention from the main issue being discussed, Ball (1988, 1991) has defined mathematics *content knowledge* to include both knowledge *of* mathematics and knowledge *about* mathematics. She argues that to teach mathematics effectively, individuals must have knowledge of mathematics characterised by an explicit conceptual understanding of the principles underlying mathematical procedures. This knowledge must also be characterised by one's ability to connect mathematics topics, rules and definitions. Additionally, one must also have knowledge about the discourse of mathematics and an understanding of what it means to know and do mathematics. Grossman, et. al. (1989) include beliefs about the subject matter as another component of subject matter knowledge. They suggest that "...teachers' beliefs about the subject matter, including an orientation toward the subject matter contribute to the ways in which teachers think about their subject matter and the choices they make in teaching" (p.27).

Pedagogical content knowledge or subject-specific pedagogical knowledge consists of an understanding of how to present specific topics and issues in ways that are appropriate to the diverse abilities and interests of learners. Thus, pedagogical content knowledge has two critical components - knowledge of presentations and a subject-specific knowledge of the learners. Shulman (1986) sums up these components:

...for the most regularly taught topics in one's subject area, the most useful forms of representations of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations - in a word, the ways of representing the subject that make it comprehensible to others... (It) also includes an understanding of what makes the learning of specific topics easy or difficult; and the conceptions and preconceptions that students of different ages and backgrounds bring with them to learning. (Shulman, op. cit., p.9, my emphasis)

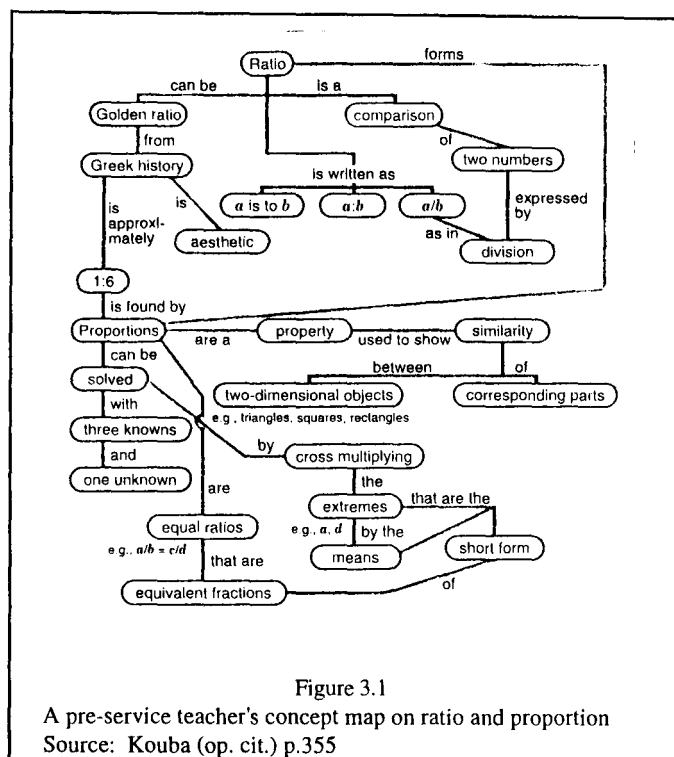
As a result of their lack of sound content knowledge and pedagogical content knowledge in mathematics, the pre-service teachers in Brown and Borko's study also focused on procedural rather conceptual understanding of the topics discussed. In other words, the teachers had difficulties in making the transition to what Brown and Borko refers to as "higher-order thinking and reasoning" about mathematics teaching. Yet, as Kouba (1994) points out, this kind of higher-order reasoning is at the very heart of being a reflective teacher and of being able to carry out effective self-evaluation.

Kouba (op. cit.) describes an approach (based on the use of concept maps) she and her colleagues have found successful in their mathematics teacher education programme. This approach, she suggests, may help novice teachers to become good evaluators of their level of mathematics content knowledge and their pedagogical content knowledge regardless of the style of teaching used. As a first step, the teacher creates a concept map of the mathematical knowledge and connections they want the students to know by the end of the lesson or unit. The act of constructing the map is meant to help both to increase that teacher's understanding of the content in the lesson or unit and help and to draw her or his attention to any gaps or misunderstandings in the mathematical content and connections. A sample map on ratio and proportion constructed by a pre-service teacher is given in figure 3.1.

Kouba provides a simple acid test to enable the teacher to know where he or she stands. If the map has parallel disconnected strands, the teacher has a linear fragmented view of the topic. Such a teacher, in Kouba's view, needs help in making the transition to higher-order reasoning. He or she also needs "help in thinking through and making connections between concepts and procedures and among various representations of mathematical ideas" (p.355). If on the other hand, the concept map produced



somewhat resembles a web as in figure 3.1, then "that teacher has a more integrated understanding of the mathematical content...than the person who produced a linear map" (ibid).



Kouba's test may be simplistic, yet she reports that the concept maps helped identify gaps in the mathematical understanding of pre-service teachers who used the maps. The teachers became more aware of what to look for in the content as they designed mathematics lesson plans.

It can be inferred from the above discussion that self-appraisal is basically formative appraisal and even when it is formal - such as in self reports - it is oriented towards problem solving. It can even be useful in the process of any formal (summative) appraisal. For example, it can be used to prepare for the initial meeting (in say superior-subordinate appraisal) in order to help an individual decide which aspect of her or his work should be considered for appraisal. Undoubtedly, evaluation has the most value for an individual or a course team if it is formative, under their control and its results are utilised. However, the extent to which an individual can engage in such evaluation depends on the purpose of the appraisal. For instance, apart from an intrinsic sense of professional satisfaction that may be derived from self-appraisal, there may be little recognition, support or reward by the institution (or the employer) for the time and effort involved in improving teaching and enhancing its quality. Furthermore,

questions may be raised about the seriousness and validity of such evaluation. As Eraut et al (1987) point out, the capacities to be self-critical and develop self-monitoring strategies are often limited by socialisation, psychological and practical factors such as time, energy and isolation.

Indeed, many of the actions teachers take in their classrooms are based on implicit expectations, attitudes and values. Teachers are accurately aware of some of these expectations, particularly those emphasised in transactions with people outside the school, but less aware of others. Some professional norms are so internalised that they only become apparent when somebody questions them or some unusual incident draws attention to them. Since it is rare for these (internalised), norms to be made explicit or tested, the possibilities for (self-) evaluation of those norms are minimal. In fact, if these norms are allowed to remain unexamined indefinitely, the teacher's mind may be closed to much valid information and the possibilities for change will also be minimal. As Eraut et al (op cit.) argue, if individuals rely only on their experiences, they become 'prisoners of their programmes' and see only what they want to see!

Even Elliott (op.cit.) admits to the inherent weaknesses of self-evaluation :

Self-monitoring...although a necessary condition of awareness, is by no means sufficient...It remains possible for a person who gives an objective account of his situation to honestly misdescribe some aspects at the same time, e.g. due to the complexity, ambiguity or insufficiency of the evidence...(Elliott, 1978, p9).

Mathias and Rutterford (1983) also argue that while self-evaluation may be an essential ingredient for the evaluation of teaching, it does not, in itself, lead to better evaluation or improvement in the quality of teaching. In most cases, they argue, it merely reinforces the status quo. There is therefore the need to open oneself to new perspectives and new sources of evidence. As Day et al (1987) observe, one has to be prepared to see oneself as others see one in order to better understand one's behavioural world and one's effect upon it. This is so especially in cases where one's employer is not willing to dole out rewards and promotions on the basis of how best one can evaluate oneself. As Fletcher (1984) rightly points out, organisations may be reluctant to promote or give pay rises on the basis of self-appraisal. Arguably, one way of maximising the benefits of self-appraisal as well as countering some of the effects of its weaknesses is to bring a colleague into the classroom to assist in the self-appraisal process. Such appraisal, known as peer or collegiate appraisal is the second type of appraisal and is discussed below.

3.4 Peer Appraisal

Dean (1991) suggests that skills in self 'observation' need to be improved to enhance the validity of self-appraisal. One way of achieving this is through working with colleagues who, because they are different people, will see differently from one and may thus enlarge one's seeing while at the same time, ensuring that the appraisal will be confidential and that only agreed information will be forwarded to other people. In other words, teachers should be encouraged to invite peers into their classrooms for the purpose of both assisting them in the collection of appropriate information which will be helpful in inquiring into their teaching and providing 'fresh eyes' in order to help them test the validity of their own interpretations and judgements of the teaching and learning in their classrooms.

A peer, in this context, is a colleague who is believed to be broadly equivalent in experience, status, values and beliefs and who is perceived as being able to be both supportive and yet challenging. However, two people of unequal rank can work as 'peers'. For example, Heads and deputies in both primary and secondary schools would want to work alongside their colleagues in the classrooms, each appraising the work of the other. Thus, as Turner and Clift (1988) point out, peer appraisal can provide for all levels of staff within an institution the opportunity to practice appraisal in a less controversial setting and to experience what it feels like to be both appraiser and appraisee. Here, there would be no formal status differentials, no formal power relationships and no necessary competition for reward. For example, in a study by Kauchak, et al (1985), the researchers found that teachers were generally positive about peer appraisal because of its collegial nature. A similar finding was made by Rothberg and Buchanan (1981).

Romberg (1988) also observes in a review of the literature on collegiality that within schools, collegial relationships are highly correlated with satisfying school climate and general effectiveness. For example, teachers who had the opportunities to plan together, observe each other, and diagnose and evaluate students together were found to be happier with teaching than those who did not have such opportunities (Little, 1982). Such findings are indeed in line with studies in peer observation.

An example of such studies is Glickman's (1986) study which showed that teachers benefit greatly when they observe one another's work with the view to helping them to

improve their practice. Peer observation, according to Glickman, places the teacher in control of improving her or his existing skills or of developing new skills. The teacher who engages in peer observation assumes responsibility for her or his own development and works in collaboration with other teachers to become a more effective professional, particularly in cases where the observed teacher selects what is to be observed and how the observation is to take place. Furthermore, peer observation eliminates the problems that arise when a supervisor and a teacher work together in a *clinical supervision*.

With clinical supervision, the process of observing the teacher's behaviour is linked to the formative appraisal model. What the supervisor learns about the teacher is not supposed to be used when summative judgements about the teacher are required. Despite this, in many cases, teachers feel that they cannot trust their supervisors or that their supervisors are imposing their teaching styles on them. However, a well trained supervisor can avoid the conflict he or she faces when he or she plays both the helper and the judge, by concentrating more on the former role when appraising a teacher's work for professional development purposes.

It must be reiterated at this point that studies on peer collaboration in the teaching of mathematics are very scarce indeed. Most studies on peer collaboration in mathematics education are on peer-tutoring, and concentrate on the use of students as teachers to help their peers to learn mathematics. It has been suggested by some researchers in this area of mathematics education such as Linton (1972) and Sharply, et. al. (1983) that both the peer tutor and the tutored gain from the peer tutoring exercise. The tutors benefit systematically by reviewing, for the purpose of tutoring, material which they have studied and which are relevant to the exercise. The *tutees* (i.e. those being tutored), according to research in this area, would also benefit from having tutors who are somewhat advanced in mathematical attainment who could bring a wider range of knowledge and experience to bear on the tutoring. For example, in a study on the grade differences between student tutors and (student) tutored, Linton (op. cit.) examined the effects of 13-year-old pupils being tutored by other 13-year-old pupils, 15-year-old pupils, and 17-year-old pupils respectively. His findings indicated that the 17-year-old tutors were more effective in helping the 13-year-old tutees who were making grades Ds and Fs in eighth-grade mathematics than were 13- or 15-year-old tutors.

Sharply, et. al.(op. cit.) however, found in a similar study that although the tutees benefited from peer tutoring, there was very little association between the achievement-level of the tutors and the gains made by the tutees. The matter is by no means clear-

cut, yet it would appear that much would depend on what is being studied and at what level.

Relating the above findings to peer observation in mathematics teaching, one would not be far from right if one suggested that the observer, or the *peer appraiser* who has adequate content and pedagogical knowledge of the subject can be of great help to the appraisee. Admittedly, there seems to be no consensus on what critical knowledge the mathematics teacher should possess in order to ensure effective teaching of the subject. Some scholars (e.g. Shulman, 1985) suggest that since one cannot teach what one does not know, mathematics teachers must have in-depth knowledge of both the specific mathematics they teach and the mathematics that their students are to learn in future. Others suggest that knowledge of cultural and ethnic diversity is essential for effective mathematics teaching. Still, others see general pedagogical principles as the necessary component of the mathematics teacher's prerequisite knowledge. Yet, as Ball (1988) rightly points out, knowledge of mathematics is obviously fundamental to being able to help someone to learn it. Post, et. al. (1991) also argue that a firm grasp of the underlying mathematical concepts is an important and necessary framework for mathematics teachers to possess.

As mentioned above, the *Professional Standards for Teaching Mathematics*, produced by the National Council of Teacher of Mathematics (NCTM, 1991) in the USA emphasise the role of self-evaluation and peer evaluation as necessary components in the improvement of mathematics teaching. Schwartz (1992) argues that since for many teachers, adopting the constructivist view of mathematics teaching envisaged by NCTM's teaching standards will be profound, peer evaluation will be a necessary part of the evaluation and growth process. In other words, since the threat that usually characterises superior-subordinate evaluations are absent in peer evaluations, teachers with different philosophies of mathematics teaching can freely exchange ideas. Through the sharing of these different beliefs, those teachers whose beliefs are not in line with the constructivist principles of mathematics teaching may gradually change their beliefs. He argues further that in later stages of change, when peers who share the same philosophy of mathematics and its teaching discuss and reflect on their teaching, the nature of the peer evaluation can be expected to change. Schwartz writes:

Here one person's idea would be expected to stimulate and provoke a series of ideas from the other (colleague). In the light of these new perspectives, each (of the peers) would be likely to perceive and acknowledge the points at which their former ideas, methods, and attitudes fell short of the goals. (Schwartz, 1992, p.59)

Leiva (1995) also stresses the importance of peer evaluation in the professional growth of mathematics teachers. She argues that just as the practices are changing with respect to the assessment of students' mathematical performance, the practices and uses of the evaluation of mathematics teaching must also change. She points out that enlisting the support of other mathematics teachers to collaborate in the evaluation process ensures that special attention is paid to the mathematics content as well as the mathematics pedagogical knowledge exhibited in the teaching. This point seems to address Grouws's (1994) concerns about the 'managerial' forms of teacher evaluation in the USA. Grouws points out that not much attention is given to the mathematics actually taught in most superior-subordinate evaluations of mathematics teaching. He writes:

In assessing mathematics teaching, the subject actually taught is given insufficient attention. In some schools the assessment form shows nothing that examines actual mathematics being taught. For example, one can look at a completed evaluation...and be unable to determine that it is a mathematics teaching evaluation. (Grouws, 1994, p. 446)

Like self-appraisal, peer appraisal is formative appraisal because information obtained from such appraisal is used more often for the purpose of enhancing professional development of both the appraiser and the appraisee than for the purpose of passing judgement on the appraisee's performance. Thus, as Day et al (1987) argue, peer appraisal, if successful, could lead to higher teaching 'standards'. They point out further that the success of peer appraisal would depend on confidence in the colleague chosen to share the appraisee's topics, issues, aspirations, strengths and weaknesses as well as on acceptance that honesty can develop in ways which will encourage and support rather than opportunities for 'point scoring' or belittling. A trusted (and skilled) colleague can be used, for example, to check against bias in self-reporting and to assist in a more lengthy process of self-evaluation.

Like anything else, peer appraisal has its limitations. The notion of the 'critical friend' or trusted colleague is a valuable one but appraisals which use this concept must be professionally managed so that they do not become mere cosy chats. As Wragg (1987) points out, if peer appraisal is badly done, complacency would be reinforced, especially if two teachers who had little or no experience of other schools were either too easily satisfied or too embarrassed to offer anything other than soothing remarks. Such teachers would simply confirm each other's practices, engage in mutual congratulations and then go on happily about their business without breaking the stride. Furthermore, if a colleague is not skilled (or not trusted), then unless such appraisals become a regular part of the classroom overtime, the children and their teacher may react to the presence of the observer in such a way as to cause untypical behaviour. Even where

both appraisee and appraiser are skilled, peer appraisal could be time consuming. This is because the observer and the teacher must spend time together before and after the work observed to negotiate and fulfil the 'contract'.

In Kauchak, et . al.'s (1985) study, although teachers were generally positive about the method under discussion, they voiced one particular concern: that the practice could lead to increased professional competition and isolation in schools. The teachers in the sample used phrases like "spying", "jealousy", " personality clashes", "bigger and resentful", and "dog eat dog" (p.36) to describe the possible consequences of a peer evaluating system in a school.

The two methods of appraisal discussed so far focus on the types of appraisal which are linked 'solely' to professional development. Thus, they are concerned mainly with formative appraisal which involves monitoring ongoing teaching and has as its main purpose, the provision of feedback to teachers in order to help professional growth and enhance classroom teaching. Yet those with management responsibilities for the appraisal system as a whole may also engage in summative appraisal in which information is collected and might be used as a basis for informed decisions in areas of, for example, promotion and tenure, assignment and salary (Stiggins and Bridgeford, 1984). One form of this summative appraisal is superior - subordinate appraisal or managerial appraisal.

3.5 Managerial Appraisal

Managerial appraisal or appraisal by superiors is the kind of appraisal which is common in industrial, commercial and other bureaucratic organisations. This is the kind of appraisal which the literature (e.g. Bame, 1972; McWilliam and Kwamena-Poh, 1975) seems to suggest operates at the pre-university levels of the Ghanaian education system. Yet, as mentioned above, other writers such as Gokah (1993) presents teacher appraisal in Ghana as a combination of both formative and summative models, implying that the managerial method can be used to pursue both purposes of appraisal. The teacher appraisal system currently operating in Ghana is discussed in a later chapter, however it is worth mentioning that an excerpt from a report of an education officer responsible for the appraisal of mathematics teachers appears to support the claims made by some authors of the dual purpose of teacher appraisal in Ghana.

The officer paid brief visits to a number of schools and (also) undertook intensive visits to a few schools. During the visits, professional guidance was given especially on mathematics. He also

teamed up with the senior welfare officer (of the Ghana National Association of Teachers) to inspect the work of twelve teachers who were due for promotion to Assistant Superintendent, Superintendent and Senior Superintendent grades... (GES, 1991, p.2)

Managerial appraisal has several purposes : to control the actions of the subordinates, probably to ensure the 'effective performance' of their duties and responsibilities, but possibly to restrict their activities according to either the policies of the organisation or the wishes of the immediate superior; to provide information about the work and activities of the subordinates and possibly to provide opportunities for the subordinates to show initiative through innovatory procedures; to make decisions about promotion or some other form of reward in a systematic and 'fair' way; and to make decisions about the duties and responsibilities in the future (Bailey, 1983). The method used for this type of appraisal may vary, but the common form seems to involve an annual (or sometimes a more frequent) report which is based on an appraisal interview.

That the U.K. Government favour this type of appraisal more than any other (in education) is shown in a key document on teacher appraisal, *Teaching Quality* . The document dismisses self-appraisal with faint praise in favour of appraisal by others and states clearly who these 'others' are and how the appraisal should be conducted :

... the Government believe that ... formal assessment of teacher performance...should be based on classroom visiting by the teacher's head of department and an appraisal of the teacher's contribution to the life of the school (DES, 1983, p.27).

Indeed, the requirement in the Education (School Teacher Appraisal) regulations, 1991 that all teachers should be appraised by someone with management responsibility for them presupposed a superior-subordinate method of appraisal. As Wragg, et al (1996) observed in most of their case studies " teachers themselves were centrally involved in negotiating the focus of the appraisal, but it was predominantly the appraiser who exercised control over the way the process was conducted" (p.129). This observation indicates that managerial appraisal is being used alongside other methods in many schools in the UK.

Elsewhere, some researchers have conducted studies in which the superior-subordinate method was the main method used to collect data on teacher appraisal. For example, Tawari and Osarobo (1994), in a study to determine how well teachers were performing in Nigerian secondary schools, used a rating scale - the teachers' instructional performance scale (TIPERS) which was made up, of two sections (A and B). Section A sought background information from the teachers on their sex,

qualifications, teaching experience, subject specialism and school area. Section B focused on various components of the teachers' instructional performance. Teachers completed section A and their heads of departments completed section B indicating their assessment of the teacher's instructional performance. The researchers 'found' a significant difference in instructional performance between professional and non-professional teachers.

In a somewhat different study, Akpe (1994) relied solely on head teachers and their assistants to provide information about their teachers' performance in order to validate a teacher appraisal instrument. The researchers 'found' no significant differences between the scores given by the head and those given by their assistants and concluded that "the evaluation instrument is valid as it tends to reflect a true picture of the teacher's performance in the classroom" (p.261). Such is the convenience of the managerial method of appraisal, albeit it may be at the expense of validity!

There are a number of other factors which make managerial appraisal attractive to both superiors and their subordinates. It is argued that superior appraisal can identify career and professional aspirations with relevant in-service training which the senior colleague (i.e. the superior) might be able to implement. It may also enable the superior to develop a realistic overview of the strengths and needs of the subordinate, and this might assist a more effective representation of the latter's needs within the institution (Turner and Clift, 1988). Managerial appraisal can, arguably, help to break down some of the detrimental features of hierarchies, such as distance, secrecy and monopoly of influence, especially in cases where every member of staff is to be appraised by some superior. In such situations, managerial appraisal may be seen by all staff as providing them with the opportunity to be professionally accountable and thus to develop professional confidence and 'competence'. Indeed, if every member of staff is being appraised by some superior, and provided the appraisal is not centred on management needs, then this kind of appraisal can help every appraisee feel valued and respected as a colleague. For example, Bradley, et.al (1989) found that many of the teachers who participated in the pilot appraisal schemes (conducted between 1987 and 1989 in the UK) thought appraisal had provided them with an opportunity to have a serious professional discussion about their work with an informed colleague (possibly a superior) for the first time in their careers.

It must be emphasised, however, that if the superior is not well informed in the subject the subordinate teaches, the (outcome of the) appraisal may not be as beneficial as it should. Leiva provides an anecdote which supports this point:

Mr Hille has been ...teaching for three weeks when I made an announced observation in his second-year-algebra class. His lesson on ellipse had been carefully planned, he was ready with models, strings, calculators, overhead transparencies, and a lesson plan. Somewhere at the beginning of his enthusiastic presentation, he slipped from equations of ellipses to hyperbolas, while naming and graphing them as ellipses! Suddenly, he realizes what he was doing and looked at me in horror, but he went on for a few minutes, "keeping his cool" as he would explain later. He asked questions and assigned a few problems from a previous section. The period ended. To an observer with little or no mathematics background, Mr Hille's lesson appeared excellent. (Leiva, 1995, p.44)

Leiva concluded that the planning and technical aspect of the lesson were appropriate but that the teacher was not secure in his teaching nor in the mathematical content and the connections within the topic. If Leiva was not a mathematics teacher herself, the conclusion might be been different and Mr Hille might not get the help he so much needed!

A similar anecdote is provided by Koss and Marks (1994). The authors report that a mathematics teacher was observed teaching a geometry lesson. The assistant principal included in the evaluation report a recommendation that the teacher begin classes with a warm-up problem because the students were observed to be talking in the groups for the first few minutes of the class. The teacher later met with the administrator to explain that she expected the students to talk in groups, discussing questions from the previous day's assignment. For further clarification, the teacher gave the administrator a copy of the sections on students' and teachers' roles in mathematics discourse from the NTCM's mathematics teaching standards. The implication here is that the administrator was not aware of the section of the standards which permitted students to discuss mathematics in class! In any case, inaccurate judgements about a teacher's lesson could result from the lack of expertise on the part of the evaluator.

Another limitation of managerial appraisal is that if it is conceived by appraisees as primarily a contribution to 'positive and efficient' management of the teaching force rather than a means of supporting and enhancing the quality of learning, then it is unlikely to meet with unqualified success. Unfortunately, many superior appraisals are so conceived. As Christopher et al (1983) point out, where appraisal is encouraged by authorities (such as the LEA), there is bound to be, at the very least, a residue of suspicion and scepticism as to the real purposes of the exercise. Even where extensive negotiations have been made over purposes and forms of confidentiality have been ensured, the process of appraisal is unlikely to be comfortable as many teachers would see the exercise as a means of control.

Furthermore, if teachers see 'value for money' as the key justificatory concept for the introduction of formal (summative) appraisal schemes, they are most likely to be suspicious. After all, what does a teacher have to gain from having her or his work examined? As House (1972) argues, if there is no punishment for not exposing one's behaviour and many dangers in doing so, the 'prudent' teacher would give lip service to the idea of appraisal and drag both feet!

Indeed, attempts to change teachers and schools which have originated from 'outside' have often met with resistance or rhetoric rather than reality of change. This is particularly true of those attempts which have been under-resourced and failed to take into account that change is a long-term process. It seems that resistance to innovation which is the product of managerial appraisal may be because teachers themselves have played no significant part in its creation and development. It follows that where teachers are not themselves involved in decisions regarding the design, process and use of appraisal, the latter will have a negative effect on teachers' attitude.

There are, of course, other factors which make superior appraisal threatening and counterproductive. For example, a dominant, critical and controlling attitude on the part of the superior - who in certain cases might lack specialist knowledge or the awareness of the subordinate's stress and anxieties - could generate a hostile attitude from the subordinate. This is so especially in a situation where the superior is desirous of appearing to be powerful and therefore downgrades expressions of frustration or concern on the part of the appraisee.

To reiterate, if teachers see appraisal as an attack on the limited professionalism they have so far achieved, or as a means of pushing them to become educational workers who have no control over the content of their work and have to accept the judgement made by their managers, they are bound to fight back, as such view of appraisal presupposes that they are incapable of acting responsibly or autonomously or that they are incompetent, inefficient or in need of re-skilling.

3.6 Conclusion

In this chapter, the relevant literature on the appraisal of teachers, particularly in the UK and USA was reviewed and the strengths and weaknesses of three methods of appraisal discussed. It seems clear from the review of the literature that the greatest problem associated with teacher appraisal is that it produces an impasse. Teachers, like other professionals, work for some form of extrinsic reward (even if this is outweighed by some 'intrinsic' reward) and formative evaluation alone is unlikely to provide the

necessary institutional context of teachers' reward. To arrest this situation, there seems to be the need to complement formative evaluation with summative evaluation. Yet summative evaluation brings with it accountability and loss over the control of the process of appraisal. It appears that the problem is one of how summative evaluation can support, rather than undermine, formative evaluation and/or how the latter might feed into the former to provide a 'fairer' picture while maintaining its distinctive purpose and integrity. How well the teacher appraisal system in Ghana is (seen to be) achieving this difficult goal is clearly relevant to the present study, albeit it concentrates on the professional development of mathematics teachers. The study will not examine this delicate balance in any detail. This could be the subject of a future study.

As mentioned above the, two studies which mainly informed the present study are Bame's (1991) account of teacher motivation and retention in Ghana and Nyoagbe's (1993) research on the impact of the education reforms on teacher job performance. As far as the present study is concerned, the above studies as well as other studies conducted both within and outside Ghana suffer from one major deficiency. That is, most of the research is conducted using samples drawn from teacher populations generally. None has come to my notice which exclusively focused on mathematics teachers. Yet the findings of 'general' teacher appraisal studies may not apply in all subject areas, albeit they can guide enquiry into the appraisal of teachers in specific subject areas. It is of course possible that some observations about teachers' response to appraisal schemes may be valid across subject areas but it is important to identify which observations about teachers' response may not be valid in all cases. The question however is : how do we know which observations are valid across disciplines and which are not? There seems to be no way of knowing this other than conducting studies which concentrate on the appraisal of teachers of specific subjects in the school curriculum. For example, Hopkins and West (1995) show that the effects of appraisal depend upon such factors as perceptions of appraisal and how it is implemented. This finding may be more valid across subject areas than, for instance, their observation that many teachers in the UK seem to have found appraisal a rewarding experience in terms of boosting confidence and self-awareness. Even within a particular subject area, the latter positive impact of appraisal may only apply to certain categories of teachers. The implication is that many questions remain unanswered by the available literature on teacher appraisal.

As far as mathematics education is concerned (and this could be the case in many other subjects areas) evaluation of the teaching of mathematics is not just a matter of making observations/judgements but one of embracing values as well. In other words, efforts to improve the teaching of mathematics ought to depend on what good mathematics

among students, teachers, appraisers and indeed the general public. Can any appraisal scheme be seen in the same way by all mathematics teachers within say the same school? Research has shown that a relationship exists between teachers' conceptions of mathematics and classroom practices (e.g. Thompson, 1992). But does teachers' conception of mathematics along with their disposition towards its teaching dictate their interaction with an appraisal system and the benefits it can bring? Do teachers with higher qualifications in mathematics react differently from those with lower qualifications to appraisal? Do mathematics teachers with a greater length of teaching experience demonstrate a more positive attitude to appraisal? How can an appraisal scheme help every mathematics teacher to improve her or his practice? These are but a few of the questions which remain unanswered by studies in teacher appraisal.

Besides, the current emphasis on constructivist approach to mathematics teaching seems to question the validity of the findings of any teacher evaluation study based on transmission model of teaching and learning. It also questions the validity of evaluation instruments based on the latter model. The constructivist paradigm is described alongside others in chapter 5 but I will describe it briefly here. Constructivism is a philosophical perspective on knowledge and learning which asserts that knowledge is not passively received but actively constructed by the learner (von Glasersfeld, 1983). Applied to the teaching and learning of mathematics its main aim is to guide students to construct their own mathematics, taking into account the socio-cultural setting within which the construction takes place. If the constructivist principle apply to students' learning, then they surely apply to teachers' professional development. It is therefore important to examine schemes designed to appraise mathematics teachers in order to see if they 'fit' the teacher's role under the constructivist approach. For example, social constructivists emphasise the importance of context in doing mathematics, yet not all the mathematics done in school (at least currently) can be easily put in contexts familiar to the students. Avoiding mathematics areas which cannot easily be placed in context may not be the way forward. The solution may be an appraisal scheme designed to enhance mathematics teachers' pedagogical thinking and reasoning to enable them to give their students the opportunities to understand and appreciate unfamiliar contexts in which certain types of mathematics is placed.

Another limitation of the research on teacher appraisal is that most of the studies were conducted outside Ghana. Although some of the findings can be generalised to cover the Ghanaian educational setting, they do not generally take into account the Ghanaian culture, or the conditions under which Ghanaian teachers work. With regard to mathematics teaching, the new Education Reform Programme in Ghana stresses the importance of guiding students to participate in the development of mathematical

importance of guiding students to participate in the development of mathematical processes and relationships. This requires teachers to have highly developed mathematical thinking skills. It is only by sharpening such skills that teachers can quickly form and reform conjectures about students' understanding and beliefs from which they (i.e. teachers) can generate and evaluate alternative strategies. How well can the current teacher appraisal instruments cope with this requirement?

Finally, the studies conducted in Ghana have all concentrated on basic education (primary and junior secondary) teachers. There is therefore no research evidence on the appraisal of mathematics teachers in Ghanaian senior secondary schools. Considering that student' achievement in secondary mathematics determines their social destination in Ghana, it is important to investigate how the appraisal system can be used to help improve its teaching in Ghanaian secondary schools. The present study seeks to overcome some of the deficiencies mentioned above, by attempting to fill in some of the gaps in the existing literature on teacher appraisal.

CHAPTER FOUR

THE VALIDITY OF TEACHER APPRAISAL : A THEORETICAL FRAMEWORK

4.1 Introduction

The concept of performance appraisal as an employee testing strategy has a long history, particularly as regards trades and labour jobs, where apprentice blacksmiths, carpenters or painters must prove the mastery of their craft by performance. In these cases "scoring" might involve simply judging the acceptability of the product, which can be seen, felt, examined and therefore in some way compared to a standard. Here the appraisee knows what the standard is and can therefore determine whether or not he or she has performed to the required standard. Consequently, it is relatively easy to make valid judgements about such performance. However, the appraisal task becomes more difficult when the primary outputs by the candidate are not concrete 'products' but 'processes' (such as decisions, actions, interactions, explanations and so on) that vary from candidate to candidate and have no single 'objective' standard to use as a scoring template. Teaching provides a handy example.

In the teaching profession particularly in the U.K. where greater emphasis is placed on developmental models of appraisal as well as on the complexity of the teaching process, it is difficult, if not impossible, to decide an appropriate fixed criterion of good practice (Graham et al,1985). As Brophy and Evertson (1976) argue, 'effective' teachers not only need to be able to implement a large number of skills - diagnostic, instructional, managerial and therapeutic - but they also need to recognise which of the many skills they possess applies at a given moment and be able to perform that behaviour effectively. Also Wise et al (1984) argue that although it is possible to view teaching effectiveness as a continuum, the further one moves along this continuum from 'minimum competence' towards 'excellence', the more difficult it is to generalise about specific indicators. That the HM Inspectorate (DES,1989b) also share the above view is shown clearly in their report of the National Steering Group on the School Teacher Appraisal Pilot Study:

It is clear that appraisal cannot and should not be designed to provide a simplified account of the appraisee's performance against a set of fixed criteria of good practice. We would therefore **strongly** oppose the mechanistic use in appraisal of standard checklists of performance (DES, 1989b, par. 61, my emphasis).

Yet it may be too much to hope that teachers' employers in Ghana, where education competes with many other sectors for the nation's scarce resources, will be persuaded by this 'educational' argument. Indeed there are writers (e.g. Andreson et al, 1987) who share the view that it is possible to make judgements about teachers' work and that such judgements seek to 'improve' teaching through differential reward and/or retention of personnel. Even in the U.K. where much emphasis is put on the developmental aspects of teacher appraisal, the HM Inspectorate, in spite of their 'strong' opposition to the use of a set of fixed criteria of good practice, argue in a separate document (DES, 1989a) that essentially, appraisal is about the judgement of performance and that underlying the purposes of teacher appraisal is the crucial question of what are reasonable 'standards' to be expected of individual teachers.

Nevertheless, the question one might ask here is : how can one make 'accurate' judgements about the teacher's work for any purpose? This is a question which clearly invokes the issue of validity of measurement instruments as well as that of assessment procedures. Therefore in an attempt to answer the question in relation to teacher appraisal in Ghana in general, and the appraisal of mathematics teachers in particular, this chapter discusses the concept of validity and the context in which it is used in the present study.

4.2 The Concept of Validity

Validity is the single most important issue in the discussion of any appraisal system (Trethowan, 1987). Indeed, if the (teacher) appraisal system is to serve its intended purpose(s), then the inferences and judgements that are made from it must be defensible. This means that the selection, development of the instruments and procedures for collecting information as well as the basis for synthesising the information and drawing inferences from it, must be clearly linked to the purpose(s) for which judgements, inferences and decisions are made (Fletcher, 1992).

Validity thus refers to the degree to which evidence supports the inferences that are drawn from the measurement instruments or procedures. Put in another way, the validity of an appraisal system is the fidelity of the inferences drawn from the response to the system (Powney, op. cit.), or "the extent to which observed measures approximate values of the 'true' state of the unobservable behaviour" (Johnston & Pennypacker, 1980, p.190). Indeed, there are many different ideas and methods of arriving at the 'truth' and this situation reflects the different definitions and types of validity. The result of the variations in the definition of validity (and its types) is that it

is often unclear whether validity is a property of measurement instruments (Black & Champion, 1976), of individual scores (Johnston & Pennypacker, 1980), or of observers (Lehner, 1979). The following examples will elucidate this point.

Black and Champion (1976) define validity of a measurement instrument as "the property of a measure that allows a researcher to say that the instrument measures what he (sic) says it measures..." (p.222). And using the word "accuracy" in place of validity, Lehner (op. cit.) argues that accuracy can be established by using an 'expert' observer or the consensus of several observers (i.e. validity resides in the nature of the observations). Johnston and Pennypacker's (1980) definition of validity, quoted above, provides an example of validity defined in terms of scores. Thus, validity of any assessment scheme can sometimes be said to depend on the instruments used, sometimes on the observers, sometimes on the scores produced by the instruments and/or the observers scores, and sometimes on other relevant factors. But does this apparent inconsistency in the usage of the term "validity" affect the ability of an appraisal system to measure what it is intended to measure? One might argue, on the face of it, that the lack of a 'standardised' definition of a term is a potential threat to the 'correct' usage of that term.

Admittedly, if different authors use the same term to refer to different things or the same author uses the term to denote different things on different occasions, then there are bound to be problems regarding the use of that term. However, a closer examination of the way the term "validity" is used by different authors (or by the same author on different occasions), would reveal that the concept remains somehow 'intact'.

If we define an "instrument" as the procedure designed to measure the presence and/or magnitude of a phenomenon; a "score" as a result of the measurement process; and an "observer" as the person who carries out the measurement, then as far as the validity of the entire process of appraisal is concerned, we have a triad - that is, three closely related concepts rather than distinct aspects of the measurement process. This means that if validity is defined in terms of any 'member' of the triad, it is implied that it can be defined in terms of the other two. Indeed, it is hardly possible that a valid instrument used correctly (by an 'expert') will produce invalid scores. Similarly, if we think of measurement as involving, at its simplest, a relationship between a variable which is not directly observable and one that is, won't inaccuracies of the recording of scores of the observable variables affect the correlation between the observable and the unobservable variables?

Surely, errors such as observation and coding inaccuracies, calculation mistakes and

interpretation bias (all by the observer) can invalidate the measurement. In much the same way, contamination of scores by factors other than the property being measured - an error which results from the instrument (Mueller et al., 1977) - can also invalidate inferences and judgements made from the measurement. In fact, as argued below, the above factors are only three of the many factors which can affect the validity of any appraisal system.

It follows that the validity of any appraisal system is at least the total validity of the observations, scores and instruments employed in the scheme. If it can be established (at any time according to a pre-determined criterion) that any one or more members of the above 'triad' is invalid, then the whole assessment scheme is invalid. This triple validity demand makes the appraiser's task most formidable. This is so especially in a case where the outputs one is appraising are not concrete 'products' but 'processes'.

As House (1980) rightly observes, it is reasonably safe to posit that no single appraisal system, no method will guarantee the achievement of the triple validity established above. This means that several assessment approaches will be appropriate and the appraiser can then choose an approach (or a mix of approaches) on the basis of his/her preferences or on the basis of some agreement reached by those involved in the appraisal system. Ideally, the appraiser should be trained in several approaches and should know the weaknesses of the various approaches so that he or she might guard against threats to their validity.

One thing we will find out as far as the present study is concerned is whether or not the teacher appraisal system in Ghana relies on a mixture of approaches. In other words, the question that I will seek to answer is: does the appraisal system rely too much on a particular approach? A number of questions follow from the last question. For example, if the appraisal system does or does not rely too heavily on a particular system, are there other approaches than can be used to improve the validity of the system? Are appraisers trained to use a mixture of different approaches?

4.3 Evaluating the Validity of Assessment Systems

How do we know whether or not a particular assessment system measures what it is designed to measure? In other words, how do we evaluate the validity of the system? In an attempt to answer either of these questions, I shall discuss different methods of validating assessments generally via the discussion of the traditional 'criterion-construct-content' types of validity. I shall relate the concept of construct validity to the

appraisal of mathematics teachers in Ghana in chapter 8.

4.3.1 Criterion-Related Validity

Before any kind of assessment (interviews, appraisal, simulation etc.) is ready for use, its validity must be established on a representative sample of persons. The sample scores are not themselves employed for operational purposes but serve only in the process of ‘assessing the assessment’. If the assessment proves valid by this method, it can be used on other samples in the absence of the criterion measures which the assessment is intended to measure (Anastasi, 1988). The next stage would then be to compare the scores of the assessment with the criterion measures themselves to find out whether or not the two sets of measures correspond to each other.

Criterion validity of the test (or indeed any form of assessment) refers to the relationship between scores on the test and measures of the criterion. The criterion measures against which the test scores are validated may be obtained some time after the test scores have been obtained (in the case of predictive validity), or at the same time as the test scores (in the case of concurrent validity).

The predictive validity of any assessment system indicates the effectiveness of the (assessment) system in predicting an individual’s performance in specified activities. For example, a mechanical aptitude test may be used to predict a candidate’s subsequent job performance as a mechanist. The most obvious role of tests as predictive devices focuses on their use in vocational guidance (Wolf,1988), the selection of employees (Bray & Grant, 1966) and educational tests for entry to further education (Mitter, 1979).

The process of estimating the predictive validity of a test is straightforward. Test scores are simply correlated with ‘future’ measures of an external criterion. However, it may not always be worthwhile or indeed feasible to wait for the criterion measures to ‘mature’ (that is, the time the phenomenon one is interested in becomes available on the sample groups) in order to obtain the information that the assessment is trying to predict. For example applying the concept of predictive validity to vocational training, Wolf observes:

... predictive validity is in practice likely to be extremely hard to measure and establish simply because of the mobility of workers, and their different career paths after completing a given qualification. (Wolf, 1988, p.17)

As a compromise solution, concurrent validation can be employed as a substitute for predictive validity. This is because in the former, the criterion is always available, even if in a limited form. In this case the test or tests can be administered to a group on whom the criterion data are already available, thereby providing a simpler, quicker or less expensive way of obtaining a set of ‘comparable’ scores. For example, the test scores of an employee may be compared with their job performance, depending, of course, on how the criterion (job performance) is defined and measured. The predictive validity of the test can then be assessed from the comparison.

In teaching, the assertion that knowledge related to subject matter is an essential component of teachers’ professional knowledge is neither new nor controversial. It must however be pointed out that researchers do not seem to agree on elements of knowledge that are essential for effective subject matter teaching. Nevertheless, in mathematics teaching, Shulman (1986) for example, has suggested that a teacher’s prerequisite knowledge ought to include both mathematics content knowledge and pedagogical content knowledge. To the extent that these components correlate with the effective teaching of the subject, one’s knowledge of the above may be used to predict one’s mathematics teaching effectiveness.

Conversely, if a teacher is employed to teach mathematics on the basis of her or his knowledge of the subject (depending of course on how this is measured) then a correlation between knowledge of mathematics and its teaching is being implied. The teacher’s knowledge of mathematics is being used to predict her or his mathematics teaching. The problem however, would be the difficulty in listing all the criteria that can be used to measure one’s knowledge. Perhaps a “back door” approach which is often used in practice, would be to determine whether or not a teacher lacks any of the components with regard to the teaching of particular mathematics topics or skills. Lack of any of the components in specific contexts may predict inefficient mathematics teaching relating to those contexts.

In any case, as argued below, criterion related validity on its own has limited uses in teaching generally. This is because of the difficulties in determining what constitutes effective teaching. Indeed in any field that criterion-related validation is used, it is important that the criterion measure itself is valid. This means that, any judgements based on validation against external criteria should begin by challenging each criterion in turn. How is it derived? How stable is it? Is it the only external criterion available? Is there a cluster of criteria? One should also ask if high predictive validity implies that the test is inherently valuable, or it suggests that there is something wrong with the

course of study or the way the job is performed, or indeed with the test itself.

The implication is that in the classroom it is important to consider all the possible alternatives of measuring a particular construct to find out if a particular instrument is not measuring a different construct which correlates well with the one we are interested in. This is why, in my view, construct validity subsumes both criterion-related validity and content validity which is discussed below. I will therefore be referring to the concept of construct validity in the discussion of the validity of teacher appraisal in Ghana in chapter eight.

4.3.2 Content Validity

Before an instrument can be used to test the presence of a particular skill, aptitude or attitude, the construct has to be translated into a set of distinctive behaviours. The behaviours are described in terms of how people tend to act, or what people tend to say, or perhaps what others tend to say about them. The measurement instrument is constructed on the basis of such characteristic behaviours. Content validity of the instrument refers to the representativeness of the sample of behaviours the construction of the instrument was based on, in terms of the construct being measured. Leaving out any important behaviours might undermine the content validity of the instrument. Similarly, including too much emphasis on a single sub-area of potential behaviours or irrelevant behaviours can also weaken the content validity of the Instrument. Put simply, content validity refers to how well the instrument gives appropriate emphasis to the various 'components' (e.g. the behaviours) of the construct.

Devries et al (1981) have observed that measurement standards that must be achieved in the development of the content for an appraisal instrument are *deficiency*, *contamination* and *distortion* of measures. Measurement deficiency involves the degree to which the content of the appraisal process excludes some performance criteria considered to be important and representative of the appraisee's work. If the criterion say "encourages pupils to develop interest in the subject " is as important as "seems at ease in the classroom", then both items should be included in the content of the appraisal instrument to avoid violation of the deficiency requirement. Measurement contamination is concerned with the inclusion of performance criteria that are not related to typical teacher performance. For example using the trait "appearance" as a measure of teacher performance may be inappropriate if it has got nothing to do with the teacher's work (Mueller, et. al., op. cit). Finally, measurement distortion involves the degree to which relevant performance criteria are weighted disproportionately in the

appraisal instrument. For example, if the two criteria "encourages pupils to develop interest in the subject" and "seems at ease in the classroom" are equally important, then they must be given the same emphasis in the appraisal instrument. As in the case of criterion-related validity, content validity on its own is not enough. It is however important to observe that questions about validity begin with how appropriate the content is and radiate outward to other issues such as how the 'score' relate to the construct being measured (Messick, 1975). Thus as mentioned above, content validity is also subsumed by construct validity - which is the subject of the next section

4.3.3 Construct Validity

Sometimes, validity is presented as the agreement between two or more attempts to measure the same property through "maximally different methods" (Campbell & Fiske, 1967). Often, construct validity is assumed when an assessment measure correlates well with several other measures, each being possible but different measures of the (same) behaviour or disposition concerned (Mischel, 1981), or of a variable which is known to correlate strongly with the variable one is trying to measure (Chronbach and Meehl, 1955). Construct validity thus refers to the relationship of the assessment to a whole network of ideas about what it measures. Any data throwing light on the nature of the construct (e.g. the property that is being assessed) and the conditions affecting its development represent appropriate evidence for this type of validation. Construct validation starts with defining the construct to be measured. If defining the construct is a problem then assessing the measurement's validity becomes even a bigger problem.

Applied to teacher appraisal, this means that before one chooses a particular instrument or method of assessing a teacher's work, one must describe what it is about the teacher's work that one want to measure. Having established what aspect about the teacher's work that is going to be measured, the next question would relate to the criteria that should be used to measure the construct, which would in turn lead to the question of whether all the criteria and how much of each of the latter would be used to measure the construct. Hence establishing construct validity in teacher appraisal involves establishing the other two validities (content and criterion) described above. If at any time it can established for example, that the content of the appraisal scheme is not appropriate, then the appraisal is simply not valid!

It has been mentioned a number of times that the ultimate goal of teacher appraisal is to improve pupil learning. One way of achieving this goal is by ensuring that teaching is improved. Thus as far as the present study is concerned, the construct the teacher

appraisal system in Ghana is designed to measure is teacher's 'effective teaching' of mathematics. Establishing the validity of the system is establishing how accurately this construct is (seen to be) measured as well as its potential to improve the teaching of mathematics in Ghana. To the extent that mathematics teaching effectiveness is the construct being measured, the criteria used to assess mathematics teachers' work should not only reflect the construct, but should be criteria that have been validated (by research and practice) as capable of measuring the construct under discussion.

Therefore, in establishing the validity of the appraisal system, one of the things the study will look at is the criteria that are used to appraise mathematics teachers in order to find out if they meet the above requirements. In other words, it is within the "construct validity" framework (and more) that the validity of the appraisal of mathematics teachers in Ghana will be examined in chapter eight.

4.4 Recent Development in the Theory of Validity

In the mid-1970s there seemed to be substantial coherence between the professional and pedagogical literature in discussions of validity as a guiding concept in educational measurement. Validity had three interrelated aspects - criterion, construct and content validity - which I have described above. Although Loevinger (1957) had raised concerns about this partitioning of the validity concept her concerns were not widely reflected in the scholarly and pedagogical literature of the time. Arguing in the context of scientific rather than educational measurement, she criticised the three-part scheme for having categories that were not logically distinct. Content and criterion-related categories, she argued, were possibly supporting evidence for construct validity which subsumed them and much more. Only construct validity, in her view, provided a scientifically useful basis for establishing the validity of a test (Moss, 1992.).

Messick, (1975) revisited the issue arguing, as had Loevinger, that content and criterion considerations provided relevant but insufficient evidence about the validity of the test-based inference and that "all measurement should be construct-referenced" (p.957, original emphasis). In addition, Messick (op cit.) argued for an expansion of the concept to include explicit consideration of the consequence of a test use. A number of the writers (e.g. Cronbach, 1990) have since then joined the argument about the centrality of construct validity and the importance of considering social consequences of test use.

Indeed, excluding the consequential component of an assessment scheme from the

definition of the validity of the scheme risks diminishing the importance of validity. As Anastasi, (1986) rightly points out, "almost any information gathered in the process of developing or using a test is relevant to its validity" (p.3). However, Messick (1989) cautions:

...it is not that adverse social consequences of test use render the use invalid but, rather, the adverse social consequences should not be attributable to any source of the test invalidity such as the construct irrelevance variance. If the adverse social consequences are empirically traceable to the sources of the test invalidity..... then the validity of the test use is jeopardised.... If the social consequences cannot be so traced.... then the validity of the test use is not overturned. (Messick, op cit., p.11)

The definition of validity adopted in the present study reflects Messick's position on the potential social consequences of assessments. As far as the present study is concerned, issues relating to the social consequences of the appraisal system may include the potential of the system to favour certain categories of teachers at the expense of others. Is the appraisal system seen to be fair? Do some teachers see the appraisal system in a more positive light than others? What are some of the possible causes of any differences between the perceptions (of the appraisal) of different groups of teachers? What are some of the possible consequences of such differences, and so on. These questions are by no means novel, yet they are relevant to the validation of the teacher appraisal system in Ghana. The hypotheses formulated in chapter 5 are intended to answer some of these and other related questions.

In the following section, I will concentrate on the main method (and instruments) used in the appraisal of mathematics teachers in Ghana and show how their validity will be examined.

THE MAIN METHOD OF TEACHER APPRAISAL IN GHANA

The literature on teacher evaluation in Ghana (e.g. Hicks, 1960; Bame 1991) suggests that the managerial method is about the only method used in the appraisal of teachers in pre-tertiary institutions in Ghana, an observation which was confirmed in the pilot study. The literature also suggests (and this was also confirmed in the pilot study) that the main instruments employed are classroom observation and interviews. I will therefore concentrate on these instruments and how their use(s) as well as the outcomes of their uses can affect both their validity and the validity of the entire appraisal scheme.

It must be said from the outset that identifying appropriate *content* for teacher

performance appraisal criteria is a complex conceptual and empirical task. Perhaps the major unresolved validity issue, with regard to teacher appraisal, from both the testing specialist's and the lay person's point of view is the apparent 'absence' of technically, logically, educationally and ethically defensible criteria for good teaching (Dwyer, 1993). The 'lack' of such criteria has been the focus of sharp criticism of teacher evaluation for many years and has remained a central issue in establishing the validity of any teacher evaluation system (Dwyer, op. cit.). Nevertheless, if teacher appraisal is to fulfil the promise of improving performance (Graham et al, 1985; Trethowan, 1987; Bame, 1991; Barber et al, 1995) then there is the need to validate it by identifying the kinds of evidence upon which the evaluation of the appraisal should depend. As far as the present study is concerned, there are important attributes of both the data gathered on teacher performance and appraisers which may affect the validity of appraisal in Ghana.

Important attributes of the data gathered include performance criteria and standards, and data collection sources and methods; and those of appraisers include expertise and training (Duke & Stiggins, 1986). These attributes will be examined especially in the classroom observation of mathematics teachers' work to see how they can affect the validity of teacher appraisal in Ghana.

4.5 Observation of Teaching

Darling-Hammond et al (1983) observed that classroom observation usually coupled with teacher interviews and conferences, is the mainstay of most teacher evaluations. Indeed, The Graham Report (1985) envisaged that classroom observation be an essential feature of appraisal as it promises to offer the most practical procedure for collecting data about teacher performance. This view was echoed by ACAS (1986) and was also mentioned in the Education (School Teacher Appraisal) Regulations (DES, 1991). Many researchers (e.g. Mortimore and Mortimore, 1991) have highlighted the importance of classroom observation in the appraisal process. Other researchers like Barber, et al (1995) have observed that teachers are generally happy to see classroom observation as part of the teacher appraisal process.

This is hardly surprising, as most teaching/learning takes place in the classroom. As pointed out in the ACAS Report (ACAS, op. cit.), the purpose of classroom observation is to gather information about the 'overall' work of the teacher. Yet as argued above, no single method can guarantee the achievement of the triple validity criteria. It is indeed doubtful if information about the overall work of the teacher can

be obtained through classroom observation only. Scriven spells out the disadvantages of using classroom observation as the sole means of collecting data about teachers' work:

Classroom observation not only violates every tenet of sampling theory (too small, non-random, reactive, biased observer, etc.) but can only look at what is essentially irrelevant in all but the most bizarre cases, namely teaching style. This ritualistic evaluation is at its worst, the bait-and-sandwich technique of substituting something worthless for what is advertised to the community as serious accountability. (Scriven, 1986, quoted by House and Lapan, 1989, p.57)

Indeed, classroom observations may be valuable “if *properly* done as part of a more global strategy, but they cannot bear the brunt of teacher evaluation alone” (House and Lapan, op. cit., p.57, emphasis added). In other words, classroom observation may overcome some of its weaknesses if it is done by 'experts' using the appropriate criteria for the measurement of teacher effectiveness.

Classroom observations take two main forms - formal or informal. Formal visits are usually planned and are sometimes preceded and followed by a conference between the appraiser and the teacher. Informal observation may include unannounced drop-in visits by say a superior. They can also vary in frequency, ranging from one or two formal visits per year to almost weekly informal drop-in visits. This variation applies to time too. Observations can vary in length from a few minutes to an entire class period or more. As the present study concentrates on the professional growth of (mathematics) teachers the question to ask here is : what degree of formality, frequency and length is most appropriate for promoting growth? Admittedly, the answer to this question will vary greatly from teacher to teacher and from school to school, yet some generalisations can be made.

First, when the purpose of the appraisal is to promote the professional development of individual teachers, the attributes of sound performance behaviours may be different from when the purpose is to make value judgement on the teacher's work. If, for example, the appraisal is to identify the teacher's 'area(s) of needed improvement', then he or she may volunteer information about which of the criteria of the appraisal he or she thinks is difficult to meet. In other words, the appraisal may be based on criteria that are tailored to the individual context and capabilities of each teacher and which are endorsed by the teacher as appropriate for them. In this case, legal constraints might not decide the choice of the criteria. Rather, the teacher and the appraiser should determine which criteria are relevant, and growth oriented for that teacher and the feedback the teacher receives focused on those criteria. This requirement means that

the appraiser must be an 'expert' in the teacher's subject area and must be trained in the appraisal of the teacher's subject. Additionally, to ensure that the teacher reveals her or his 'area(s) of needed improvement', it is important that formative appraisals are conducted in a 'friendly' atmosphere. Indeed, if teachers perceive the atmosphere as 'threatening', they may hide their difficulties for fear that the latter may be used for summative purposes. This situation, which may arise especially in cases where the same appraiser appraises the teacher for both formative and summative purposes, has the potential of defeating the objective of formative appraisals.

Second, if the goal of classroom observations is to obtain a representative sample of teacher performance from which to draw conclusions about the teacher's needs, then it is impossible to draw conclusions from a sample of only one or two hours of performance. Judgements based on such a scanty sample may exclude many important behaviours and may therefore violate the deficiency criterion discussed above. Consequently, the content validity of the appraisal might be weakened and this will render the judgements based on it invalid.

Finally, an important part of classroom observation for professional development is the post-observation conference. As suggested by Wragg, et al, (1996) this could be a regular part of the observation and could focus on the strengths and weaknesses of the teacher's performance. Post-observation conferencing could provide an opportunity for both the teacher and the appraiser to exchange views about the observed lesson. Without it, the teacher may not get to know her or his areas of improvement and the appraiser may not be able to understand fully the actions of the teacher during the lesson. The present study will investigate the form classroom observation takes and whether or not teachers are given feedback on observed lessons. It will also look at how teachers get such feedback and the length of time between the end of an observed lesson and when feedback is given.

Observation for summative appraisal

When the appraisal is for promotion or any other summative purpose, the teacher may be required, for example, to demonstrate that he or she can meet the criteria for the appraisal. It is important to emphasise that when the purpose is to ensure that teachers have met a minimum acceptable levels of performance for summative purposes, the appropriateness of the specific behaviours ought to be evaluated in terms of their clarity to all parties involved in the appraisal, the consistency in their application, and their relevance to the teachers' work Devries, et. al. (1981). Only then can all interested parties be sure that the due process rights of teachers whose jobs may be on line are protected.

The appraiser may also be required to demonstrate that he or she has the necessary expertise which will enable them to make accurate judgements about the teacher's performance. In order to increase the credibility of the appraisal (and therefore its validity), it would be necessary for the appraiser to receive training in the appraisal of the teaching of the relevant subject(s). This will avoid invalidity arising from tracing adverse social consequences to validity weaknesses of the evaluation system (Messick, 1989). It is also essential that at least the *deficiency* criterion discussed above is met. In other words, the criteria used for the appraisal must cover most if not all of the teacher's work. To the extent that the above conditions are met, the (construct) validity of the appraisal may be strengthened.

Relating this to the present study, an investigation will be conducted into the level of training appraisers have received in the training of mathematics teachers for summative purposes. The amount of the teacher's relevant work which appraisers take into account for summative appraisals will also be investigated. Relevant questions would include whether or not promotion examinations and interviews reflect the mathematics teacher's work.

Next, I look at the other main instrument for collecting information about teachers' work for summative purposes namely, the promotion interview. As mentioned repeatedly in this thesis, although the present study concentrates on the professional growth of mathematics teachers, it also examines what possible effects the summative aspects of the appraisal system can have on the professional development of mathematics teachers.

4.6 Promotion interviews

The promotion interview in the Ghana Education Service is a form of selection interview. This is because the end is not one of making the GES more effective by helping teachers to be more effective as in the case of the appraisal interview within the UK formative teacher appraisal model, where the objective is usually to review performance and set targets (Bradley et al, 1989). Nor is the end one of giving advice and information with the view to assisting the individual teacher to adjust more effectively to himself or herself as in counselling interviews (Erickson & Shultz, 1982). Rather, the purpose of the promotion interview is to reward 'satisfactory' performance assuming that such performance will continue after the promotion (Obeng, 1995). Put differently, the promotion interview is the event at which teachers whose performance is deemed to be 'satisfactory' and who are considered the potentially most effective by

the GES, are considered for reward by way of promotion to the next rank in the Service. Thus the interview is used as an instrument which seeks to measure what has been achieved and to predict what more can be achieved by the teacher. How such measurement and prediction can be done reasonably accurately is the subject of this section.

Both outside and within education, reliability and validity of selection interviews have been called into question, and as early as 1916, investigators were questioning the value of such interviews. Scott (1916), for example, described an experiment in which he had sales managers judge the ability of applicants for sales positions. The results were a serious challenge to the reliability and validity of the selection interview. The unreliability of the technique was underlined by the considerable disagreement amongst the judges. The low (criterion) validity of the instrument was underlined by the low correlation between ratings and the actual production records of the applicants. Of course, the validity of the criterion - production records - could itself be questionable, in which case the low correlations would tell very little about the validity of the ratings, yet as is done in the validation of many assessment systems, the validity of the criterion is often taken as given (Wolf, 1996).

Without stifling the discussion with the “criterion problem”, if Scott’s instrument was designed to predict the ‘productivity’ of the applicants and provided production records provided an ‘objective’ measure of productivity, then the results of the study showed that the validity of the interview was questionable as reported. Similar results were reported by Hollingworth (1922) in a study involving applicants for a sales job. Hollingworth also found considerable disagreement between the 12 sales managers who took part in the study on their interview ratings of the salesmen.

The search then began to identify and eliminate the sources of error in the interview technique. An interesting study in this direction was carried out by Magson (1926) who attempted to discover how estimates of general ability are normally made in everyday life. Magson besides reporting that his untrained interviewers (drawn from a wide variety of careers) were unable to assess general intelligence with any degree of accuracy, showed that the estimates that were made were at least in part based upon the facial expressions and personal appearance of the interviewee. Spielman and Burt (1926) went on further to show that a further source of the varied assessment (i.e. inter-rater unreliability) amongst judges was that of fundamental disagreement about the meaning of the trait or construct which was being assessed.

Since (about) the middle of this century, major reviews of the research literature on

selection interviews have been done by Wagner (1949), Mayfield (1964), Ulrich and Trumbo (1965), Wright (1969), Arvey and Campion (1982) and ICRA (1992). While acknowledging the problem of reliability and validity in selection interviews, each of the above suggested ways of improving the reliability (if not the validity) of such interviews. For example, Mayfield (op. cit.) observed that interviewers are more influenced by unfavourable, negative information than by favourable positive information and that the type of answer the interviewee gives is influenced by how the question is asked. He stressed the importance of studying closely the variables which are capable of influencing the judgements of interviewers. The implication is that if these variables are clearly identified and their potential to influence the results of the interview acknowledged, the variations in interviewer ratings might be reduced and reliability improved. Mayfield suggested further that interviews should be structured rather than unstructured as in the latter type (of interview), interviewers tended to talk too much and to make decisions about selections too early.

Ulrich and Trumbo (op. cit.) drew similar conclusions regarding reliability and validity and suggested that the interview should be limited to a clearly defined purpose particularly when the interview is to do with decisions regarding the interviewee's career. In a similar vein, the International Centre for Research in Assessment (ICRA, op. cit.) observed in their review of the literature on oral assessment that studies on interviewing have shown consistently that interviews have limited validity as predictive tools and tend to have low reliability. In addition, they observed that interviewers' judgements are influenced by factors which cannot be easily controlled. Like the above reviews, ICRA also concluded that structure is of great value in interviewing. They suggest further that reliability may be increased greatly if the traits answers are being used to assess are made clear in substantive terms and that predictive validity may be enhanced if "situational interviews" are employed. The latter suggestion presumably refers to using scenario-type questions which can produce responses about how candidates would actually behave in the position the interview is designed to select them into.

Relating the rather disturbing evidence about the reliability and validity of selection interviews to the present study, it is clear that credibility is of great importance here. Of course, the issue of content validity is also important. Indeed, if the promotion interview takes stock of the teacher's performance and rewards her or him (under the assumption that such level of performance will be sustained over time) as claimed by Obeng (1995), then it is important that the interview covers most if not all of the teacher's work. As Messick (1989) observes, if adverse social consequences arise as a result of either failing to identify the trait that is to be measured or failing to measure it

with the appropriate criteria, then the assessment is clearly invalid. Yet identifying all areas of the teacher's work is one thing and finding the appropriate criteria to measure them is another. As discussed above, the research evidence shows that it is difficult to achieve both content validity and criterion validity in selection interviews, not to mention the usual imperfections (due to lack of training on the part of the assessor) in applying even a perfect model.

This means that, the promotion interview in the GES may be inherently invalid. It means that 'good' teachers who may deserve promotion may not be promoted and/or that 'bad' teachers who may not deserve promotion may be wrongly promoted as a result of the weaknesses of the interview. Admittedly, some of the errors can be reduced to a very low level by appropriate training, yet it is vital that teachers see any form the promotion interview takes as credible (Duke and Stiggins, 1986).

Credibility would depend on many factors, including knowledge of the technical aspects of teaching, knowledge of subject area and familiarity of the teacher's classroom and students. As far as the present study is concerned, a key dimension of the credibility issue is the appraisers' knowledge of mathematics. This issue is discussed in some detail in chapters 5 and 8 and it suffices to say that an appraiser's lack of expertise in mathematics can seriously undermine the validity of the judgement he or she makes on a teacher's performance. This may be the case in spite of the fact that he or she may be able to comment on the general aspect of the lesson, such as the appropriateness for the level of student attainment or the appropriateness of the course objective. It is difficult to imagine a mathematics teacher taking the promotion interview (or classroom observation) seriously if he or she perceived the interviewer to have little valuable knowledge of direct relevance to the teacher, the content area, and the grade level of particular group of students.

Among the important issues that will be looked at in the present study are teachers' perceptions of the promotion interviews and how these can affect the validity of the interviews. These perceptions will be measured in terms of what appraisers and mathematics teachers regard as the ultimate purpose of the interview and the consistency with which the appraiser is perceived to pursue the objectives of the interview.

4.7 Conclusion

Validation is a difficult process in teacher appraisal procedures because it is difficult to identify clearly, the construct one intends to assess. This is because it is difficult to

decide upon the criteria of success or what constitute 'good' practice. It is therefore hardly surprising that the view widely held (by many teachers and educationalists) is that, it is extremely difficult to determine what constitutes competent work in teaching and to identify the nature of evidence required as the basis for judgements about individual performance (Schon, 1983). Indeed, teaching is a multifaceted activity and thus entails weaving together many different kinds of knowledge and insight. It involves weighing and considering competing notions and commitments, making tough choices, analysing and reflecting carefully on the consequences of actions and decisions (Elliott, 1989).

However, an attempt was made in the last chapter to identify some of the methods and instruments that can be employed in collecting data about teachers' work for both formative and summative purposes. As stated a number of times in this thesis, formative appraisal concerns mainly the professional development of the teacher and as a result, decisions made about the teacher's performance may be used to improve the teacher's practice. Summative appraisal on the other hand, concentrates on data required to make a value judgement about the teacher's work in order to reward or punish her/him.

Concerning the methods that may be used to collect data in the appraisal scheme, it was pointed out that each method has its weaknesses and it would appear that a combination of methods is likely to be relatively strong because of the multiple sources of data different methods generate. The present study will investigate if the managerial method remains the only method of appraisal in Ghana. It will also investigate whether or not whatever methods used involve instruments which cover the wide range of teachers' work and whether or not appraisers who use the instruments are well trained in the use of the latter. As for the specific behaviours that teachers and appraisers may be required to exhibit, it was argued that these would depend on the purpose of the appraisal. As far as formative appraisals are concerned, the study will look at the following:

- * Appraisers' expertise in mathematics, its teaching and its appraisal.
- * How the criteria employed in the appraisal of mathematics teachers are related to mathematics teaching effectiveness.
- * The atmosphere within which formative appraisal are conducted.
- * Providing teachers with feedback on their performance particularly after classroom observation.

With regard to summative appraisal the study will examine:

- * The appraiser's credibility in terms of the level of training in the appraisal of mathematics teaching.
- * The criteria used in the summative appraisal of mathematics teachers in order to find out how much of the teacher's work is covered by them.
- * The match and/or mismatch between teachers' perception of the criteria used for summative appraisal and those of appraisers and examine how clear the criteria are to both parties.
- * Whether or not multiple methods and instruments are used to collect data on teachers' work.

The next chapter looks at how the discussion in this chapter can be related to different groups of teachers' perceptions of teacher appraisal for formative purposes. Specifically, the hypotheses discussed in the next chapter are designed to measure teachers' perceived impact of formative appraisal by looking at their perceptions of the benefits of the appraisal (in Ghana), particularly the system's potential to help them to improve their work. This position is in line with that taken in studies which have both been conducted within the context of appraisal policies that address both formative and summative demands and focus on teachers' attitude towards performance appraisal processes (e. g. Kauchak, et al, 1985). Thus perceived positive impact of appraisal in Ghana, even if indirect or unanticipated, may affect the validity of the scheme positively, whereas perceived negative outcomes may affect it negatively. For example, the supervisory relationship may, following appraisal experience, change to become more trusting, teachers may take appraisal more seriously, or they may develop attitude of enquiring about their own development (Kilbourn, 1990). On the other hand, the process may be negatively perceived if identified problems cannot be corrected (Natriello, 1990), or may lead to defensiveness, frustration, wasted time, work overload, or superficiality (Kilbourn, op. cit.). Surely, an appraisal scheme producing a perceived positive impact is more likely to be valid (considering the emphasis being laid of the formative aspect of appraisal in the present study) than the one which is seen to produce negative impact. To the extent that formative appraisal is designed to help teachers to improve their practice, the hypotheses discussed in the next chapter seek to measure mathematics teachers' perceived validity of the appraisal system as a formative process.

CHAPTER FIVE

HYPOTHESES FOR IDENTIFYING THE VARIABLES RELATED TO PERCEIVED SUPPORT

5.1 Introduction

In the last chapter, an attempt was made to establish the criteria with which the validity of the appraisal of mathematics teachers in Ghana will be judged. As mentioned in chapter one, in addition to the criteria discussed in the last chapter, mathematics teachers' perceptions of the teacher appraisal system in Ghana would also inform the conclusions about the validity of the system. To get clear insight into these perceptions and also to identify which variables are significantly related to the perceptions, a number of hypotheses were formulated and tested in the present study. The issues which informed the hypotheses were discussed briefly in chapter 1 and as mentioned in that chapter, the latter are discussed in detail in this chapter. It was also mentioned in chapter one that the main dependent variable used in the formulation of the hypotheses was *perceived organisational support*.

As pointed out in chapter 1, employees in an organisation form global beliefs concerning the extent to which the organisation cares about their well-being. These beliefs constitute the employees' perception of the organisation's commitment to them. A number of studies have supported the view that employees' commitment to the organisation is strongly influenced by their perception of the organisation's commitment to them. For example, Buchanan (1974) found that with managers in business and government, beliefs that the organisation recognised their contributions and could be depended on to fulfil promises were positively related to moral commitment as measured by the standardised Organisational Commitment Questionnaire (OCQ). Steers (1982) also reported similar effects of the same beliefs on moral or affective attachment of hospital staff, engineers and scientists.

Still outside the world of education, O'Reilly and Chatman (1986) have found that perceived organisational support is associated with expectancies that high performance would produce (in addition to material rewards such as pay and promotion) social rewards including approval and recognition, and as a result, enhances job performance. Mowday et al (1982) have also found that perceived organisational support on the part of employees leads to the latter's strong involvement in the organisation which includes performance that goes beyond the call of duty. In other words, perceived organisational support could lead to actions for which the individual (employee)

receives no immediate reward but which benefits the larger organisation.

In education, Eisenberger et al (1986) found perceived organisational support to be positively related to job attendance among private high school teachers. The study involved other employees from non-teaching organisations. Both the teachers and non-teachers were given 36 statements about the degree to which the organisation appreciated their contributions and would treat them favourably or unfavourably in diverse situations. The employees, particularly the teachers, were found to view their evaluations by the organisations as positive or negative to a consistent degree across various dimensions and to believe such evaluations would influence many aspects of their treatment. The researchers reported further that the effect of perceived organisational support on job attendance was greater among teachers expressing a strong acceptance of the appropriateness of trading work effort for organisational rewards. In a later study (Eisenberger et al, 1990), the researchers confirmed that perceived support was positively associated with job performance as indicated by performance and attendance measures.

Many other educational researchers have come up with findings which are not different from the above findings. Bidwell (1955), for example, using role theory as his framework argued that one of the variables governing the behaviour of persons in administrative interaction is the set of role expectations which they hold for each other. Teachers and educational administrators can be seen as participating in the same organisation. In their administrative interaction, when a negative discrepancy occurs between what the teacher expects the administrator to do and what the latter actually does, the teacher will experience frustration and will show less commitment to his work. On the basis of this theory, Bidwell carried out a study from which the findings confirmed his assumptions: teachers who perceived the behaviour of a school administrator as being consistent with their expectations would tend to be more committed than teachers whose perception were not consistent with expectations. The nature of commitment would depend on the expectations and whether or not they were actually fulfilled.

In a study of appraisal of headteachers, Hellawell (1989) found that the perspective adopted (by those involved in the appraisal process) varies according to whether the individuals concerned see themselves primarily as appraisers or appraisees. In the study, those who saw themselves primarily as appraisees perceived appraisal as judgemental, top-down and not open to negotiation. On the other hand, those who saw themselves primarily as appraisers (although they themselves could also be appraised) saw appraisal as non-judgemental, supportive, multi-directional and negotiable. Also

Montgomery (1984) found that there was improvement in teacher performance following the use of an approach to teacher appraisal which was seen by teachers as stressing the positive aspects of teaching. As Turner and Clift (1988) rightly point out, teachers who see appraisal in a supportive mode are more likely to be committed to improving their teaching than those who see appraisal as a one-off judgement of teacher effectiveness to be used as a basis for reward or punishment.

A recent study in teacher appraisal involving 109 LEAs in England proves this point. Over 70 percent of the 658 teachers who took part in the study felt that they had derived personal benefits from the (developmental) appraisal; nearly half of them believed that appraisal had changed their classroom practice (presumably for the better); and many felt that appraisal gave them the attention and recognition they deserved (Wragg, et al, 1996). These perceptions reflect not only the mode in which the teachers involved saw the exercise, but the relationship between the teachers and their appraisers, for over 90 percent of the teachers were happy with their appraiser.

On the other hand, in a study on the determinants of teacher satisfaction and dissatisfaction in Ghana by Bame (1991), the researcher found that in the view of both former and practising teachers, two of the three principal reasons which drive teachers away from teaching are the lack of opportunity for professional development and poor relationship with supervisors (who are mainly the teachers' appraisers). The third reason was low remuneration.

The rest of this chapter discusses the hypotheses formulated to investigate the perceptions of different categories of teachers of the teacher appraisal system in Ghana. As stated in chapter 1, seven variables were used as the main independent variables in the formulation of the hypotheses, which used perceived support as the main dependent variable. The seven independent variables are given below:

1. Experience with appraisal
2. Respondent's last appraiser
3. Training in appraisal
4. Experience in maths teaching
5. Rank of respondent
6. Gender
7. Professional status of respondent

The seven main hypotheses formulated in the study are discussed below.

5.2 Hypothesis 1

At both the junior and senior secondary levels, mathematics teachers who have been appraised will be more positive about the potential of teacher appraisal in Ghana to help them improve their teaching of mathematics than those who have not been appraised.

It was mentioned in the last chapter that classroom observations and promotion interviews are the main instruments used to gather information about Ghanaian teachers for the purpose of appraisal. Mathematics teachers who have been appraised by others through the above instruments are deemed to have *appraisal experience*. Those who have not been so appraised have no appraisal experience. The object of selecting appraisal experience as a variable for the study is to find out if there are any differences between the perceptions of teachers who have actually gone through the appraisal process and those of teachers who have not. Any differences between the two sets of perceptions could help describe the impact of teacher appraisal in Ghana.

The impact of performance appraisal on individual and organisational effectiveness has generally been assumed to be dependent on subsequent managerial action such as providing feedback, rewarding 'good' performance and eliminating barriers to work effectiveness. For example, both Kazdin (1980) and Komaki et al. (1988) found that the performance of employees who were appraised improved when managerial action followed the appraisal. The above view of performance appraisal is compelling but a number of studies have highlighted the view that appraisal may also affect work productivity even if it is not followed with subsequent managerial action (Graen, 1976; Katz & Khan, 1978).

Specifically, social information-processing theory postulates that an individual's attitudes and beliefs can be significantly influenced by subtle social cues that affect the way in which events at work are perceived (Salancik & Pfeffer, 1978). Virtually any behaviour can serve this cueing function even when it is not intended to do so. For example, the frequency with which a manager appraises a subordinate's performance may help shape the latter's beliefs about the relative importance of her or his various work activities. More so if the subordinate is aware of the relative importance the manager attaches to appraisal. The manager's behaviour (e.g. the amount of time and effort he or she puts in the appraisal) may also signal whether or not the subordinate can expect to be rewarded for performing well on her or his work or punished for performing poorly. As Naylor, et al. (1980) observe, such outcome expectancies are an essential element of many cognitive models of work motivation, and can guide

behaviour (sometimes long) before the outcomes actually materialise. These outcome expectancies determine the direction of the relationship between appraisal experience and work motivation (Naylor, et al, op. cit).

The implication of the social information-processing theory is that performance appraisal may in itself have effect on subordinate productivity through its influence on the subordinate's perceived importance of her or his work. It is therefore reasonable to expect this effect to be separate from, and in addition to, the effect of subsequent managerial action.

Using the social information-processing theory, Larson and Callan (1990) predicted, in a study to investigate whether or not performance *monitoring* by itself can influence an individual's work without being coupled with managerial action, that monitoring by itself would increase performance on a task in comparison with when performance on the task was not monitored. Monitoring in this context refers to gathering information about the work effectiveness of others (Larson & Callan, op. cit.). As mentioned above, this prediction was expected to come true even when monitoring was not followed by the deliverance of any feedback or other forms of performance consequences. The only requirement was that the monitoring activity be apparent to the individual or group whose performance was being monitored. The researchers also predicted that when monitoring was followed by the delivery of some performance consequences such as reward for instance, performance on the monitored task would increase significantly in comparison with when monitoring was not followed by the delivery of any performance consequences. Larson and Callan's study strongly supported both predictions.

It has been stated a number of times in this thesis that very little research, if any at all, has been done in the field of teacher appraisal in mathematics education. This is perhaps because mathematics education is a young discipline. In fact, no study on the appraisal of mathematics teachers has as yet come to my notice in spite of the thorough search of the literature on appraisal in the U.K. and elsewhere. As Askew and William (1995) rightly observe after a review of recent research in mathematics education (5-16), there are many areas in mathematics education where answers are most needed but where not much attention has been given to them by researchers. Among these areas, the authors noted, is teacher effectiveness - where research can throw light on how, for example, a 'novice' mathematics teacher might become an 'expert'. Askew and William observe:

...it is clear that expert teachers have much smoother transitions between different phases of the

(mathematics) lesson than do novices, but it is far from clear whether this is a cause or effect of expertise (Askew and William, op. cit., pp.42-43).

Yet, turning novices into experts in mathematics teaching is only one of the many aspects of teacher appraisal which have not received the required attention in research in mathematics education. Not even Grouws's (1992) extensive review of research in mathematics education threw light on this area!

It is worth reiterating at this point that the main aim of teacher appraisal is to improve the quality of pupil learning via the improvement of teachers' work (see Mortimore & Mortimore, 1991, for example). Indeed, this aim, as far as the present study is concerned, has recently been clearly restated by Gokah (1993) who was until 1995, the director of the Inspectorate Division (ID) of the GES - the quality control wing of the Service which is charged with ensuring the maintenance of high educational standards in all pre-university institutions :

...the Inspectorate Division of the GES aims at identifying the strengths and weaknesses of schools in order to improve the quality of education offered and raise the standards of pupil achievements in [our] schools...(Gokah, 1993, p.1).

Surely, improving the quality of education means improving the quality and/or the use of educational inputs of which teaching arguably constitutes a major part. It is therefore hardly surprising that one of the functions of ID has been described as:

monitoring and supervision of teaching and learning in the educational system and ensuring that educational programmes and processes conform to the aims of the [Inspectorate] Directorate..., introducing, promoting and encouraging professional innovations in education,... and giving guidelines on methodology and content of syllabuses in the various subject areas...(Gokah, op. cit., p.2, my emphasis).

As the name indicates, the ID conducts its duties through the process of inspection, using the latter to investigate problems emanating from education and offering suggestions for remedies where appropriate.

Before the introduction of the current reforms (mentioned in chapter 2), inspections of schools were conducted mainly by officials from the headquarters (HQ) of the ID, under the guise of seeking "first hand" information about schools and teachers' work in those schools. Many commentators (e.g. Bame, 1991) have observed that this centralised system of inspections created tension between teachers and headquarters

officials who are thought to be far removed from the ‘realities’ of the conditions under which most teachers - especially those in the rural areas - work.

The reforms have brought a number of changes which are designed to “strengthen the management and supervision of basic (i.e. primary and junior secondary) schools at the *District* and *Circuit* levels” (Gokah, op. cit., p. 4). These changes include the selection of Circuit Supervisors with higher qualifications and experience to be in charge of supervision of schools at the above levels. Regional and HQ inspectors remain in charge of senior secondary schools and other pre-university institutions but, here too, the selection of supervisors has been streamlined to “ensure that the supervisors have adequate expertise in the teaching (and supervision of teachers) of the various subjects in the senior secondary school programme” (ibid).

Thus in addition to the appointment of better qualified supervisors, the functions of the ID, as far as supervision of schools and appraisal of teachers in the latter are concerned, have been decentralised - devolving from the headquarters, through regional co-ordinators and district supervisors to circuit supervisors. Perhaps the most remarkable change is the involvement of some ‘senior’ mathematics teachers in the inspection process at the senior secondary level (MAG, 1994). Additionally, appraisals are now also done internally in the various schools by teachers’ colleagues (e.g. heads and heads of mathematics departments). These ‘internal’ appraisals are a welcome idea not only because it is cost-effective as Willerman et al (1991) observe but because of the many ‘educational’ advantages of peer observation.

Indeed, most heads of department of mathematics who are in the position to appraise mathematics teachers’ work are likely to have reasonably adequate knowledge of the topics in the school curriculum and are also most likely to be seen by the appraised as capable of helping them to improve their work. There may also be some supervisors who may be seen by mathematics teachers to possess the necessary mathematical content and pedagogical knowledge to enable them to help the teachers.

Drawing on the social information-processing theory and on the recent ‘changes’ which the ID claims to have made in the appraisal processes, coupled with the findings of a pilot study towards the preparation for the present study, it was hypothesised in the present study that there would be a relationship between experience with the appraisal process and a teacher’s level of perceived organisational support - measured by the teacher’s perception about the degree to which appraisal, as is done presently in Ghana, would help her or him improve her or his mathematics teaching. In other words, it was predicted that experience with the appraisal process would influence perceived support

more than no experience. The direction of the relationship was predicted to be positive - i.e. teachers who have been appraised (especially those who have recently been appraised not necessarily by GES officials), are more likely to perceive a higher degree of professional support than those who have not been appraised before.

5.3 Hypothesis 2

At both the junior and senior secondary levels, mathematics teachers who were last appraised by GES officials will be less positive about the potential of teacher appraisal in Ghana to help them improve their teaching of mathematics than those who were not last appraised by GES officials.

Among the factors that have been identified as capable of affecting judgements and subsequent action on subordinate performance is perceived supervisor-subordinate similarity (Byrne, 1961; Golightly, et al. 1972; Baskett 1973; Rand & Wexley 1975). In research on perceived similarity, it has generally been assumed that an appraisee who is perceived as similar to the appraiser is more attractive to the latter, so that decisions regarding that person are biased positively (Byrne, 1961; Byrne et al, 1966). Experimental manipulations of similarity have generally supported this assumption. Persons seen as similar in professional background and attitude were treated and judged more favourably than those who were seen in a different light (Baskett, op. cit.). However, studies conducted in the field suggested that bias judgements resulting from similarity might be less significant than those conducted under laboratory conditions.

For example, Pulakos and Wexley (1983) found that perceived similarity between managers and their subordinates led both to give higher performance ratings to the other. Subordinates who perceived the supervisor as similar to themselves and those whom the supervisor perceived as similar reported less role ambiguity, more confidence and trust in the supervisor, and greater influence on the supervisor. Yet, studies involving college and job-applicant interviews found significant individual differences in the effects of perceived similarity (e.g. Dalessio & Imada, 1984).

Nevertheless, if perceived similarity led to a more positive working relationship between superiors and subordinates, in studies such as the one by Kingstrom and Mainstone (1985), this could produce greater insight into what is important in receiving a better appraisal report or feedback. This insight (rather than bias) might have led to more positive performance judgement. The above explanation is consistent with

findings that the quality and frequency of supervisor-subordinate interactions are important influence on subordinate performance (e.g. Liden & Graen, 1980). Kingstrom and Mainstone (op. cit.) found that superior responses to a measure of personal acquaintance with the subordinate were positively related to performance ratings and to actual sales productivity, suggesting that the rating reflected true performance differences rather than bias.

As far as the main dependent variable used in the hypotheses (i.e. the degree to which teachers of mathematics think teacher appraisal in Ghana can help them to improve their teaching of mathematics) is concerned, similarity between appraisers and appraisees refers to cognitive and value similarity (Senger, 1971). In this context, similarity would not only be in terms of shared philosophies of the nature of mathematics, which could also lead to those of its teaching and learning (Thompson, 1984; Peterson, et al., 1989; Raymond, 1993), but in terms of shared views about the purpose(s) and the form(s) of the appraisal process(es). Specifically, teachers who share the same philosophy of mathematics and its teaching - and the appraisal of it's teaching, of course - are more likely to perceive similarity between themselves and the appraiser than those who do not share the same philosophy of mathematics as the appraiser.

Considering that most of the appraisers of mathematics teachers are older and senior members of the GES who are not necessarily mathematics specialists (Konadu, 1994), these appraisers would most likely be guided by 'old' internalised methods of teaching mathematics by which they, when students, were taught the subject. Yet there is now much emphasis in Ghanaian mathematics syllabuses on 'modern' ideas like group discussion (e.g. Hoyles, 1985, 1990), problem solving (e.g. Schoenfeld, 1985, 1994), investigational approaches (e.g. Cockcroft, et al, 1982) and computers as tools in the mathematics classroom (Noss, 1986; Noss et al, 1991). In fact, some of these have already been incorporated into the training college mathematics syllabuses in Ghana (National Teacher Training Council, 1992). Most mathematics teachers - particularly those in the senior secondary schools as well as the few mathematics specialists in the junior secondary schools - are more likely to have values which are in line with the current constructivist principles on mathematics teaching. These values may be different from those of the GES appraisers, especially the non-mathematics specialists amongst them. Indeed, this turned out to be the case in the pilot study which findings the present study is based on. The pilot study revealed that mathematics teachers, especially those at the senior secondary level, thought they shared similar views about mathematics and its teaching with their 'colleagues' (e.g. heads and heads of department) more than they did with officers from the GES. It was therefore predicted that those teachers who were last appraised by GES officials were more likely

to be less positive about the potential of teacher appraisal in Ghana to help them improve their teaching of mathematics than those who were not last appraised by GES officials.

5.4 Hypothesis 3

At both junior and senior secondary levels, mathematics teachers who have been trained as appraisees will be more positive about the potential of teacher appraisal in Ghana to help them improve their teaching of mathematics than will those who have not been so trained.

Providing teachers with training that would help them to improve their practice and/or obtain reward for good practice might go a long way to boost their morale. The present study looked at an example of such training. This is the sort of training teachers receive in order to help them pass promotion examinations and interviews conducted by the Ghana Education Service (GES). Nearly every year, teachers who have served a number of years in the GES and whose work is deemed 'satisfactory' are invited to attend prescribed courses, write promotion examinations (or in some cases attend promotion interviews) for the purpose of promoting them to the next grade in the GES. Thus the variable under discussion is a kind of "*beat the appraiser*" training. Yet it is also the kind of training that can help teachers improve their teaching. This is because promotion in the GES is meant to reward teachers for satisfactory practice (Obeng, 1995).

As mentioned in chapter 2, there are different criteria for promotion in the GES, and these depend on the particular rank a teacher wishes to be promoted to. For promotions from the lowest rank in the GES (i.e. *teacher*) to that of the next one which is assistant superintendent, the candidate can either attend 'prescribed' and 'promotion' courses, followed by work inspection in her or his sixth year of continuous service in the former rank or pass a prescribed examination followed by work inspection in the fourth year. From assistant superintendent to superintendent, the teacher is required to attend an in-service training course, obtain a satisfactory report at the course, and pass a prescribed examination after the course. Assistant superintendents who do not wish to take the prescribed examination are required to do four years' satisfactory service and attend at least two prescribed courses.

Many teachers opt for the promotion examination route, which is why the "*beat the*

appraiser" training is of great importance to certain teachers. If the training teachers receive as appraisees is *valid*, then not only should they be able to pass promotion interviews and examinations, they should be able to transfer such training to their work to help them improve their performance, for as Asiedu-Akrofi (1982) points out, examinations and interviews are based on teachers' work. Furthermore, valid training - i.e. one that achieves the transfer that it is designed for - has been found to increase self-efficacy among trainees (Bandura, 1982).

Bandura (1977) describes self-efficacy as one's belief that he or she can perform a specific task. That is, when individuals feel they are capable of high performance, they are more likely to attempt the appropriate behaviour in order to achieve their goals. Indeed, self-efficacy has been found to influence performance in a variety of organisational situations, including sales performance (Barling & Beattie, 1983), perceived career options (Lent et. al., 1987) and job attendance (Latham & Frayne, 1989). Bandura (1982) identified four informational cues which trainers can use to enhance a trainee's self-efficacy. These are, enactive mastery, vicarious experience, emotional arousal and persuasion. Of practical importance, as far as the present study is concerned, are the first three types which are described briefly below. Readers interested in the fourth type should see Bandura (1982) for a detailed discussion of this type of informational cue.

In enactive mastery, trainers focus on the trainees' experience with a particular task. Positive experiences and success with the task tend to increase self-efficacy, while failures lead to low self-efficacy. A second way of increasing self-efficacy is by observing others then modelling their behaviour. Observing others exhibit successful performance increases one's own self-efficacy, particularly when the model is someone with whom the trainee can identify (Bandura, 1986). Also Gist et al (1989) observed that behavioural modelling is an effective training technique because it operates through self-efficacy to influence performance. The researchers found that observing a model perform a specific computer software task enhanced the individual's belief about their own capabilities to use the software correctly.

A third method of influencing self-efficacy is emotional arousal. This can be achieved through positive goal setting. Goals which raise the level of anxiety are negative and could lead to low self-efficacy (Bandura, 1982). Empirical studies conducted in a wide variety of contexts have consistently shown that setting specific difficult but attainable goals lead to high performance (Locke & Latham, 1990). Goal setting is important because without specific goals, people have little basis for judging how they are doing, or for gauging their capabilities. Self-motivation is sustained by adopting specific

attainable sub-goals that lead to large future goals (Locke & Latham, op. cit.)

As far as mathematics teaching is concerned, it seems clear, as pointed out by Murray et. al. (1995), that training programmes that are successful in increasing teachers' self-efficacy are the ones that address two basic issues: firstly, teachers' perceptions of the nature of mathematics and secondly, the skills that teachers need for day-to-day classroom activities. Indeed such training programmes provide opportunities to address not only teachers' perception about what mathematics is and how it is learnt and practised, but also their perceptions about their own mathematical attainments and how they (can) 'do' mathematics. Such programmes also provide opportunities for the sharing of information or some basic guidelines for establishing desirable learning environments in the classroom.

Regarding the skills that mathematics teachers need for their day-to-day classroom activities, these are clearly those skills that enable the teacher to create and sustain on a daily basis, the learning environment which will support the type of learning in children which the teacher has come to accept as desirable. With the current emphasis on constructivism, the teacher is expected to support a problem-centred approach to the learning of mathematics. Furthermore, if the training programme is *valid* - in the sense that it seeks to raise teachers' self-efficacy - then it should enable the teacher to share her or his skills with other teachers while at the same time testing the robustness of those skills. This could be so, particularly in a training programme which exposes teachers to doing mathematics at their own level as a vehicle to encourage them to reflect on the nature of mathematics and its learning (Simon and Schifter, 1991).

In such a programme, teachers may be challenged at their levels of mathematical understanding and problem-solving ability using various mathematical learning tools (see Noss et al, 1991 for an example of such training). This would enable them not only to increase their mathematical knowledge, but to experience a depth of mathematical learning that, for most of them, would be unprecedented. Training programmes which provide the opportunities discussed above might be seen by teachers to help them improve their mathematics teaching even if the training is designed to help them pass promotion examinations. However, much will depend on the extent to which trainers use the various techniques to raise teachers' self-efficacy in the teaching of mathematics.

Indeed, the above discussion suggests that the influence of the trainer can have a pivotal effect on teacher self-efficacy. Thus the GES officials and others who train mathematics teachers can exert influence that is positive in the sense that it increases

self-efficacy of mathematics teachers who attend appraisal training courses. If this is the case, as Asiedu-Akrofi (op. cit.) seems to suggest, then one would expect respondents who had been trained specifically in the appraisal process to be more positive about the potential of appraisal in Ghana to help them improve their teaching of mathematics than those with no such training.

5.5 Hypothesis 4

At both junior and senior secondary levels, more experienced mathematics teachers will be less positive about the potential of teacher appraisal in Ghana to help them improve their teaching of mathematics than less experienced ones.

Studies comparing novice and experienced teachers are concentrated in different areas. For example, Evertson, et al (1980) looked at the depth and breadth of experienced and novice teachers' knowledge of subject matter. The conclusion made in this and other similar studies was that the more experienced teachers were better able to apply their knowledge to the classroom setting and make use of more teaching strategies because of this knowledge. In a similar vein, Berliner (1986) looked at teachers' knowledge of their students and concluded that experienced teachers seemed to know their students better than novice teachers did. The present study looks at the relationship between mathematics teaching experience and teachers' perceived organisational support. This is one of the areas where previous research on appraisal appears to have been silent on. The hypothesis under discussion was formulated with the view to filling this gap.

Experience in the present study was operationalized with respect to the number of years the individual has taught mathematics. Specifically, information about a teacher's mathematics teaching experience was gathered with the following question: "*For how long have you been teaching mathematics?*". Another question was asked pertaining to one's total experience as a teacher. This total teaching experience was measured by asking: "*For how long have you been in the teaching field?*". Information about the latter more encompassing teaching experience was gathered because people may accumulate relevant knowledge and skills in mathematics teaching in different settings (e.g. through INSET courses, although they were not teaching mathematics at the time they attended such courses) that may help explain age-related differences in perception about the quality of support they receive from their supervisors.

For the purpose of this study, experienced mathematics teachers were those who had

taught mathematics at the appropriate level for more than *five years*. This is in line with the experienced-inexperienced dichotomy used in studies which have examined the differences between experienced (or expert) and inexperienced (or novice) teachers. For example, in Carter, et al's (1988) study involving expert and novice mathematics teachers, those teachers designated as experts had all taught for more than five years. Similarly, in a number of studies conducted by Singapore's Institute of Education to investigate the characteristics of expert teachers, five years' teaching experience was a requirement for the experts who took part in the studies. Finally, in Leinhardt and Smith's (1985) study on the relationship between teacher expertise and teacher behaviour, "the expert teachers were selected on the basis of ...growth scores of their students in mathematics over a *five year period*" (p.251, emphasis added).

Research on perception about people has focused on the way in which information about a person is encoded and organised in memory and how the resulting mental representations are retrieved and transformed into social judgements, affective reactions and behavioural decisions (Scrull & Wyer, 1989). Researchers in this domain (e.g. Hastie & Park, 1986) have suggested that when individuals are asked to make judgements about others, they retrieve relevant judgements already formed during early interactions or they create judgement on the basis of information from long term memory. In the former situation, individuals rely on judgements created when evidence was encountered. In other words, they form an impression of others "on-line". Often such judgements and inferences are made spontaneously as the judgement informing these inferences already exists. However, if a relevant judgement does not exist, the person will, as mentioned above, create a judgement on the basis of information from memory. Teachers form opinions about their supervisors in either of the two ways described above and the type of the opinion (i.e. either positive or negative) is influenced by the leader-member exchange process described by Graen and Cashman (1975).

The leader-member exchange model describes the process by which members in an organisation evolve their roles through interactions with their superiors. As a result of this process, quality of exchange ranging from low to high develops between the teacher and the supervisor. Early research examining the model indicated that a superior develops different quality exchange relationships with subordinates and those relationships are relatively stable over time (Dansereau et al, 1975; Graen & Cashman, 1975). Later studies were focused on the relationship between exchange quality and supervisor and subordinate attitudes and behaviours. Results suggested that, in comparison with a low quality exchange relationship, a high quality exchange relationship is related to more supervisor support and guidance, higher subordinate

satisfaction and performance, greater subordinate influence in decisions, and lower subordinate turnover (e.g. Kingstrom & Mainstone, 1985).

The relationship between Ghanaian teachers, particularly the experienced ones, and their supervisors has been far from anything which can promote a high quality exchange behaviour between the two groups. The rather depressing relationship that has, until the recent 'changes' made in line with the new educational reform programme, existed between teachers and their supervisors is well documented. Writers such as Bame (1991) have observed that supervision by GES officials does not seem to have changed from the form it took in the Colonial days when inspectors went into the schools to find faults with teachers' work. This 'cold' relationship between teachers and supervisors dates back to the beginning of the twentieth century when the system of "payment by results" was introduced into the country.

Although teachers are no longer paid by results, it would appear that the evaluative reports of visiting officers still determine teachers' pay increases and promotion. As pointed out in the teachers' conditions and schemes of service for members of the Ghana Education Service:

Promotions shall be made according to merit and in accordance with the scheme of service. In determining the individual's claim for promotion, account shall be taken of efficiency, qualifications, seniority, experience, sense of responsibility, initiative, general behaviour and where relevant, his (sic) powers of leadership and expression (GNAT, 1987, paras 20, 21, my emphasis).

Obviously, only the authors of the conditions of service know which combinations (or permutations !) of the above characteristics will actually determine when to and when not to promote a teacher . Therefore, although paragraph 22 (op cit.) states that "relevant experience ELSEWHERE, and periods of further approved training shall count for the purpose of promotion (original emphasis)", it is clear that GES officials determine, to a large extent, the promotion prospects of most - if not all - Ghanaian teachers. This means that the aims of GES officials engaged in supervisory activities and teachers' perceptions of those aims play a significant role in what happens in the classroom in particular and in the schools in general. These aims (and how they are perceived by teachers) obviously have a bearing on the teaching of the various subjects in the school curriculum - and mathematics is no exception.

Following Graen and Cashman's (1975) observation about the relative stability of superior-subordinate relationships over time, it is reasonable to expect more experienced teachers (most of whom witnessed for longer periods the hostile attitudes

of the supervisors before the introduction of the new reforms, as well as the incompetence which led to the abolition of the GES Council in 1982 [Konadu, 1994]) to make “on-line” judgements in the negative direction about the supervisory activities of GES officials. This is more so in the case of mathematics teachers, considering that most of the supervisors may not have the requisite knowledge in mathematics or its teaching to enable them to offer any help to these teachers.

It was predicted that in spite of the recent changes that have been made with regard to the appraisal of teachers in Ghana, the leader-member exchange model described above, suggests that a lot of time is required for teachers to adjust their “on-line” opinions about their appraisers to reflect any positive changes that have been brought about by the reforms. Consequently, more experienced teachers were expected to be less positive about the support they receive from their appraisers than their less experienced colleagues.

5.6 Hypothesis 5

At the senior secondary levels, mathematics teachers with higher rank will be less positive about the potential of teacher appraisal in Ghana to help to improve their teaching of mathematics than teachers with lower rank.

whereas at the junior secondary level, mathematics teachers with higher rank will be more positive about the potential of teacher appraisal in Ghana to help to improve their teaching of mathematics than teachers with lower rank.

There has been an increasing concern with factors that influence the stability and intensity of employee dedication to organisations as employers. The frequent allusion to employment as the trade of effort and loyalty for material commodities or social rewards (e.g. Etzioni, 1961; Mowday et al, 1982) suggests the usefulness of developing a detailed social exchange interpretation of organisational commitment. Arguably, the processes involved in employees’ inferences concerning the organisation’s commitment to them, and the contribution of such perceived organisational support to employees’ commitment to their work in the organisation itself would depend on a number of factors including one’s ‘position’ (i.e. one’s rank as far as the present study is concerned) in the organisation. The present study looks at the relationship between mathematics teachers’ rank and their perceived support in an attempt to examine the ‘effects’ of using a single appraisal system for both summative and formative purposes. There is indeed no gainsaying that a teacher’s rank in the

GES depends on the number of promotions he or she has earned. The next section therefore looks at the system of promotion in the GES.

5.6.1 Promotion in the GES

Promotion within the Ghana Education Service (GES) has been discussed in an earlier chapter and will only be summarised here. As mentioned in chapter 2, a qualified teacher without a degree or diploma enters the GES at the rank of “teacher” but the entry points for diploma and degree holders is at the rank of superintendent. The criteria for promotion to the various ranks, depend on the number of years one has served in one’s present rank. For promotion from the rank of “teacher” to that of assistant superintendent or from assistant superintendent to superintendent, the candidate can either attend ‘prescribed’ and ‘promotion’ courses, followed by work inspection *or* pass a prescribed examination in mathematics, English language, elementary education and ‘general paper’, also followed by work inspection. As mentioned in chapter 2, the number of years the candidate should serve before they are eligible for promotion through a particular route, depends on their present grade. For example, teachers seeking promotion to the rank of Assistant Superintendent through the non-examination route must serve for at least five years, whereas those seeking promotion to the grade of Superintendent using the same route must serve for at least four years. A teacher with a rank of superintendent normally gets promoted to the rank of senior superintendent after three years’ service unless her or his work has been found to be very unsatisfactory. It is worth pointing out (again) in this chapter that graduate teachers and diploma holders from the university colleges enter the teaching profession at the rank of superintendent.

Promotions from the rank of senior superintendent upwards to the rank of director are by recommendations and promotion interviews. In theory, a teacher with the rank of senior superintendent or above qualifies to attend an interview for promotion every three years, but in practice promotions at those levels are limited by the vacancies available. For example Konadu (1994) refers to an advertisement that appeared in 1993 for the post of a GES Headquarters Director which stated that the applicant should have served with the rank of assistant director for 15 years! It is worth reiterating that a teacher can, through long service, reach the rank of assistant director without GCE “O” level passes. It may be inferred from the above description of the promotion system in the GES that a mathematics teacher’s rank could be influenced by a number of factors including their *appraisal experience*, the sort of *training* they have had as appraisees, their (mathematics) *teaching experience* and, as pointed out below, their *professional*

status in the GES. These factors and the links between them are examined in a later chapter. It suffices to say that the above factors can influence teachers' inferences about the Service's commitment to them.

The Ghana Education Service uses the same criteria to promote teachers at both the basic education and senior secondary school levels. In other words, the promotion system does not take into account whether one teaches in the primary school or the secondary school. Although this practice is seen by the leaders of the Ghana National Association of Teachers (GNAT) as a measure which has brought 'justice' to many and boosted teachers' morale (GNAT, 1981), senior secondary school teachers who are mostly graduates and diplomates are peeved by the system. A number of protests have been made for these teachers by bodies like the National Association of Graduate Teachers (NAGRAT) yet the situation still remains unchanged.

This is indeed an unfortunate situation because in a way, it devalues academic qualifications in a 'learning industry' where ironically the aim of teachers is arguably to help pupils to gain such qualifications. One may argue that appraisal for professional development and that for promotion are two different issues. But are they? Surely if they are not, as the literature seems to suggest is the case in the GES, then senior secondary teachers are more likely than their counterparts at the junior secondary level to be negative towards the whole appraisal system. In other words, teachers at the basic level of the Ghanaian education system might be more satisfied with the present system. It is therefore reasonable to expect senior secondary mathematics teachers with higher ranks to be less positive about the appraisal process than their junior secondary counterparts. It was consequently predicted that at the senior secondary level, rank will correlate negatively with perceived support. In other words, a mathematics teacher with a higher rank will be less positive about the potential of the appraisal system to help her or him to improve her or his teaching than one with a lower rank. At the junior secondary level, the relationship between rank and perceived support was predicted to be positive.

For the purpose of the present study, a higher rank was taken as any rank above that of superintendent. This is because, superintendent is the highest rank that any teacher can enter the GES at. As mentioned above, teachers must serve for at least three years in the rank of superintendent before they are promoted to the rank of senior superintendent. This means that any teacher at the latter rank may have been in the GES for at least three years. It was decided that this period is long enough for teachers to have either experience appraisal personally or learnt about the system.

5.7 Hypothesis 6

At both junior and senior secondary levels, female mathematics teachers will view the potential of teacher appraisal in Ghana to help them improve their teaching of mathematics differently from male mathematics teachers.

The effects of the gender of an appraisee on performance appraisal have been investigated in a tremendous amount of research. Most of this research has been conducted with laboratory procedures. Although some inconsistencies exist, the majority of these studies have found a bias in favour of males in the appraisal of performance, especially when the job is traditionally male dominated (Nieva & Gutek, 1980; Ruble & Ruble, 1982; Kalin & Hodgins, 1984).

A number of researchers (e.g. DeNisi et al, 1984; Dobbins et al, 1985) have attempted to develop an understanding of the processes underlying gender differences in appraisal, focusing on the social-cognitive processes of appraisers. According to this orientation, most appraisers enter the appraisal situation with well developed schemata or stereotypes of men and women. These stereotypes link each gender with common behaviours and characteristics. The observation, interpretation and retrieval of the appraisee's performance are then biased towards the stereotyped characteristics. This is more so in the case of appraisers who are sex-typed. As Bem (1981) points out, such appraisers conceive of maleness and femaleness as mutually exclusive categories, have a rich cluster of associations that surround these concepts, and use this network of associations to organise information about appraisees. Several studies (e.g. Frable & Bem, 1985; Markus et al, 1982) have supported Bem's proposal about individual differences in sex stereotyping.

In mathematics education, a good number of studies have been conducted into gender differences in mathematics learning, a relatively few into gender differences in mathematics teaching, and possibly none into differences, if any, in the appraisal of female and male mathematics teachers. Grouws (1992) reports that between 1978 and 1990, approximately 10 percent of articles which appeared in *The Journal for Research in Mathematics Education* were on gender issues. The majority of these articles, and indeed of work on gender issues elsewhere, focused on differences in mathematical achievement of females and males. As one would expect, different researchers reported on gender differences in different areas of mathematics as well as on different contributing factors. For example, Swafford (1980) concentrated on algebra; Callahan

and Clements (1984) reported on rote counting skills; Fennema and Tatre's (1985) study was on spatial areas; Hoyles (1988) looked at gender and computers; Fennema et al (1981) examined gender and mathematics anxiety; and Hart's (1989) enquiry dealt with the quality of teacher interactions.

As mentioned above, what has not been investigated is whether or not there exists gender differences in the way mathematics teachers are appraised, or whether or not school administrators and inspectors hold different beliefs about females and males in mathematics teaching. This is another gap which needs filling, and this is what the hypothesis under discussion was formulated to do. The questions that need to be answered are: Do appraisers attribute causation of success and failure experiences in mathematics teaching differently for females and males? Do they (i.e. the appraisers) believe that there are differences in the characteristics of a 'good' female mathematics teacher and her 'good' male counterpart?

There seems to be no research evidence to suggest that any of the above questions can be answered in the affirmative. However, there is evidence that suggests that teachers hold different beliefs about appropriate learning experiences for boys and girls. Leinhardt et al (1979), for example, reported that teachers had more academic contacts with boys than with girls in mathematics - a subject often seen as masculine, and more academic contacts with girls than with boys in reading - a subject stereotyped as feminine. Stage et al (1985) also found that teachers provide more encouragement for boys than for girls to learn mathematics.

If the available research evidence on gender inequalities in mathematics learning and its teaching is anything to go by, then it is probably safe to suggest that female teachers would appreciate support in mathematics teaching differently from their male counterparts. But even if this was the case, would that also suggest that appraisers would be more positive towards the appraisal of female mathematics teachers? Considering the lack of consistent evidence on gender inequalities in appraisal, it seems difficult or even impossible to give a definite answer to the last question.

Nevertheless, in spite of the complexities and inconsistencies that exist in some of the findings of studies on the effects of appraisee gender on performance appraisal, the pilot study which informed the present study revealed that women were more likely to be positive about the potential of appraisal in Ghana to help them to improve their performance in mathematics teaching than their male colleagues.

Could it be the case that by way of encouraging more women to join the mathematics

teaching force in Ghana, appraisers tend to appraise the tiny proportion of female mathematics in the GES in a more positive way than their male counterparts? In 1992, female mathematics teachers constituted less than 10% of all mathematics teachers in the country and less than 0.1% of all teachers in spite of the compulsory status of mathematics in the curriculum (GES, 1992). If indeed appraisers were more positive towards female mathematics teachers than their male counterparts, could this have led to higher appraiser-appraisee exchange quality (Liden & Graen, 1980) and consequently to higher perceived support among female mathematics teachers as revealed by the pilot study? Again this question is difficult to answer. However, following the findings of the pilot study, it is reasonable to expect a difference between Ghanaian female mathematics teachers and their male counterparts in the way they perceive teacher appraisal in Ghana. It was therefore predicted that at both (junior secondary and senior secondary) levels, female mathematics teachers will view the potential of TAG to help them improve their teaching of mathematics differently from their male counterparts.

5.8 Hypothesis 7

At both junior and senior secondary levels, professional mathematics teachers will be less positive about the potential of teacher appraisal in Ghana to help them improve their teaching of mathematics than will non-professional mathematics teachers.

As mentioned in chapter 2, the Ghanaian education system has three main parts : basic education - comprising primary and junior secondary schools (JSS), senior secondary school (SSS) and tertiary institutions including initial teacher training colleges (ITTCs), polytechnics and the country's four universities. It is worth reiterating that Ghana has three main programmes of teacher education for professional mathematics teachers. These are : the 3-year post-secondary course in mathematics, science/agricultural science and technical skills; the 3-year diploma course in advanced mathematics (an upgrade of the phased out two-year mathematics specialist course) and the 2-year post-diploma degree courses at the University College of Education, Winneba; and the graduate and PGCE mathematics courses at the University of Cape Coast (UCC). It was also mentioned in chapter 2 that there are a number of non-professional mathematics teachers teaching mathematics in Ghanaian schools. These are mainly non-professional graduates, national service personnel and other professional teachers with fields of specialisation different from mathematics but who nevertheless teach the subject at either the JSS or SSS level .

It must be pointed out that apart from the differences that may exist between "professionals" and "non-professionals" in terms of their academic and professional qualifications in mathematics, the two groups have different terms of contract in the GES. Whereas some of the non-professional mathematics teachers may be employed on *temporary* basis by the GES, all professional mathematics teachers are employed on *permanent* basis by the GES and may remain permanent employees of the GES if they so wish. This means that one's *mathematics teaching experience* may to some extent depend on one's *professional status*. That is, mathematics teaching experience is expected to correlate very highly with professional status. Consequently, it is reasonable to describe one's mathematics teaching expertise in terms of one's professional status. Put simply, professional mathematics teachers in the present study are expected to have higher levels of mathematics teaching expertise than their non-professional counterparts. The implication is that the professionals are expected to teach mathematics more effectively than the non-professionals (see Borko & Livingston, 1989, for example). It follows that a mathematics teacher's *rank* in the GES could depend on her or his *professional status*. These causal inferences, particularly those regarding mathematics teaching experience, rank and professional status as well as those made above (in section 5.7) are summarised at the end of this chapter.

As pointed out in chapter 3, one of the issues that ought to be investigated in teacher appraisal is the impact of teachers' expertise on their attitude to appraisal. This is because the relationship between teachers' level of expertise and their attitude to teacher appraisal for formative purposes in particular could have very important implications for in-service teacher education. In mathematics, this investigation is important because the current emphasis on constructivism demands that teachers have sound content and pedagogical (content) knowledge in mathematics (NCTM, 1991). Indeed, a mathematics lesson based on constructivist principles could go in many different directions (in terms of mathematics concepts) depending on the type and quality of pupil-pupil as well as teacher-pupil interactions that go on in the classroom. If there exists a relationship between teachers' knowledge of mathematics and their attitude to teacher appraisal, such relationship might be useful in informing programmes designed to help teachers with difficulties adapting to the new ways of teaching mathematics.

The question any such investigation should seek to answer is: are teachers with higher qualifications in mathematics less or more positive towards formative teacher appraisal than those with lower qualifications? As far as the present study is concerned, this question can be restated : are professional mathematics teachers less or more positive about teacher appraisal than their non-professional counterparts?

The last question can be investigated in two different ways. One of these is by comparing teachers' and their appraisers' levels of expertise in mathematics and its teaching to see if the appraisers can actually provide the teachers with the necessary support to enable the latter to develop professionally. This will enable one to predict the direction of the relationship, if any, between teachers' mathematics expertise and their perceived support. A second way of approaching the question is by looking at the similarities and differences (if these can be captured) between teachers' perceptions of mathematics and those of their appraisers. The assumption here is that teachers' professional needs may depend on their perceptions of mathematics and its teaching. Whether or not an appraiser can provide opportunities for mathematics teachers to meet their professional needs is thus assumed to depend on the appraiser's perception of mathematics and its teaching. Using the above assumption, one can hypothesise that an appraiser who shares the same or similar views of mathematics and its teaching with an appraisee is more likely to provide the latter with the opportunity to develop professionally than one whose perception of mathematics differs significantly from that of the appraisee. The present study examines both ways.

Considering mathematics teachers' and appraisers' levels of expertise in mathematics and its teaching, it can be argued that to the extent that knowledge of mathematics is essential to its effective teaching (Shulman, 1986; Borko & Livingston, 1989), appraisers are likely to be more capable of 'helping' non-professional mathematics teachers to improve their work than 'helping' professional mathematics teachers. This is because as pointed out above (in the discussion of *Hypothesis 2*), most of the appraisers of mathematics teachers are older and senior members of the GES who are not necessarily mathematics specialists. These are mainly specialist and diploma holders in subjects other than mathematics. It is very difficult to imagine how an officer without say GCE ordinary level pass in mathematics can advise a mathematics teacher on the teaching of a topic in elective mathematics (i.e. Additional Mathematics) let alone on one in advanced level mathematics. It is therefore reasonable to predict that professional mathematics teachers will perceive professional support from the GES in a less positive light than non-professional mathematics teachers.

Regarding teachers' (and appraisers') perceptions of mathematics and its teaching, a number of authors and researchers in mathematics education (e.g. Lerman, 1983, 1993; Thompson, 1984, 1992; Peterson et al., 1989) have suggested that teacher beliefs about what mathematics is and what it means to know, do and teach mathematics may be the driving force in the communication of mathematical ideas. Beliefs, Fazio (1986) points out, expose our fundamental ideas about our life experiences and directly

affect our actions whether we consciously acknowledge those beliefs or not. Teacher beliefs directly influence teacher actions, which in turn influence students' belief systems (Kloosterman & Stage, 1992). As far as mathematics education is concerned, Thompson (1984) has recorded:

The observed consistency between the teachers' professed conceptions of mathematics and the way they typically presented the content strongly suggest that the teachers' views, belief and preferences about mathematics do influence their instructional practices. (Thompson, 1984, p.125)

This could imply that teachers who, for example, experienced mathematics lessons as consisting of predictable patterns of exposition followed by independent seat work (when they were students) are likely to base their mathematical beliefs on these experiences. They are likely to teach in the same manner perpetuating the chain of beliefs about mathematics as mechanical in nature, a fixed body of procedures that can be performed (sometimes) without thinking, an independent endeavour, and difficult except for people who happen to be lucky enough to be good at it (Raymond, 1993). Individuals internalise such beliefs through continuous exposure to school and home situations that reinforce the notion that the above description of mathematics reflects the "true" nature of mathematics.

On the other hand, teachers who when students were exposed to different methods of organising work in mathematics - group work, individual work, project work, and so on would approach the teaching of mathematics differently from the one described above. It is the differences in approaches employed by different people in the teaching of mathematics which can often create tensions between a mathematics teacher and her/his supervisor or appraiser, especially when the two hold different philosophies of the nature of mathematics and its teaching and learning (e.g. Koss & Marks, 1994). Among the philosophies being referred to here are the three major philosophies - Platonism, Formalism and Constructivism - which, according to Davis and Hersh (1981), dominated the 'foundations' debate earlier this century. I do not intend to discuss the first two philosophies of mathematics in any detail as the present study puts emphasis on constructivism. Readers interested in the various philosophies of mathematics (education) should see Ernest (1991), for example.

Briefly, Platonists believe that mathematical "objects" exist and that any meaningful question about a mathematical object has a definite answer, whether we are able to determine it or not. Formalists, on the other hand, do not believe in the existence of mathematical objects. They believe that mathematics just consists of axioms, definitions and theorems. They see mathematics as a science of rigorous proofs. Any

logical truth must have a starting point - the axiom upon which the theorem is built. The axioms may be false or true but, to the formalist, that is not important. What is important is the valid logical deductions that can be made from the axioms.

A radically different alternative to Platonism and Formalism is Constructivism. Constructivists believe that mathematics does not grow through a number of indubitable established theorems, but through the incessant improvement of guesses by speculation and criticism. Lakatos (1962), for example, argued that mathematics is not infallible and like all the natural sciences, it too grows from criticism and correction of theories which are never entirely free of ambiguity or the possibility of error or oversight. Starting from a problem, there is a simultaneous search for proofs and counterexamples. New proofs explain old counterexamples, new counterexamples undermine old proofs. Lakatos, however, did not actually carry out a programme of reconstructing the philosophy of mathematics with a fallibilist epistemology. It is also uncertain as to what would be the objects of Lakatos' informal mathematics.

Without digressing from the main discussion, these philosophies have dominated mathematical thinking at different times in history and it can be argued that one's personal philosophy of mathematics may be influenced by the dominant philosophy during the period one was a student of mathematics, albeit personal philosophies may change over time. It would appear that the current thinking is weighted heavily in favour of constructivism, perhaps because it is the 'latest' of the three philosophies mentioned above. Indeed, many mathematics educators - particularly those in the more advanced countries - envision a mathematics curriculum in which students at all levels acquire different ways of perceiving mathematics. They argue that when students take control of their own learning and construct an understanding of mathematics, they may challenge the 'traditional' views of mathematics (perhaps referring to the other two philosophies and), implying that those 'traditional' views are no longer tenable (Cobb et al, 1991).

A number of researchers (Carpenter, et al., 1988; Simon & Schifter, 1993; Raymond 1993, Jaworski, 1994) have reported findings which seem to suggest that the constructivist approach can lead to better understanding of mathematics as well as better communication of mathematical ideas by students. For example, Simon and Schifter (op. cit.) studied the effects of a constructivist-oriented in-service programme for teachers on their students' learning of mathematics. The researchers found that, along with the transformations in the nature and quality of mathematics activity in the classroom, students' belief about learning mathematics changed and their attitude towards mathematics improved.

Perhaps one reason why the constructivist philosophy of mathematics education should be seriously considered as an alternative to the transmission approach to the teaching of mathematics is the child-centredness it envisages. Indeed, the fundamental goal of mathematics instruction should be to help students to build structures that are more complex than those they possessed before instruction. Here, the teacher's role is not merely to convey to students information about mathematics but to facilitate profound cognitive restructuring through negotiation of meanings of mathematical activities. Furthermore, one of the main aims of constructivism is to orchestrate discussion among students. Emphasis is therefore placed on encouraging students to verbalise mathematical thinking, to explain and justify mathematical solutions and to learn to resolve conflicting points of view.

In fact, *radical* constructivists (see von Glaserfeld 1983, 1991) argue that any suggested interpretation or solution to a mathematical problem (preferably posed by the student) is acceptable provided it indicates that the student has made appropriate suggestions. By focusing on the ways and processes by which students construct their own mathematics or mathematical 'realities', constructivism attempts to 'demystify' mathematics and make it more accessible to all students. It is however yet to be seen how well constructivism can achieve this difficult goal.

Perhaps a more 'realistic' way of achieving the switch from the transmission approach (to mathematics teaching) to the constructivist approach is to take into account the social interactions as well as the power structure in the classroom. This appears to be the position taken by *social* constructivists (see Jaworski, 1994 for a detailed discussion of radical and social constructivism). Jaworski writes:

The construction of knowledge in the classroom goes beyond interaction between teacher and students, to the wider interaction between students themselves in the social and cultural environment and beyond. It seems crucial for mathematics teachers to be aware of how mathematical learning might be linked to language, social interaction and cultural context. (Jaworski, 1994, p.28)

Even so, there are other practical problems, such as assessing mathematical performance in constructivist settings (see Wolf, 1990, for example), which can make the constructivist agenda difficult to pursue in mathematics education. In any case, as far as the present study is concerned, it is reasonably safe to posit that in Ghana, it is in the universities and other relevant tertiary institutions that the differences between the different philosophies of mathematics are discussed at all. Yet, lack of clear links or connections between these institutions and the GES has meant that whereas the

professionals, particularly those in the senior secondary schools - who may have studied in these institutions - may have been exposed to varied views of mathematics and its teaching, their appraisers (who are mainly certificate "A" teachers with long service and/or diploma holders in subjects with little or no mathematical 'content') may not be exposed to the different views of mathematics teaching. Non-professional mathematics teachers are therefore more likely to share similar views of mathematics and its teaching with their appraisers than would professional mathematics teachers. Consequently, it was predicted, as mentioned above, that professional mathematics teachers would be less positive about the potential of the teacher appraisal system in Ghana to help them improve their work than their non-professional counterparts.

To summarise briefly, in this chapter, seven hypotheses were formulated. These hypotheses both form the basis of teachers' perceived validity of the teacher appraisal system in Ghana and could help fill the gaps in our knowledge about the appraisal of mathematics teachers in particular and that of teachers in general. In addition to the hypotheses - which predicted that the various independent variables would each be directly related to the dependent variable - some causal links were inferred between some of the independent variables.

Specifically, it was observed that a mathematics teacher's rank in the Ghana Education Service depends to a large extent on her or his teaching experience and professional status. This is because mathematics teachers' promotion to the next rank in the GES depends on the number of years they have served in their present rank. Yet the number of years a mathematics teacher can remain employed by the GES depends on whether the teacher is a professional or not. This means that a mathematics teacher's professional status influences her or his teaching experience which in turn influences her or his rank. Nevertheless, considering that certain categories of teachers (e.g. graduates/diplomates) enter the Service at the rank of superintendent, a mathematics teacher's professional status can directly influence her or his rank. In other words, professional status can influence rank directly and also indirectly through teaching experience.

Other factors that can influence rank are the promotion inspection/interview (i.e. appraisal experience) and the training designed to help teachers pass the promotion examination or interview. In addition to the above causal inferences, it can be speculated that some of the independent variables would correlate very strongly with one another. For example, it can be inferred from the discussion of the issues that informed the hypotheses (in chapter 1) that appraisal experience would correlate with appraisal training, last appraiser and professional status whereas mathematics teaching

experience can be hypothesised to correlate with gender since most of the ‘experienced’ mathematics teachers in Ghanaian secondary schools were found to be male (GES, 1992). The main hypotheses as well as the causal links are tested in chapter 7.

CHAPTER SIX

METHODOLOGY

6.1 Introduction

This chapter presents the method employed in the study. It also focuses on the instruments developed specifically for the study. The chapter also gives a brief description of the pilot study which tested the instruments used in the survey.

Webb et al (1966) have stressed the importance of employing different methods in the study of the same empirical units. This is a method Denzin (1989) calls *between-method triangulation*. The rationale of this strategy is that the flaws of one method are often the strengths of another and by combining methods, researchers can maximise the benefits of each while at the same time minimising their unique shortcomings. Webb and his colleagues observe:

So long as one has only a single class of data collection, and that class is the questionnaire or the interview, one has inadequate knowledge of the rival hypotheses grouped under the term “reactive measurement effects...” It is too much to ask any single class that it eliminate all the rival hypotheses subsumed under the population, content and reactive effect groupings. As long as the research strategy is based on a single measurement class, some flaws will be exposed, and even if fewer are exposed with the choice of a (particular) method, there is still insufficient justification for its use as the only approach. No single measurement class is perfect, neither is any scientifically useless...When a hypothesis can survive the confrontation of a series of complementary methods of testing, it contains a degree of validity unattainable by one tested within the mere constricted framework of a single method (Webb et al 1966, pp.173-174).

As shown in this and later chapters, the principle of triangulation guided not only the methods used in collecting data for the study, but the methods selected for the analyses of the data. In other words, in addition to using different methods such as questionnaires, interviews and direct observation for the data collection, different methods of analysis were used to cross-validate the results of the study.

In a similar vein, in order to examine the validity of the teacher appraisal system in Ghana, the views of different stakeholders in education, particularly those of teachers and appraisers were taken into account in making judgements about the validity of

the system. Indeed, a valid performance appraisal is one which, given the value position which underpins it, is consistent with all the evidence that is relevant to that position, and which has taken alternative views of that performance into consideration (Anastasi, 1986; Messick, 1989).

As teachers are the implementers of most educational changes, particularly those involving classroom practices (Fullan & Hargreaves, 1992), it is essential that the examination of the validity of the teacher appraisal system in Ghana, or indeed in any country, be viewed from their standpoint. The methodology used in this study was therefore influenced by the above view.

I shall begin the discussion of the methods employed in the present study with the preparation I made towards both the pilot study and the main study.

6.2 Preparation

Preparations towards the pilot as well as the main study involved a number of steps. For example, in order to identify the appropriate items to include in both the mathematics teacher appraisal questionnaire (referred to in the thesis as the *teacher questionnaire*) and the appraiser questionnaire, I examined a number of existing instruments. With regard to the teacher questionnaire, these were instruments which aimed at assessing teachers' attitude towards the teaching and learning of mathematics and those assessing their attitude towards teacher appraisal generally. As no study involving the appraisal of mathematics teachers had come to my notice, most of the items used in the study were modifications of those used in mathematics education studies which were somewhat related to the present study (e.g. Kouba, 1994). Other items used were borrowed from instruments used in teacher appraisal studies generally. Specifically, some of the items on Ghanaian teachers' attitude towards Ghana Education Service officials' supervisory activities were either borrowed or adapted from the items used in the teacher motivation study described by Bame (1991). Those items regarding teachers' attitude towards mathematics teaching and learning were adapted from studies investigating mathematics teachers' attitude towards the teaching and learning of the subject (e.g. Raymond, 1993). Some of the items used in the appraiser questionnaire were similar to those used in the teacher questionnaire. Such items were derived from the same instruments as those on which the teacher questionnaire were based. Other items were derived from Ghanaian teachers' expressed opinions about the supervisory activities of GES officials in similar studies. It is important to point out that the items selected were informed by both the hypotheses

discussed in the last chapter and the theoretical framework discussed in chapter 4.

The design of the questionnaires for the main study is described in section 6.4.6 below. Nevertheless, the following examples show how the hypotheses and the theoretical framework informed the questionnaire items. The item numbers in the examples below correspond to the item numbers in the final questionnaire (see Appendix A1).

Items 32-35 (Fig 6.1) were used to collect teachers' views about how well the appraisal system can help them improve their teaching of mathematics.

32 Please state 3 ways in which you can improve your teaching of mathematics.

1st.....

2nd.....

3rd.....

33. Can the way teacher appraisal is done in our schools today help you to do the first (1st) thing you have stated in item 32 above?

Yes No

If no please state how teacher appraisal can be improved to help you to do the first (1st) thing you have stated in item 32 above

34. Can the way teacher appraisal is done in our schools today help you to do the second (2nd) thing you have stated in item 32 above?

Yes No

If no please state how teacher appraisal can be improved to help you to do the first (2nd) thing you have stated in item 32 above

35. Can the way teacher appraisal is done in our schools today help you to do the third (3rd) thing you have stated in item 32 above?

Yes No

If no please state how teacher appraisal can be improved to help you to do the third (3rd) thing you have stated in item 32 above

Fig. 6.1

Items used to collect teachers' views about teacher appraisal.

Hypothesis 1 concerned the relationship between appraisal experience and perceived support. The relevant questionnaire item was: *"Have you ever been appraised as a mathematics teacher?"* (item 1).

Hypothesis 2 examined the relationship between last appraisal source and perceived support. The item used was: *"If appraised, please state the position of the person who appraised you last."* (item 1).

Hypothesis 3 examined the relationship between training and perceived support, and the item used was : *"Have you ever had training as an appraisee?"* (item 2).

Hypothesis 4 looked at teachers' mathematics teaching experience. The relevant item was: *"For how long have you been teaching mathematics?" (item 18).*

Hypothesis 5 investigated the relationship between rank and perceived support. The item used to collect teachers' rank was: *"Your rank in the GES is:" (item 38).*

Hypothesis 6 was about gender and perceived support, and the relevant item used was: *"Please state your sex" (item 36).*

Hypothesis 7 examined the relationship between professional status and perceived support. The item used to collect teachers' academic and professional qualifications in mathematics was : *"Which 'certificate(s)' do you have?" (item 39).*

Additionally, items 5-13 were used to collect teachers' views about Ghana Education Service officials who appraise their work. For example, item 5 stated: *Ghana Education Service officials who appraise my (or other teachers') mathematics teaching are well versed in the teaching of mathematics.* Respondents were asked to indicate whether this was (always/seldom/often/never) the case. In a similar vein, items 20-31 were used to collect teachers' views about teacher appraisal (in Ghana) generally.

Preparations towards the interviewing exercise involved much the same steps as those undertaken to develop the two questionnaires. The preparations involved the development of interview 'blue print' specifying the areas to be covered and the questions to be asked. A considerable amount of time and effort were put in developing appropriate interviewing skills. As in the case of the questionnaires, the preparation began with the study of materials describing the process of interviewing (e.g. Anastasi, 1986; Oppenheim, 1992). These materials included manuals, descriptive articles and transcripts of interviews carried out using the "critical incident" technique (Hoyles, 1982). These initial exercises provided a sense of the form the interviews in the present study should take, the appropriate questions to ask and the probes and prompts to use. I was also trained by my supervisors and other experienced researchers in the Mathematical Sciences department of the Institute of Education. In addition to this training, I also attended a number of seminars (run by the Institute of Education) on the development of interviewing skills. I found this training helpful in both the pilot and the main research. The pilot study is discussed below.

6.3 The Pilot Study

I conducted the pilot study leading to the present study in Ghana from October to December 1993. The purpose of the pilot was to gain insight into the relative strengths and weaknesses of the research instruments in order to make possible improvements

prior to the main study. The sample for the pilot study consisted of 50 secondary mathematics teachers and 10 appraisers selected from two districts in the regions selected for the real study. Two instruments, a teacher questionnaire and an appraiser questionnaire (in the form of open-ended questions) for GES officials responsible for appraising mathematics teachers were developed for the pilot study. I administered these questionnaires in an attempt to investigate the appraisal of mathematics teachers in Ghanaian secondary schools. It is important to point out that one of the aims of the pilot study was to test the hypotheses for the main study. In that direction, the pilot study not only helped reduce the number of relevant variables for the main study (e.g. the variable “age” was dropped from the formulation of the hypotheses because it correlated very highly with mathematics teaching experience), it also identified which variables were significantly related to the dependent variable (ie. perceived support).

The revised versions of both instruments are described in section 6.4.6 below. However, it is worth discussing one important item of the pilot (teacher) questionnaire as it informed the revision of the instruments for the main study. This item was intended to find out what the term “*teacher appraisal*” meant to Ghanaian mathematics teachers. The item read: “*Teacher appraisal may be seen differently by different people. Please state in a few words what you think teacher appraisal is.*”

Indeed to say that appraisal means different things to different people is an understatement. For example, Wragg et al (1996) used appraisal as a term “emphasising the forming of qualitative judgements about an activity, a person or an organisation” (p.3). The authors differentiated between appraisal and assessment - which they used as a term “implying the use of measurement and/or grading based on known criteria” (ibid). Simons (1989) had a slightly different “vision” about appraisal and its future uses in the U.K. In an introduction to a book she edited with John Elliott, she predicts:

Teacher ‘appraisal’ is the in-vogue term for new ways of determining the quality of teaching in our schools...there are many ways in which the concept of appraisal can be construed and many paths that could, and have been, followed in prosecuting this goal. But we should not forget as we read about these that we shall soon be working in a situation where the performance of pupils on national tests of achievement related to a prescribed curriculum is intended to constitute evidence of teacher effectiveness. Thus teacher appraisal and pupil performance will be directly linked in a way that has not been contemplated since the ‘payment by results’ of the nineteenth century was abandoned (Simons, 1989, p.4).

Thus Simon’s predictions do not differentiate between assessment and appraisal as is

done by Wragg et al (op. cit.). As expected, nearly all the teachers who took part in the pilot study defined the term as a way of *assessing* teachers' work and finding ways of *helping* them improve their work. Thus the teachers sampled saw appraisal as having both summative and formative wings - a combination of the definitions given above. Indeed this view of teacher appraisal reflected the responses given by the teachers in the entire questionnaire, and their appraisers also saw "*teacher appraisal*" in a similar light. That is, both teachers' and appraisers' views of teacher appraisal coincided with the activities of the Inspectorate Division of the GES. In other words, teachers and their appraisers saw teacher appraisal as both a formative and a summative process as indicated in the literature on teacher appraisal in Ghana (e.g. Gokah, 1993).

In the light of the analysis of the pilot study, two sections of the teacher questionnaire as well as a number of items in the appraiser questionnaire were revised. For example, the question : "*Why do you think mathematics is a compulsory subject in the Ghanaian school curriculum?*" was changed to "*What are your views about mathematics as a school subject?*". This is because the first question could not reveal appraisers' perceptions of the nature of mathematics and its teaching and learning. The latter question was thought to be more capable of eliciting appraisers' views about mathematics and its teaching better.

I tested the revised instruments personally in England. The instruments were also tested in Ghana (by two research associates at the University of Cape Coast). It is perhaps worth pointing out from the outset that as the instruments were designed to collect Ghanaian mathematics teachers' views about the appraisal system in Ghana, only a few of the items could be tested in England. Four (4) secondary schools in England were involved in the piloting of the revised instruments. Two of these were grant maintained and the other two were Local Education Authority (LEA) controlled. In each school, 2 mathematics teachers and the teacher responsible for the management of appraisal in the school were sampled. Regarding the teacher questionnaire, the only section that could be tested in England was section VII of the Mathematics Teacher Questionnaire (MATAQ - Appendix A1). This section contained the same items used to collect Ghanaian mathematics teachers' perceptions of the support they receive from the Ghana Education Service. The items under discussion are given in figure 6.1 above.

The object of piloting the above items in England was to find out if the wording of the items was appropriate. The conclusion made after piloting the items was that the wording was okay. Indeed, the consistency with which all the 8 mathematics teachers responded to the items suggested that the wording was appropriate and that the items were capable of eliciting the required responses. For example, the teachers who

responded "no" to the first part of any of the *items 33-35* stated ways in which they thought the appraisal system (in England) could be improved to help them improve their practice. The responses were in line with the responses they had given in *item 32*. It is worth pointing out that the (English) teachers' attitude to appraisal did not vary much. Each of them responded "no" to at least one of the *items 33-35*. They all seemed to prefer the idea of observing and being observed by a colleague. They stressed the importance of exchanging ideas and experiences with colleagues through classroom observation. Both teachers from one of the grant-maintained schools observed that the system was "too formal". It must be reiterated that the object of testing the questionnaire in England was to test the wording of the items and not to compare UK mathematics teachers' views about appraisal with those of their Ghanaian counterparts.

As in the case of the teacher questionnaire, only a few items of the revised appraiser questionnaire (Appendix A2) could be tested in England. The items used related to how teachers were selected for appraisal in the schools and the lengths of time involved in the classroom observation. Teachers in charge of the management of appraisal in the schools were asked to respond to the selected items. In addition to the individual items tested, the four 'managers' (from the four schools) were interviewed generally about the form teacher appraisal took in their schools. They all described how they were implementing the school teacher appraisal guidelines. All the schools were using an appraisal cycle with at least seven stages. Common to all the cycles the managers described were the following stages:

- a) Initial meeting
- b) Self appraisal
- c) Gathering information
- d) Classroom observation
- e) Appraisal interview and setting targets
- f) Appraisal statement
- g) Follow-up (review meeting).

Detailed description of the various (teacher appraisal) stages in one of the schools is given in Appendix B11.

In addition to testing sections of the revised questionnaires in England, 12 copies of the revised *teacher questionnaire* and 2 copies of the revised *appraiser questionnaire* were sent to Ghana to be tested by two research associates at the University of Cape Coast. The completed questionnaires were received about two months later. All the questionnaires were well completed. Indeed, the analysis of the completed

questionnaires indicated that the wording and the arrangement of the items in the revised questionnaires were appropriate. This observation paved the way for the main study.

6.3.1 Findings of the Pilot Study

One important finding of the pilot study was that it revealed the changes that had been made in the appraisal system in line with the educational reform programme in Ghana. Before the pilot study, the terms “inspection”, “supervision” and “guidance” were conflated in the literature and it was difficult to tell who was actually responsible for teacher appraisal at the various levels of education in Ghana. The reforms had placed teacher appraisal firmly under the control of the Inspectorate Division of the GES. The activities of the Inspectorate Division are discussed elsewhere in this thesis. However, it is worth describing the changes that were revealed in the pilot study here. In line with the on-going decentralisation policy of the government, the functions of the Inspectorate have been decentralised, devolving from the national headquarters *inspectors*, through regional *coordinators*, district *supervisors/inspectors*, to circuit *supervisors*.

The above (highlighted) designations show the differences between the duties of the various officers of the Inspectorate Division. For example, at the circuit level, the main duty of circuit supervisors is to supervise teaching and learning in the basic schools as the second line of supervisors after headteachers. Thus, in theory, the appraisals that the circuit supervisors are to conduct are to be mainly formative, yet as explained below, this is hardly the case. The circuit supervisors are responsible to the district supervisors/inspectors who more or less delegates the inspection of basic schools to the circuit supervisors under them. This means that the circuit supervisors have become both *supervisors* (appraising teachers for formative purposes) and *inspectors* (appraising schools and teachers for summative purposes) at the primary and junior secondary levels. This revelation guided the selection of appraisers at the senior secondary level for the main study. As mentioned below, all the appraisers for senior secondary level were selected from the regional offices and the headquarters of the Inspectorate Division of the GES.

There are other findings of the pilot study which are also worth discussing. For example, an important observation was made with regard to the participants’ responses to two of the original items - “*do you think appraisal affects your teaching performance*”? and “*if yes, please state whether appraisal affects your teaching performance positively or negatively*”. All the teachers sampled thought appraisal

affected their performance. Of the 50 teachers sampled, 36 (72%) thought that appraisal did affect their teaching performance positively, and 14 (28%) thought it affected their performance negatively. To examine the relationships between mathematics teachers' perceived support and each of the independent variables used in the formulation of the hypotheses, chi-square tests of association were performed using the relevant items in the questionnaire. The results of the chi-square tests as well as the very high correlations between some of the independent variables led to the revision of the hypotheses. For example, age was dropped as an independent variable because it correlated very strongly ($r=.88$) with teaching experience. Thus the findings of the pilot study made clearer which variables were relevant to the main study.

6.4 The Main Study

I collected the data for the main study between May and August 1995. This was a time when a similar programme was being undertaken by the GES to assess the impact of the educational reform in Ghana. This explains why, as mentioned below, I was able to observe many appraisers at work.

6.4.1 Population

The target population for the study consisted of mathematics teachers in mid-southern Ghana - comprising the Ashanti, Central, Eastern and Greater Accra regions of Ghana. However, due to some practical difficulties, the study was limited to full-time secondary mathematics teachers in publicly operated schools, referred to in this chapter as "government (secondary) schools".

The few privately owned secondary schools in the above (selected) regions were excluded from the study because teachers in these schools were usually hired on temporary or part-time basis. Besides, they were not appraised by the Ghana Education Service (GES) for promotion and other purposes as their counterparts in government schools. Furthermore, most of these part-time teachers were also full time teachers in government secondary schools (Bame, 1991). For the above reasons, including privately owned secondary schools in the study might have led to duplicate listings, whereby some mathematics teachers might have had the chance of being selected more than once. This situation could have biased the results of the study (Kalton, 1983). This was more so because many teachers did not disclose part-time work for various reasons and it was therefore very unlikely that all duplicates (arising from including

private schools) could be detected and adjusted for unequal selection chances. For the same reasons, mathematics teachers who taught on part-time basis in government schools were excluded from the study.

6.4.2 Sample

Although secondary mathematics teachers were the unit of analysis of the study, as mentioned above, the sampling frame for the study consisted of government secondary schools in the selected regions. In other words, mathematics teachers were sampled by schools. This design was preferred to simple random sampling of individual secondary mathematics teachers not only because it was to ensure that mathematics teachers in the selected regions were adequately represented, but it avoided the problem of the huge transportation and other costs involved in tracing teachers selected through simple random sampling. Also, as Stuart (1984) rightly points out, using simple random sampling in such circumstances could lead to high incidence of non-response and increase biases resulting from the latter.

However, in an attempt to preserve the random principle on which statistical inferences depend while at the same time allowing a design that would ensure adequate representation of teachers in the sample regions, the study used a stratified cluster sampling method to select participants. Stratification was done by region and type of school.

6.4.3 Method of Selecting Sample Schools

Junior secondary schools in Ghana, unlike the senior secondary schools, are scattered throughout the whole country. Nearly every single town or village with a primary school has a junior secondary school. Because of this, the method of sampling mathematics teachers by schools (selected at random from a list of schools in each region) proved extremely difficult and almost impossible to use. Two districts were therefore selected at random from each of the 4 regions. In each district, 4 circuits were selected at random and all the mathematics teachers in the selected circuits were sampled. In all 129 junior secondary schools participated in the study.

At the senior secondary school level, mathematics teachers were sampled by schools selected at random from a list of schools in each region. 15 schools were selected in each of the Ashanti and the Eastern regions whereas 10 schools each were selected from the secondary schools in the Greater Accra and the Central regions. The number of schools selected in each region reflected the number of schools in the region.

6.4.4 Sample Sizes.

The size of the sample of junior secondary mathematics teachers who took part (in the study) in each of the regions reflected the number of junior secondary schools in the selected circuits in that region. The sample sizes were as follows:

Ashanti Region	57 (1 absentee)
Central Region	39 (no absentee)
Eastern Region	61 (no absentee)
Greater Accra Region	36 (11 absentees)
<i>Total</i>	<u>193</u> (12 absentees recorded).

It is worth mentioning that the response rate in the J.S.S. was very high. In fact, there were only a handful of schools (mainly in the Accra Metropolis) where, due to the shift system, a few of the mathematics teachers could not be accessed. In all the other regions, the response rate was almost 100%. The 12 recorded absentees brought the response rate to about 94%.

As in the junior secondary schools, the sample sizes of senior secondary mathematics teachers in the various regions reflected the number of schools the selected regions. The following table shows the number of completed questionnaires obtained from the senior secondary respondents in the regions.

Ashanti	- 79 (17 absentees)
Central	- 45 (13 absentees)
Eastern	- 75 (9 absentees)
Greater Accra	- 49 (7 absentees).
<i>Total</i>	<u>248</u> (46 absentees recorded)

6.4.5 Method of Selecting Appraisers

With regard to junior secondary level appraisers, the circuit supervisors of the 8 selected circuits in each region were sampled. The list below gives the districts which participated in the study.

- Accra - Accra Metropolis and Ga districts;
- Central - Swedru and Winneba districts;
- Eastern - Akuapem North and Asamankese districts;
- Ashanti - Obuasi and Nkawie districts.

Three circuit supervisors (2 from Accra metropolis and 1 from Swedru district) did not return their completed questionnaires, resulting in a return rate of just over 90%. As the appraisal of teachers in the senior secondary schools is done mainly by inspectors at the Regional Offices as well as those at the headquarters of GES, 2 inspectors each were sampled from each region and all the inspectors at the headquarters were also sampled. 8 (out of 8) and 7 (out of 10) completed questionnaires were returned by inspectors from the relevant regions and headquarters respectively, resulting in a response rate of 100% and 70% respectively. Thus, in all, out of the 50 supervisors/inspectors sampled, 44 responded, giving an overall response rate of 88 percent. Attempts made to recover the non-returned questionnaires were not successful.

6.4.6 Questionnaires

As mentioned above, two questionnaires were constructed for the investigation of the issues raised in the study. These were: a mathematics teacher questionnaire - MATAQ- (Appendix A1) and a questionnaire to be completed by GES officials responsible for the appraisal of mathematics teachers - AQ - (Appendix A2).

Teacher Questionnaire

The teacher questionnaire was composed of sections organised as follows:

SECTION I : This section comprised items enquiring about participants' experience with the appraisal process and what factors they think should be taken into account when considering a teacher's claim for promotion as well as questions about respondents' opinion about who should appraised them. This section contained three of the independent variables used in the formulation of the hypotheses (discussed in the last chapter) namely, *appraisal experience*, *respondent's last appraiser* and *training experience*.

SECTION II : This section was made up of items designed to measure teachers' opinion of their appraisers as well as their opinion about what actually goes on by way of appraisal (i.e. about appraiser behaviours). The rather 'sensitive' nature of this section made it difficult to include any 'negatively' phrased statements as these could be interpreted by respondents as the researcher's opinion about GES officials. Therefore all the items were 'positively' phrased as recommended by Melnick and Gable (1990). A 4-point scale ranging from *Always* (4) to *Never* (1) (with *Often* [3], and *Seldom* [2] in-between them) was used. As mentioned above, an example of the items in this

section was “*Ghana Education Service officials who appraise me/other mathematics teachers are well versed in the teaching of mathematics*” - which sought to measure respondents’ opinion of the mathematics teaching expertise of their appraisers.

SECTION III : This section consisted of a list of factors which are taken into account when considering a teacher's claim for promotion (GNAT, 1987). Respondents were required to rank FOUR of these factors in a descending order of importance according to how they *thought* their appraisers would consider them for promotion purposes. This section was designed to enable comparisons to be made between teachers’ perceptions of promotions in the GES and their appraisers’ perceptions of the same (see AQ item 21a) . Furthermore, the clarity (to both teachers and appraisers) of the criteria used for promotion purposes could be described in terms of the match/mismatch in their perceptions of promotions in the GES.

SECTION IV: This section consisted of items intended to enquire about teachers’ perception of school mathematics as well as the level at which they teach mathematics. The item enquiring about teachers’ views about school mathematics was intended for investigating the relationship between mathematics teachers’ views about school mathematics and their perceived support. This item was also intended for investigating the match/mismatch between mathematics teachers’ perception of school mathematics and that of their appraisers. The object was to find out if teachers’ perceived support could be explained in terms of the match/mismatch between their perceptions of school mathematics and those of their appraisers.

There were also items about respondents’ (*mathematics*) *teaching experience* - one of the independent variables - and how promotion could affect the supply of mathematics teachers. The item measuring the effect of promotion on the supply of mathematics teachers was : “*If promoted, would you continue teaching mathematics?*”

SECTION V : The items in this section were designed to measure respondents’ attitude towards the system(s) of appraisal currently operating in Ghanaian schools. A Likert scale was used with a 5-point response format and descriptors as follows: *Strongly Agree* (1); *Agree* (2); *Neither Agree nor disagree*(3); *Disagree* (4); and *Strongly Disagree* (5). The six items in this section were balanced between positively and negatively phrased statements in line with Likert’s (1932) recommendation. The items also mirrored the items in the next section.

SECTION VI : As mentioned above, the items in this section were similar to those in section V. However, unlike those in section V, they were designed to measure the

difference between respondents' views about teacher appraisal as was being done in Ghana and their views as to what the aims of appraisal should be. Here too, a Likert scale was used with a 5-point response format and descriptors as follows: *Strongly Agree* (1); *Agree* (2); *Neither Agree nor disagree*(3); *Disagree* (4); and *Strongly Disagree* (5). As in the case of items in section V, the six items in this section were balanced between positively and negatively phrased statements. One of the items in this section read: "*Teacher appraisal should be a way of helping me to be more effective*". Its corresponding item in section V read: "*Appraisal in our schools today is a way of helping me to be more effective*".

SECTION VII: This section comprised items on mathematics teaching as well as respondents' views about the potential of the teacher appraisal system in Ghana to help them improve their teaching of mathematics. Respondents were asked to state ways in which they could improve their teaching of mathematics and say whether they thought teacher appraisal as was being done in Ghana could help them do what they had stated they would do. The main dependent variable used in the formulation of the hypotheses was taken from this section (see fig. 6.1 above).

SECTION VIII: The last section of the teachers' questionnaire contained items on certain teacher characteristic, such as age, sex and qualifications. Thus, the items in this section required "factual" answers about the various teacher characteristics. Three of the independent variables were taken from this section. These were *gender*, *professional status* and *rank*.

Appraiser Questionnaire

The appraiser questionnaire was designed to reveal, among other things, the purpose(s) of teacher appraisal from appraisers' point of view. Such perceptions were used, among other things, to establish the validity of the appraisal of mathematics teachers in Ghana. Unlike the teacher questionnaire, the items in the appraiser questionnaire were open ended with the exception of items 22-26. Items 22-26 sought appraisers' biographical details such as age, sex, rank and their experience as appraisers of mathematics teachers.

Specific objectives for the open ended item were stated clearly during the construction of the items to ensure that responses were not excessively divergent as to make coding impossible. A few examples of the items and the objectives for including them in the questionnaire are given in the figure below.

ITEM	OBJECTIVE
8. How is the appraisal of mathematics teachers different from that of other teachers?	To establish appraiser's views on the appraisal process and how maths is seen by the appraiser.
10. When you visit a school, how do you select maths teachers for observation?	To find out whether or not teachers are given any notice before their lessons are observed in the classroom.
12. Would it be possible to give me 5 things you look for in the classroom when observing a maths teacher's work?	To establish the criteria for assessing a mathematics teacher's work.
19. How long does it take you to have a pretty good idea about a mathematics teacher's work to enable you to pass judgement on his/her performance?	To help establish the validity of appraiser's judgement.

Fig. 6.2

Objectives for items 8,10,12 and 19 of the appraisers' questionnaire.

It is important to reiterate that the appraiser questionnaire contained an item which was almost identical to SECTION III of the teachers' questionnaire (see item 21a of the appraisers' questionnaire - Appendix A2). As mentioned above, the section consisted of a list of factors which are taken into account when considering a teachers claim for promotion (GNAT, 1987). Just as in the case of the teachers, appraisers were required to rank FOUR of these factors in a descending order of importance according to how they would consider them for promotion purposes. This was designed to make possible, comparisons between appraisers' views of the importance of these factors and teachers' views of their importance in the appraisal process in order to establish how clear these factors are to both teachers and appraisers.

6.4.7 Method of Administering Questionnaires

Junior secondary schools

I was granted permission by the director of the Inspectorate Division and also by the directors of the various districts to conduct the research at any venue in the districts. In some districts, a circular had been sent to all the schools informing the headteachers and mathematics teachers about the research, stretching the facts a bit (see Appendices B4 & B5)! In other districts, the circuit supervisors were directed by the district directors to inform all mathematics teachers in their circuits about the research and to arrange a meeting of all mathematics teachers at specified venues.

In all the districts sampled, I met with the teachers at specified venues to administer the questionnaires. The meeting usually took the form of a workshop, the first part of which was used for the administration of the questionnaires and the second part for the discussion of some general issues on the problems facing mathematics teachers generally and those in the J.S.S. in particular. This was done after the completed questionnaires had been collected from the respondents. No discussions took place among the respondents whilst they were completing the questionnaires. I went round after the questionnaires had been completed to ensure that all sections were completed before collecting the completed questionnaires. The "workshop" lasted about 3 hours.

In the Accra Metropolis, this method proved extremely difficult to use because of the shift system. I was therefore granted permission by the district director to visit the individual schools (see appendix B6). One advantage was that because of the shift system, schools did not close until about 5.00p.m. as opposed to the other regions where basic schools closed at 2.00p.m. This meant that I could access many mathematics teachers in a day. Nevertheless, a few teachers were 'missed' either because they had just left the school for home or had not arrived yet for the afternoon shift. As mentioned above, the response rate at this level was about 94 percent.

Senior secondary schools

The method used to administer questionnaires at the senior secondary level was different from the one used at the junior level. At the former level, I visited the individual selected schools to administer the questionnaires. Whilst in the schools, I reported to and introduced myself (through a letter of introduction from one of my supervisors - Appendix B6) to the head who almost invariably quickly arranged for me to meet with the head of mathematics (HMD). The (HMD) then informed her or his colleagues about the study. I almost always administered the questionnaires to groups of mathematics teachers available in the school at the time of the visit. In some cases, especially where some of the mathematics teachers could not join the groups because they were engaged in the classroom or elsewhere, the questionnaire was administered on one-to-one basis. As was done at the junior secondary level, I went round after the questionnaires had been completed to make sure that all sections were fully completed before collecting the completed questionnaires. No questionnaires were left behind for the 46 teachers who were not available. Therefore, although nearly all the teachers who were available in the schools at the time of my visits completed the questionnaires, the response rate came to about 85 percent.

Appraisers

The questionnaires for the appraisers at the junior secondary level were left with the

Assistant Director (AD - Inspectorate section) at each district office, who in turn distributed them to the circuit officers selected. Appraisers returned the completed questionnaires to the AD and I collected them later. A similar procedure was used at the senior secondary level except that at this level, the questionnaires were left with the Director in charge of the Inspectorate section at the regional office, and the Director of the Inspectorate Division of the GES. The completed questionnaires were picked up a week later.

6.4.8 Interviews

In addition to the questionnaires, 20 senior secondary and 17 junior secondary school mathematics teachers were interviewed in detail about their responses to the questionnaire items, their experiences with the appraisal process, their teaching of mathematics and how they think the former affect the latter. These interviewees were selected on the basis of their responses to the questionnaire items. Specifically, after an initial 'analysis' of the completed questionnaires, the responses were categorised using the main independent variables. Individuals from these categories were selected at random for the interviews. Using the proportions of senior and junior secondary respondents in the sample for the study, 22 senior secondary and 18 junior secondary mathematics teachers were selected for interviewing. 2 senior secondary and 1 junior secondary mathematics teachers who had completed the questionnaires were not available for the interviews. Thus 37 (92.5%) out of the 40 teachers selected were interviewed.

Also 10 appraisers selected from the districts and headquarters of the GES as well as 6 secondary heads were interviewed in detail about their views regarding the appraisal process. The appraisers were also selected on the basis of their responses to the appraiser questionnaire. Factors taken into account in the selection of the appraisers included subject specialism, experience as an appraiser and the level of education at which appraiser worked (i.e. either JSS or SSS). The heads were selected from the senior secondary schools where at least 2 teachers were selected for the interview. All the heads and appraisers (selected for interviewing) were interviewed. As in the case of the questionnaire administration, all the interviews were done between May and August 1995. The interviews generally took place at the participants' workplace (and in some cases in their homes) at a time convenient to them.

The interviews were semi-structured following a loose framework of questions on the participants' responses to the questionnaire items as well as on their views of the appraisal system generally. This means that a range of topics were covered over the

interview, for example interviewees' perceived nature of mathematics and its teaching and learning, procedures followed by different appraisers, factors affecting the frequency of appraisals, qualifications of appraisers and their personal experiences with the appraisal process. Each interview lasted between 20 and 30 minutes. Themes and ideas emerged over the course of the interviews and were used for creating linkages in the data and for developing refined interview guidelines for subsequent interviews. Thus, the approach used was one of reflexive progressive focusing (Glaser and Strauss, 1967).

Interviews with the heads also took about 30 minutes each, the schedule covering a number of issues including how information for confidential reports on teachers are obtained, how mathematics teachers are assigned to the various classes and how the head of the mathematics department (HMD) is supported in her or his position as the first internal appraiser of mathematics teachers in the school. For example, in relation to confidential reports, heads were asked whether an invitation to attend a promotion interview depended on the confidential reports on teachers or on available vacancies. In relation to the HMD's role, the heads were asked whether the former's advice on their colleagues' mathematics teaching informed the head's report on the teachers. The interviews with the heads took place in their office.

All the interviews carried out in the study were successfully completed. This is perhaps due to the good rapport I established between myself and the interviewees. In all cases, the interviewees were provided with the opportunity to talk freely about their experiences with the appraisal process as well as make suggestions as to how the appraisal process could be improved. Permission for a possible follow-up was sought from the respondents with the question: *"...it is likely that I may call on you again. If the need arises, will you be able to spare 10 to 15 minutes of your time?"* In all, only five respondents were interviewed the second time to ascertain information about themes which were developed after the first interview.

6.4.9 Work Inspection and Observation

The purpose of the field observation was both to gather data to enable conclusions to be drawn about the validity of the appraisal system and to cross-validate the responses from the interviews and information from other sources. As in the case of the development of the questionnaires and the interview schedule, I had gained an insight into the observation of teachers in the classroom during the pilot study. I had gone round with initial teacher education teachers who were observing pre-service teachers on teaching practice. Although the present study involved serving teachers, the

exercise with pre-service teachers helped me to appreciate the difference between observing a teacher's lesson and observing others observe a teacher's lesson. This 'meta-observation' exercise prepared me for the main study. It is important to point out that I had, during the period I taught mathematics in an initial teacher education college in Ghana, observed mathematics pre-service teachers at work. As mentioned above, that exercise was different from the one I was going to perform in the main study. Nevertheless, the experience I had gained as a teacher educator also helped me to appreciate the above mentioned difference.

With the purpose stated at the beginning of this sub-section in mind, I observed the inspectors from the GES headquarters whilst they were on inspection duties in 2 senior secondary schools, one in the Greater Accra region and the other in the Eastern Region. I also observed 9 circuit supervisors who were on supervision and promotion inspection duties in the selected districts. Thus, in all, I visited 11 schools in the company of appraisers in addition to those schools I visited to administer the research instruments. The former schools were selected for reasons of geographical convenience and to give a range of different types of school. All the schools involved in the visits agreed to allow me to observe appraisers observing mathematics teachers' lessons. On each occasion, when appraisers met with a teacher either before or after an observation of the teacher's lesson, I was invited to the meeting.

Additionally, whilst in the schools, I made observations of the school environment, teaching methods and the interaction between the GES officials and the teachers in the schools generally, and that between the officials and the teachers whose lessons were observed. The extent of these observations varied with the circumstances of each visit. Whereas in some schools at least three teachers were observed by appraisers, in others only one or two teachers were observed. The visits enabled me to gain some insights into the nature of teacher appraisal in Ghanaian secondary schools. In fact, in some cases the junior secondary school shared a compound with the primary school and this also made it possible for me to see a couple of appraisers in action in the primary schools.

In order to meet the aim of finding out how mathematics teachers were actually appraised in Ghana, I decided that it was necessary to pursue the following objectives:

- i) describe appraisers' actions during the pre-observation and post-observation conferences as well as the lesson observation itself;
- ii) describe teachers' actions during the above events; and
- iii) describe how the interactions between appraisers and teachers can help mathematics teachers improve their work.

Data on the observation of appraisers at work were collected using audio tapes and field notes. All the mathematics lessons as well as the interactions between appraisers were taped and 'relevant' non-verbal expressions recorded. What was actually recorded in the field notes was influenced by the above objectives. Additionally, copies of the relevant sections of the reports written by the appraisers on the lessons observed were made available to me.

Promotion interviews

I also sat in on panel interviews designed for teachers seeking promotion to the grade of principal superintendent. The interviews took the same form in all the cases I observed. Candidates were called in and asked a few background questions about their present school, their academic and professional qualifications, their record of service and how long they had served in their rank. After these initial questions, they were then questioned about the Ghana Education Service, the Ghana National Association of Teachers and other general issues. The questions were varied from candidate to candidate but they were asked in the same manner - that is by different members of the panel of four, at most six. As in the case of the observation of lessons, I taped all the verbal interactions at the interviews and recorded the relevant non-verbal expressions made by both the interviewers and the interviewees.

6.4.10 Other Information.

I collected a number of records relevant to the research from the Ministry of Education, the Ghana Education Service and the Ghana National Association of Teachers. These included copies of the Education Minister's speeches on Mathematics, Science and Technology (Appendix B 12), documents on Science, Technology and Mathematics Education (STME) Clinics, copies of promotion examination questions (e.g. Appendix B8), inspection reports (e.g. Appendix B7) and a research report on the perceived impact of the educational reform programme on the performance of teachers in the basic educational Institutions (Nyoagbe, 1993).

6.4.11 Analyses

The data obtained from the completed teacher questionnaires were coded and transferred to computer files in Microsoft Excel (4.0). First, descriptive statistics were run on all the individual items in the teachers' questionnaire to both make sense of data and to examine any differences between the various regions. This initial examination revealed no significant differences between the regions with regard to the measures

used in the study. Nor was there any reason or theory to suggest any differences between the regions in terms of the data collected. However, there were significant differences between junior and senior secondary 'scores' within each region which reflected the fact that the two levels constitute different stages in the Ghanaian education system.

The data were therefore analysed separately for junior and senior and the results compared. After this initial analysis, the data were transferred to two files in the Statistical Package for the Social Sciences (SPSS 6.0) programme and analysed again separately (and compared) and later put together for further analysis. Chi-square analyses were initially conducted to test the significance of any relationships between the variables employed in the study. These initial analyses were followed by multivariate analyses - particularly multiple regression analyses - to throw more light on the relationships that had been revealed by the use of chi-square analyses.

Responses from the completed appraiser questionnaires were coded and transferred to two SPSS (6.0) files - one each for junior and senior secondary appraisers. Exploratory and bivariate analyses were carried on in the same way as described above. The design of both the appraisers' and teachers' questionnaires allowed comparisons to be made between the perceptions of the appraisal system of the two "groups".

All the interviews conducted in the study were tape recorded and fully transcribed. The interviews were reduced to manageable proportions by creating summary sheets for each interviewee (see Moreira, 1992). On each summary sheet, there were portions corresponding to the main variables of interest of the study. These sheets offered a quick and useful reference to respondents' perceptions of the appraisal system and helped make comparisons between teachers' and appraisers' perceptions much easier. The actual transcripts were used as references for quoting particular representative observations.

As in the case of the interviews, all the taped interactions in both the observations and the promotion interviews were transcribed and summaries of the transcripts made. The summary of the transcript and the field notes taken at each observation session or promotion interview were used to decide whether or not a) the appraisers' report accurately reflected the observed lesson; and/or b) the observation satisfied the criteria discussed in chapter 4.

The findings of the study are reported in the next two chapters.

CHAPTER SEVEN

MATHEMATICS TEACHERS' PERCEIVED VALIDITY OF TEACHER APPRAISAL IN GHANA

7.1 Introduction

This chapter and the next one discuss the findings of the study. This chapter presents Ghanaian mathematics teachers' perception of teacher appraisal in Ghana (TAG) as a formative process via the relationships between the variables used in the formulation of the hypotheses described in chapter 5. Put differently, the chapter examines mathematics teachers' perceived validity of the formative aspect of the teacher appraisal system in Ghana. It does this by looking at how different categories of mathematics teachers perceive the potential of the appraisal system to help them improve their teaching of mathematics. The next chapter discusses TAG's validity generally taking teachers' perceptions and other evidence into account.

The findings of the study are reported separately for junior and senior secondary levels because the initial analysis revealed significant differences between the levels of "score" obtained at these levels. This was expected because the junior and senior secondary levels constitute different stages in the Ghanaian education system. The junior secondary school level forms part of the basic education level which, in theory, is 'free and compulsory' for all Ghanaian children. The senior secondary level, on the other hand, is neither free nor compulsory and admission to this level is determined by students' performance at the Basic Education Certificate Examination (BECE) as well as their parents' or guardians' ability to afford the fees charged at this level. Besides, the appraisal of mathematics teachers at the two levels are done by different sets of officers in the Ghana Education Service (GES - referred to in this chapter as "the Service"). Whereas junior secondary mathematics teachers are generally appraised by circuit officers from the district offices of the GES, the appraisal of mathematics teachers at the senior secondary level is done mainly by officers from the regional offices as well as those from the headquarters of the Service. Nevertheless, the results are occasionally put together to enable comparisons between junior and senior respondents to be made.

7.2 Test (s) of Significance

The chi-square test of independence was the main test used in this study because most of the variables of interest in the study were categorical variables, and the measures

used were mutually exclusive and exhaustive (see Cochran, 1954 for a discussion of the chi-square test). The chi-square analyses were followed by multiple regression and discriminant analyses in an attempt to throw more light on the relationships between the variables used in the formulation of the hypotheses in chapter 5. It is important to observe that all the chi-square values reported in the present study were corrected for continuity as this would improve the approximation of the sampling distribution of the reported values by the chi-square distribution, as well as reduce the risk of claiming a relationship where none exists (Fisher, 1935).

Admittedly, as Camilli and Hopkins (1978) point out, correcting for continuity could, in some situations, result in failing to claim a relationship where one does exist, yet since it is one of the aims of this study to examine the relationships between certain teacher characteristics and perceived support, in order to see how the former contribute to the latter, it was reasonable to attach greater loss to accepting falsehood (type I error) than failing to acknowledge a 'truth' (type II error). Such conservatism is perhaps in line with what Rosenthal and Rosnow (1984) describe as "the healthy scepticism characteristic of the scientific (and/or educational?) temper" (p.22).

7.3 Levels of Significance

Where comparisons were made either between the two groups of respondents or between categories within a group, an alpha level of 5% was used as the criterion for rejection of the null hypothesis. The above (5%) level was chosen as it is the level which is generally used in educational research such as the present one. In fact, as shown below, most of the relationships tested in this study were statistically significant at the 1% level.

7.4 Terminology

Throughout this chapter, the teachers' perceived potential of TAG to help them (to) improve their teaching of mathematics will, for the sake of simplicity, be variously described as "*positive (or negative) about TAG's potential*", "*positive (or negative) about TAG*", "*perception of TAG*", and "*TAG's potential to help them to improve their teaching of mathematics*". Also the terms "*seniors (or juniors)*", "*senior (or junior) level respondents*", "*senior (or junior) respondents*" and "*senior (or junior) mathematics teachers*" are used at various times to refer to the same thing - senior (or junior) secondary school mathematics teachers sampled in the present study. Additionally, whenever the "seniors" and "juniors" are being compared the two types of respondents are referred to as the "*(two) groups*". If the comparison is between

different sets within a particular group, each set is referred to as a “category”. Finally, the term “(two) levels” refer to the (two) types of schools involved in the study - senior and junior secondary schools. With regard to the appraisers, junior (or senior) secondary school appraisers are referred to occasionally as “appraisers at the junior (or senior) level”.

7.5 The Main Dependent Variable

It is important to point out from the outset that the present study concentrates on TAG’s potential to help mathematics teachers improve their teaching of mathematics. As a result, the main dependent variable used in the formulation of the hypotheses discussed in chapter 5 sought to measure teachers’ attitude to the formative aspect of the appraisal system in Ghana. However, since a single appraisal system is used for both summative and formative purposes in the GES, some parts of the discussion in both this and the next chapters are on TAG generally. This is because of the extremely difficult if not impossible task of separating teachers’ perceived validity of TAG as a formative process from their perceived validity of TAG as a summative process. For example, if teachers saw the promotion process (i. e. a summative aspect of appraisal) in the GES as a disincentive rather than an incentive, this could arguably influence their attitude towards appraisal as a formative process. A teacher who might want to put in extra effort to improve her or his practice might not do so because of her or his perceived irregularities in the summative aspect of the appraisal process. Indeed, some of the reasons given by some respondents for their perceived inability of TAG to help them to improve their teaching of mathematics were to do with the summative aspects of TAG - mainly promotions. The difficulty in separating teachers’ perceived effects of the two main purposes of appraisal on their attitude to either purpose has very important implications for all teacher appraisal studies. It therefore has important implications for the analysis presented in this chapter and will consequently be taken into account in describing mathematics teachers’ perceived validity of TAG. However, in spite of the above difficulty, an attempt will be made in the next chapter to examine separately the validity of TAG as a formative process and its validity as a summative process taking all relevant factors into account.

The main dependent variable (i.e. perceived support) was taken from section VII of the mathematics teacher appraisal questionnaire (MATAQ) which dealt with mathematics teaching. Respondents were presented with the following item: “Please state three ways in which you personally can improve your teaching of mathematics”. Each respondent stated three ways in which he or she could improve his or her teaching of mathematics. Three separate items were used to gather respondents’ views about the

potential of Teacher Appraisal in Ghana (TAG) to help them to do what they had stated they would do to improve their teaching of mathematics. The (three) items were:

- a) *Can the way teacher appraisal is done presently in this country help you to do the first (1st) thing you have stated in item 32 above?*
- b) *Can the way teacher appraisal is done presently in this country help you to do the second (2nd) thing you have stated in item 32 above?*
- c) *Can the way teacher appraisal is done presently in this country help you to do the third (3rd) thing you have stated in item 32 above?*

Respondents were required to answer "yes" or "no" to each item. Yes was coded 1 and No was coded 0. Each respondent's score - measuring her or his perceived potential of TAG to help her or him to improve her or his teaching of mathematics (i.e. Perceived Support from GES) - was arrived at by adding the codes for their three responses. Thus, respondents' score ranged from 0 (i.e. 3 "noes") to 3 (i.e. 3 "yesses"). The table below shows the frequencies of the perceived support scores for both junior and senior secondary level respondents. It is worth reiterating that the results of the study are reported separately for junior and senior secondary levels for the reasons given above.

Table 7.1 Frequencies of perceived support scores for respondents at the junior and senior secondary levels.

Number of "Yesses"	JSS frequency	SSS frequency
0	20 (10.4%)	57 (23.0%)
1	36 (18.7%)	65 (26.2%)
2	62 (32.1%)	62 (25.0%)
3	75 (38.9%)	64 (25.8%)
Total	193 (100.0%)	248 (100.0%)

As the first stage in the analysis of the data reported in this chapter, the 4-point scale in the above table was dichotomised into two categories. Scores of 2 and 3 were put into one category , and those of 0 and 1 were put into the second category. The former category was designated the *positive* category , because respondents whose scores were in that category were effectively indicating that they could do at least two of the three things they had stated (they would do) with the help of TAG. In other words, scores of 2 and 3 were used as the operational definition for positive perception of the potential of TAG to improve one's teaching of mathematics. The category with scores of 0 and 1 was taken as the *negative* category, because respondents whose scores were in that category were, in a way, saying that they could not do two or more of the three things they had stated (they would do) with the help of TAG. Similarly, scores of 0 or 1 were used as the operational definition for negative perception of the potential of

TAG to help one to improve one's teaching of mathematics. It may be noted from Table 7.1 that at the junior secondary level, 137(71.0%) out of the 193 respondents were positive about the potential of TAG to help them to improve their teaching of mathematics, and 56(29.0%) had negative perception of TAG's potential to help them to improve their teaching of mathematics. The corresponding figures at the senior secondary level were 126(50.8%) positive, and 122(49.2%) negative.

For the purpose of exploratory chi-square analysis, and in order to identify probable two-way relationships between the dependent and independent variables, the various multinomial scales of the measures of some of the independent variables were also collapsed into two categories. This was done to enable 2x2 chi-square analysis to be made. However as one of the aims of following the chi-square analyses up with multivariate analysis was to examine the amount of the variance of the dependent variable explained by the independent variables, the former took on all the range of values (i.e. 0-3) in the multiple regression analyses in the second part of this chapter.

Tables 7.2 and 7.3 show the frequency counts of perceived support 'scores' in the form of contingency tables involving the main independent variables in the study, and the dependent variable at the junior and senior levels respectively.

Table 7.2 Examining the relationship between teacher characteristics and perceived (professional) support at the junior secondary level

	PERCEIVED SUPPORT		χ^2	p
	Positive (N=137)	Negative (N=56)		
1. Teachers who have been appraised Teachers who have NOT been appraised	113 24	35 21	7.7944	p<.01***
2. Teachers last appraised by GESOs Teachers NOT last appraised by GESOs	105 32	28 28	11.9564	p<.001***
3. Teachers trained as appraisees Teachers NOT trained as appraisees	68 69	19 37	3.3519	ns
4. Taught maths for over 5 years Taught maths for 5 years or less	50 87	18 38	0.1669	ns
5. Above the rank of superintendent NOT above the rank of superintendent	22 115	2 54	4.6032	p< .05*
6. Female teachers Male teachers	16 121	8 48	0.0664	ns
7. Professional maths teachers Non-Professional maths teachers	15 122	7 49	0.0034	ns
* Significant at 5%				
*** Significant at 1%				
ns = Not statistically significant				

Table 7.3 Examining the relationship between teacher characteristics and perceived (professional) support at the senior secondary level

	PERCEIVED SUPPORT		χ^2	p
	Positive (N=126)	Negative (N=122)		
1. Teachers who have been appraised Teachers who have NOT been appraised	64 62	91 31	13.9778	p<.001***
2. Teachers last appraised by GESOs Teachers NOT last appraised by GESOS	46 80	64 58	5.7598	P<.025*
3. Teachers trained as appraisees Teachers NOT trained as appraisees	30 96	47 75	5.6008	p< .025*
4. Taught maths for over 5 years Taught maths for 5 years or less	59 67	89 33	16.5128	p< .001***
5. Above the rank of superintendent NOT above the rank of superintendent	51 75	92 30	29.5701	p< .001***
6. Female teachers Male teachers	13 113	11 111	0.2056	ns
7. Professional maths teachers Non-Professional maths teachers	51 75	89 33	0.0030	p<.001***

*Significant at 5%

*** Significant at 1%

ns = Not significant

It may be inferred from the above tables that at the junior secondary level, three variables namely, *appraisal experience*, *last appraiser* and *rank* correlated significantly with perceived support. At the senior secondary level, six of the seven variables (i.e. all but *gender*) were significantly related to the dependent variable.

The rest of this chapter examines in detail the (above) results obtained by testing the main hypotheses formulated in chapter 5. It is worth reiterating that the hypotheses (involving the above variables) are first tested using chi-square procedures and later followed up with multivariate analyses methods.

7.6 Appraisal Experience

The first hypothesis tested was the one formulated to examine the relationship between appraisal experience and perceived support. The prediction was that at both junior and senior secondary levels, mathematics teachers who had been appraised would be more positive about the potential of TAG to help them improve their teaching of mathematics than those who had not been appraised. At both levels, appraisal experience was significantly related to perceived support at the 1% alpha level. Table 7.4 shows the results obtained with regard to the variable under discussion

Table 7.4 Contingency tables showing the relationship between last appraisal experience and perceived support, for junior and senior secondary respondents

JSS (N=193)			SSS (N = 248)		
(Appraised?)			(Appraised?)		
	Yes	No		Yes	No
Pos	113	24	Pos	64	62
Neg	35	21	Neg	91	31

At the junior secondary level, 113(76.4%) out of the 148 respondents who had been appraised were positive about TAG as compared to 24(53.3%) of the 45 who had not been appraised, χ^2 (1, N=193) = 7.7944, $p<.01$. At the senior secondary level however, 64(41.3%) out of the 155 respondents who had been appraised were positive about TAG, while 62(66.7%) out of the 93 non-appraised respondents were negative about TAG, χ^2 (1, N=248) = 13.9778, $p<.01$.

Thus, contrary to the above prediction, the relationship between the two variables were in different directions at the two levels. Whereas the relationship between appraisal experience and perceived support was in the predicted direction at the junior secondary level, the direction of the relationship between the variables was in the opposite direction at the senior secondary level. The deviation at the latter level undoubtedly requires explanation, and that is what the following section seeks to do.

A number of reasons may be given for the above apparent difference (between the groups) in the direction of the relationship between the dependent variable and the independent variable under discussion. First, there was a significant difference between the two groups of respondents with regard to their general perception of TAG. It may be recalled that 137(81%) out of the 193 junior secondary respondents were positive about the potential of TAG to help them improve their teaching of mathematics, as compared to 126(50.8%) out of the 248 senior secondary respondents, resulting in a significant difference between the two groups of teachers in terms of perceived support - χ^2 (1, N=441) = 17.52949 $p<.001$.

Apart from the above difference between the two groups of teachers, one other major reason why the results at the senior secondary level showed a deviation from the prediction is the type of appraisal experience the respondents get at the two levels. As shown in the next chapter, many of the appraisers who took part in the study were not mathematics specialists. This means that many appraisers were not in the position to help mathematics teachers improve their performance. In other words, the feedback most of the mathematics teachers especially those at the senior secondary level get from the appraisers could affect their perceptions of the appraisal system negatively.

The suggestion is that mathematics teachers who doubt the expertise of their appraisers would not be satisfied with appraisal feedback from such sources. Admittedly, the present study did not measure the mathematics expertise of appraisers of mathematics teachers, nor had any study describing mathematics teachers' perception of feedback from their appraisers come to my notice. Yet it may be said that most of the appraisers who participated in the present study were not mathematics specialists. Most of them therefore lacked the expertise in the teaching of mathematics and were not in the position to accurately assess the professional needs of mathematics teachers in order to help them improve their work. Put simply, since knowledge of mathematics is a necessary condition for its teaching as pointed out by authors such as Ball (1988) and Leinhardt (1988), it follows that appraisers of mathematics teachers must of necessity be conversant with mathematics and its teaching. Leinhardt (op. cit.) writes:

In studying a variety of math(s) lessons given by expert teachers, we have analysed in detail the structure of lessons and the routines used to support that structure, the mathematics content of the lessons, and the fit between such content and the student's developing knowledge base....We consider someone competent in a particular area when the individual can do actions associated with tasks in the area quickly, accurately, flexibly, and inventively under several types of processing constraints, and when he or she can explain what was done with reference to broad principles and demonstrations. Students who are engaged in learning mathematics start out far from being competent in this sense. However, they are not so far away as texts and teachers often consider them to be (Leinhardt, 1988, p.120, my emphasis).

Admittedly, in terms of clarity, Leinhardt's instrument for measuring mathematical competence may leave a lot to be desired - as probably only the author can use it, yet it is fair to say that Leinhardt's 'expert' teachers did presumably satisfy the conditions in her list - they would not be experts otherwise. The students, she claims, were in the process of developing their knowledge base and were, as a result, not competent. The teachers, on the other hand, were experts because they had (fully?) developed their knowledge base in mathematics - an interesting emphasis on the importance of mathematics teachers' subject-matter knowledge in the teaching of mathematics. The point is, certain teachers may view mathematics and its teaching in similar ways as viewed by Leinhardt and other writers who share her views.

It seems reasonably safe to posit that mathematics teachers who share the above view that adequate mathematical knowledge base should be a prerequisite of the teaching of the subject, would expect their supervisors to have "developed their knowledge base" of the subject if they are to help them improve their teaching of the subject. If such

teachers perceive their supervisors as having a weak knowledge base in the subject, then it might be difficult for them to think that the supervisors can help them to improve their work. Indeed, as shown in the next chapter, the majority of the mathematics teachers at the senior secondary level in the present study did not think their appraisers have the prerequisite knowledge in mathematics or its teaching to be able to help them improve their work. This may explain why those who have actually been appraised tended to be more negative about TAG than their non-appraised counterpart. The next section examines the relationship between respondents' last appraiser and their perceived support and perhaps throws more light on the above discussion.

7.7 Respondents' Last Appraiser

The second hypothesis tested in the present study was that at both junior and senior secondary levels, mathematics teachers who were last appraised by Ghana Education Service Officials (GESOs) would be less positive about the potential of teacher appraisal in Ghana to help them to improve their teaching of mathematics than those who were either last appraised by other persons, or who had not been appraised at all. As in the case of *Hypothesis 1*, and contrary to the above prediction, the association between respondents' last appraiser and perceived support was in different directions at the junior and senior secondary levels. Whereas the direction was as predicted in the case of the senior respondents, it was the opposite of the predicted direction in the case of the junior respondents. At the latter level, of the 133 mathematics teachers who were last appraised by GES officials, 104 (78%) were positive about TAG. This percentage was significantly greater than the 55% (i.e. 33 out of 60) who were either not last appraised by GESOs or had not been appraised at all, but whose perceived support was positive, $\chi^2 (1, N=193) = 9.7040, p < .005$.

At the senior secondary level, only 46 (41.8%) out of the 110 who were last appraised by GESOs perceived positive support. This figure was significantly less than the 80 (60.0%) out of the 138 who were not last appraised by GESOs but whose perception of professional support was positive, $\chi^2 (1) = 5.7598, p < .025$. On the face of it, whereas Hypothesis 2 appeared supported at the senior secondary level, the direction predicted was reversed at the junior secondary level. In other words, the hypothesis was not supported at the junior level. As in the case of Hypothesis 1, the 'deviation' at the junior secondary level requires explanation.

One main reason why there was an apparent deviation at the junior secondary level is

that at that level, appraised respondents were generally positive about TAG as shown in the last section. As most of these were last appraised by GESOs, it is difficult to determine whether they were positive because they were last appraised by GESOs or they were generally positive because of their appraisal experience. In fact, of the 148 respondents who had been appraised at this level, 133(93%) were last appraised by GESOs. In other words, the very high correlation between *last appraiser* and *appraisal experience* ($r=.82$) means that the former variable may have stood as proxy for the latter. In that case the apparent deviation would only be confirming the results obtained by testing Hypothesis 1.

Table 7.5 shows the frequencies for the various appraisers at the respondent's last appraisal session.

Table 7.5 Sources of appraisal feedback at respondents' last appraisal session.

Source	JSS	SSS
GESO	133(68.9%)	110(44.4%)
Head	11(5.7%)	31(12.5%)
HOD	4(2.1%)	14(5.6%)
None (not appraised)	45(23.3%)	93(37.5%)
Total	193(100%)	248(100%)

It is important to reiterate that at the junior secondary level, 148 out of the 193 respondents had had appraisal experience. The corresponding figure at the senior secondary level is 155. As mentioned above, 93 percent of the appraised respondents at the junior level were last appraised by GESOs. At the senior level, over 70 percent of those appraised were last appraised by GESOs. Thus, at this level too, the relationship between the variable under discussion and perceived support may have been mediated by *appraisal experience*. Indeed, that the later variable had considerable effect on the one under discussio is confirmed by the fact that when the data were controlled for appraisal experience, the high correlations reported above disappeared!

Table 7.6 shows the contingency tables for the two groups when the analysis was limited to those respondents with appraisal experience.

Table 7.6 Contingency tables showing the relationship between last appraisal feedback source and perceived support, controlled for appraisal experience, for junior and senior secondary respondents

JSS (N=148)			SSS (N = 155)		
	(Source)			(Source)	
	GESO	Other		GESO	Other
Pos	104	8	Pos	46	18
Neg	29	7	Neg	64	27

It may be observed that at the junior secondary level, 105 (78.9%) of the 133 appraised

by GESOs were positive about the potential of TAG to help them to improve their teaching of mathematics as compared to 8 (53.3%) of the 15 appraised by others (i.e. heads and heads of mathematics). The association between last appraisal source and perceived support among the appraised group was not statistically significant, $\chi^2 (1, N = 148) = 3.5820, P > .05$.

At the senior secondary level, the percentage of respondents appraised last by GESOs who perceived support in a positive light and that of those who were last appraised by others (and who perceived TAG positively) were nearly the same. The figures of 41.8% (i.e. 46 out of 110) and 40% (i.e. 18 out of 45) respectively, showed nearly no association between latest appraisal experience and perceived support, $\chi^2 (1, N = 155) = 0.0008, p > .90$.

Putting the two sets of results together, one could conclude temporarily that at the junior secondary school, the deviation in the predicted direction may have been caused by the strong correlation between *appraisal experience* and *last appraiser*. At the senior secondary school, the apparently strong correlation between the *last appraiser* and perceived support may have been caused by the former's relationship with *appraisal experience*.

7.8 Training

Hypothesis 3 stated that at both junior and senior secondary levels, mathematics teachers who had been trained as appraisees would be more positive about the potential of TAG to help them improve their teaching of mathematics than those who had not been so trained. As mentioned in chapter 5, the training here refers to the sort of training teachers receive in order to help them pass promotion examinations and interviews conducted by the Ghana Education Service (GES).

The results of the present study showed that out of the 193 mathematics teachers sampled at the junior secondary school level, 87 (45.1%) had been trained as appraisees. At the senior secondary level, 77 (31.0%) out the 248 mathematics teachers who participated in the study had attended such training courses. Of the 87 who had been trained at the junior secondary level, 68 (78.2%) perceived in a positive light the potential of TAG to help them to improve their teaching of mathematics, whereas 69 (65.1%) of the 106 who had not had such training were positive about the potential of TAG, making the difference between trained and untrained respondents at that level apparently insignificant at the 5% level, $\chi^2 (1, N=193) = 3.3519, p > .05$.

On the face of it, the story looked different at the senior secondary level. Of the 77 who had training, 30 (39.0%) were positive about TAG's potential of helping them improve their teaching, whereas 96 (56.1%) of the 171 who had not been so trained viewed TAG positively. At this level, the difference between trained and untrained respondents was statistically significant at the 2.5% alpha level, $\chi^2 (1, N=248) = 5.6008, p < .025$.

Although *Hypothesis 3* was not supported at either level, the direction of the rather weak relationship between training and perceived support at the junior secondary level was in the direction predicted. On the other hand, the relationship predicted in the hypothesis was reversed at the senior secondary level. That is, at the latter level, trained respondents were less positive about the potential of TAG to help them to improve their teaching of mathematics than untrained respondents.

The negative relationship between training and perceived support at the senior secondary level appear to confirm the difference between the two groups which was revealed in the last two sections. This difference may be explained in terms of the respondents' appraisal experience. This is because, as mentioned above, the training under discussion is meant to help teachers gain promotion to the next grade in the GES. The intertwining of summative and formative appraisals in the Service would almost invariably suggest that any discussion of promotion of individuals and other related issues should take into account the appraisal experience of those individuals, for it is at appraisal events that what the individual may have learnt at training courses might be used. In other words, teachers 'need' the training in order to be successful at promotion examinations and promotion interviews - which are both (summative) appraisal events, therefore any discussion of promotions should take into account the candidates' appraisal experience(s).

As far as the present study is concerned, the implication is that teachers who, for instance, after their training, did actually 'apply' it at appraisal events, might relate the appraisal training to perceived support in a different way to those who had the training but had not had the opportunity to apply it, or those who had been appraised one way or the other without having had the training, or indeed those who had neither been trained nor appraised. Admittedly, the study did not distinguish between appraisals for promotions and those for other purposes because of the intricate relationship between purposes of appraisal in the GES - indeed, not even the respondents' appraisal experiences following training could be related unproblematically to the latter - yet, controlling the effect of appraisal experience would arguably paint a clearer picture, by at least 'reducing' the confounding effects of appraisal experience.

Table 7.7 contains contingency tables showing the frequency counts for trained and untrained (appraised/non- appraised categories) at the junior secondary level.

Table 7.7 Contingency tables showing the relationship between appraisal training and perceived support, controlled for appraisal experience, for junior secondary respondents.

Appraised (Trained ?)			Non-appraised (Trained ?)		
	Yes	No		Yes	No
Pos	66	47	Pos	2	22
Neg	17	18	Neg	2	19

It may be observed that at the junior secondary level, 66 (80.0%) of the 83 respondents who were both appraised and trained were positive about the potential of TAG to help them to improve their teaching of mathematics as compared to 47 (72.3%) out of the 65 who were appraised but not trained. Thus within the appraisal category, the association between training and perceived support was not significant, $\chi^2 (1, N = 148) = 0.6882$, $P > .40$. Within the non-appraised category, 2 (50%) out of the 4 trained respondents were positive about the potential of TAG, whereas 22 (53.6%) out of the 45 respondents viewed TAG positively. Here too, the association between training and perceived support was not significant, $\chi^2 (1, N = 45) = 0.0196$, $P > .90$.

Two important observations could be made here: first, two of the expected frequencies in the ‘non-appraised’ contingency table were less than 5, and this could result in wrong conclusions being drawn about the non-appraised category in terms of the relationship being examined. This is in spite of Rosenthal and Rosnow’s (1984) claim that:

Evidence now indicates... that very usable chi-square values can be obtained even with expected frequencies as low as 1, as long as the total number of independent observations (N) is not too small (Rosenthal and Rosnow, op. cit., p.384).

The authors cited Camilli and Hopkins’ (1978) study which apparently suggested that a sample size of 20 is large enough, and claimed that small expected frequencies may work quite well in even smaller studies. Yet in a study where an inflated chi-square value is of no value, or where it is more harmful to commit a type I error than a type II error, such an advice may be counter productive. The second observation is that although no apparent significant relationship existed between training and perceived support in both categories, a slightly greater percentage of the trained (and appraised) respondents were positive about TAG than their untrained (but appraised) counterparts. These observations would arguably indicate, even if temporarily, that after controlling

for appraisal experience, there was still the tendency for junior secondary level trained respondents to be more positive about TAG.

The situation at the senior level, after controlling for appraisal experience, was not any different from that at the junior level. Table 7.8 contains contingency tables showing the frequency counts for trained and untrained (appraised/non- appraised categories) at the senior secondary level.

Table 7.8 Contingency tables showing the relationship between appraisal training and perceived support, controlled for appraisal experience, for senior secondary respondents.

Appraised			Non-appraised		
(Trained ?)			(Trained ?)		
	Yes	No		Yes	No
Pos	25	39	Pos	5	57
Neg	44	47	Neg	3	28

The senior secondary data showed that, within the appraised category at this level, 25 (36.2%) of the 69 respondents who were both appraised and trained were positive about the potential of TAG to help them to improve their teaching of mathematics as compared to 39 (45.3%) out of the 86 who were appraised but not trained. The association between training and perceived support (in this category) was not significant, $\chi^2 (1, N =155) = 0.9635, P > .30$. Within the non-appraised category, 5 (62.5%) out of the 8 trained respondents were positive about the potential of TAG, whereas 57 (67.1%) out of the 85 respondents viewed TAG positively. Again, the association between training and perceived support was not significant, $\chi^2 (1, N = 93) = 0.0638, P > .80$.

At this level too, one of the expected frequencies in the ‘non-appraised’ contingency table was less than 5, therefore, for the reasons given above, nothing much can be said about that category except that there was no apparent significance between the dependent and independent variable in that category. It could be argued here then that the apparent negative relationship between training and perceived support at the senior secondary level was due to the strong correlation (see Table 7.17 below) between appraisal experience and training at both levels. The conclusion that can be drawn here is that the present study did not find any relationship between appraisal training and perceived support. This finding was confirmed by the multivariate analyses reported in the second part of this chapter.

7.9 Mathematics Teaching Experience

The fourth hypothesis tested in the present study concerned the relationship between experience in mathematics teaching and perceived support. It was predicted that teachers who had taught mathematics for longer periods would be less positive about the potential of TAG to help them to improve their teaching of mathematics. At the junior secondary level 50 (73.5%) out of the 68 teacher who had taught mathematics for more than five years were positive about the potential of TAG to help them to improve their teaching of mathematics whilst 87 (69.6%) of the 125 teachers with five years or less experience in mathematics teaching viewed TAG positively. Thus the difference between “experienced” and “inexperienced” mathematics teachers in terms of perceived support was not statistically significant even at the 50% alpha level, $\chi^2(1, N=193) = 0.1669, P > .50$.

The situation looked different at the senior secondary level. At that level, 59 (39.9%) out of 148 of “experienced” maths teachers as opposed to 67 (67%) out of the 100 “inexperienced” teachers - nearly double the former percentage - viewed TAG in a positive light. Thus, at this level, there was as predicted a strong relationship between mathematics teaching experience and perceived support in the direction predicted, $\chi^2(1, N=248) = 16.5128, P < .001$.

The results at the senior secondary level were expected not only because of the senior the well documented ‘luke warm’ relationship that had existed between education officers and the Ghanaian teachers generally since the introduction of “payment of results” into the country over ninety years ago (Bame, 1991), but as predicted in chapter 5, most of the experienced mathematics teachers at the senior secondary level were professionals. As shown in the multiple regression analyses (in the second part of this chapter), professional mathematics teachers were generally negative towards TAG’s potential to help them to improve their teaching of mathematics.

It is therefore hardly surprising that there was a very significant difference between the two groups of teachers in terms of the relationship between experience and perceived support. For example, it has been reported that, out of the 68 experienced respondents at the junior secondary level, 50(73.5%) were positive about TAG. The corresponding figure at the senior secondary level was 59(39.9%) out of 148 respondents. The difference between the two proportions appeared to be strongly significant, $\chi^2(1, N=216) = 19.7980, p<.001$.

Two reasons may be suggested for this apparent difference between the two groups of

teachers, particularly the experienced ones. The first reason could be the result of any differences in the perceived levels of expertise between junior and senior secondary mathematics teachers, and the second reason may be due to the effect of appraisal experience on the variable under discussion. The second of the two suggested reasons is discussed first. Table 7.9 summarises the observations at the junior secondary level, controlled for appraisal experience, in the form of contingency table.

Table 7.9 Contingency tables showing the relationship between experience and perceived support controlled for appraisal experience, for junior secondary respondents

Appraised			Non-Appraised		
	(Experience)			(Experience)	
	>5 years	≤5years		>5 years	≤5years
Pos	49	64	Pos	1	23
Neg	18	17	Neg	0	21

It may be noted that of the 67 “experienced” mathematics teachers who had been appraised, 49 (73.1%) as compared to 64 (79%) out of the appraised “inexperienced” ones thought that teacher appraisal in Ghana could help them to improve their teaching of mathematics. The difference between the appraised experienced mathematics teachers and their inexperienced counterparts, after controlling for appraisal, was not significant either, $\chi^2 (1, N=148) = 0.4138, P > .50$, indicating again, the apparent lack of association between experience and perceived support at the junior secondary level.

At the senior secondary level, when the data was controlled for appraisal experience, the prediction in *Hypothesis 4* appeared unsupported within both the appraised and non-appraised groups of mathematics teachers, indicating perhaps the effect of appraisal experience on teaching experience or the high correlation between appraisal experience and the variable under discussion. It is worth pointing out that within both the appraised and the non-appraised samples, the direction of the rather weak relationship between experience and perceived support (after controlling for appraisal) was as predicted. Table 7.10 shows the frequencies for the various categories after taking appraisal into account.

Table 7.10 Contingency tables showing the relationship between experience and perceived support, controlled for appraisal experience, for senior secondary respondents

Appraised			Non-Appraised		
	(Experience)			(Experience)	
	>5 years	≤5years		>5 years	≤5years
Pos	45	19	Pos	14	48
Neg	76	15	Neg	13	18

For the appraised group, 45 (37.2%) out of 121 experienced mathematics teachers were positive about TAG, whereas 19 (55.9%) of the 34 inexperienced ones were so positive $\chi^2 (1, N=155) = 3.0933, P > .05$. The situation in the case of the non-appraised group was similar and the corresponding figures were 14 (51.9%) out of 27 and 48 (72.7%) out of 66 respectively, $\chi^2 (1, N=93) = 2.8768, P > .05$, with the higher percentages obtained in the non-appraised sample confirming the observation made earlier that at the senior secondary level, non-appraised mathematics teachers were generally more positive about TAG than appraised mathematics teachers.

It may be inferred from the above discussion that although the introduction of appraisal experience into the analysis may have weakened any significant association that there was between experience and perceived support particularly at the senior secondary level, the data still showed differences between the two levels which would require further explanation. Taking for example the appraised respondents in the two groups, whereas 49 (73.1%) out of the 67 junior secondary experienced respondents were positive about TAG, only 45 (37.2%) out of the 121 senior secondary experienced respondents were so positive, resulting in a very significant difference between the two groups, $\chi^2 (1, N=188) = 20.8070, p < .001$. In other words, the above suggested reason (i.e. the effect of appraisal experience) might be a valid one yet it did not 'eliminate' the differences between the two levels with regard to the relationship between experience and perceived support.

Considering that most of the appraisers at both junior and senior secondary levels were found to lack mathematics expertise in mathematics, it is no exaggeration to suggest that the difference between the two groups may be due the possible differences in the levels of competence and self-concept in mathematics between the two groups. Indeed, Grouws (1992) has cited a number of studies (e.g. Byrne, 1984; Marsh, 1986) on individuals' self-concept in mathematics which findings suggest that the relationship between self-concept and achievement is consistently positive. If these findings are anything to go by, then teachers who have low achievement levels in mathematics and as a result, poor self-concept in the subject, would be more likely to accept feedback from an external source than those with high self-concept in the subject. It is suggested that experienced mathematics teachers at the junior secondary level differ from their counterparts in the senior secondary schools in terms of self-concept in mathematics. This view was supported by the interviews conducted during the study.

As mentioned in chapter six, 17 junior secondary and 20 senior secondary mathematics teachers were interviewed in detail about their responses to the questionnaire items as well as their experiences with the appraisal process. At each level, 12 of the

respondents had been appraised. Of the 17 junior secondary mathematics teachers interviewed, 5 of the 6 (i.e. over 80%) experienced teachers who had been appraised were positive about the benefits of the appraisals they had had, whereas of the 20 senior secondary interviewees only 2 of the 8 (i.e. 25%) experienced teachers who had been appraised were positive about the appraisals they had received. The following views expressed by two of the respondents (both of whom were professionals and had taught mathematics for over 10 years) when asked to suggest how the appraisal process in Ghana could be improved illustrate the point made above. The junior secondary mathematics teacher said:

....I think the appraisals (I have had) have helped me. Now I can prepare my lesson notes very well. I can also teach better because now I give the pupils more exercises. I can see that they are picking up... However, I think we spend too much time on notes preparation. We don't have enough time to teach the children.... I want these officers to concentrate more on the lessons we teach and not the lesson notes... I think the officers should encourage teachers to do extra-classes without charging any additional fees. The subjects in the JSS syllabus are too many and so we don't have enough time to cover the maths syllabus. There are too many topics to cover in the short time. Now the government does not want anybody to do any extra lessons because some teachers charge money for the extra-lesson. But we here did not charge anything, yet they don't want us to do it. The officers should allow us to do extra-lessons so that we can cover the syllabus....

The senior secondary mathematics teacher, on the other hand, commented:

... First, they (i.e. the GES) must replace most of the officials who do appraisals. Most of these people are those who don't fit in the classroom. With the new reforms, they can't teach in the Junior Secondary Schools so those who don't find places in the primary schools in the urban centres are sent to the office. These people cannot help any classroom teacher. Most of the people in the office must be (replaced). We need very qualified maths teachers, those with good education background to be in the office so that they can go round and help maths teachers at both the JSS and SSS levels. Maths is not like the other subjects where students can study by reading prescribed textbooks. I passed 'A' level economics by reading economics textbooks without receiving any tuition from anybody. Maths is not like that at all. The subject as you know it yourself is very abstract so students find it very difficult even when a teacher explains the concepts to them. That is why many students fail maths especially in the senior secondary schools. So I think the officers must be well qualified mathematics teachers like the headmaster [The respondent's head was a chief examiner in mathematics with the West African Examinations Council]....

It may be noted that whereas the experienced "junior" mathematics teacher expressed acceptance of the external *source* of appraisal feedback as well as the feedback itself,

his counterpart at the senior secondary level not only rejected appraisal feedback given by GESOs, but called for the replacement of most officers who appraise mathematics teachers. Thus the two teachers perceived their appraisers differently.

To conclude, the relationship predicted in *Hypothesis 4* was only supported at the senior secondary level. Null results were obtained at the junior secondary level, suggesting a difference between the two groups in terms of the variable under discussion. It has been argued that the apparent difference between the two groups may be caused by the differences in their self-concept in mathematics. This means that experienced mathematics teachers in the junior secondary schools are more likely to perceive increased competence resulting from appraisal feedback than their counterparts in the senior secondary schools due to the relatively low levels of (perceived) competence among junior secondary mathematics teachers. One important implication of the above discussion is that when it comes time in an appraisal process to provide feedback, the recipient's perceptions of the source's qualifications to provide adequate feedback become critical to their intention to accept (and use) the feedback.

7.10 Rank

Hypothesis 5 concerned the rank of respondents. It was expected that at the senior secondary level, mathematics teachers with higher rank (i. e. those above the rank of superintendent) would be less positive about the potential of TAG to help them to improve their performance than those at the lower ranks (i.e. rank of superintendent or below). At the junior secondary level, the expectation was that mathematics teachers above the rank of superintendent would be more positive about TAG than those at the rank of superintendent or below. As predicted, there was at least a tentative significant relationship between rank and perceived support at both levels and in the respective predicted directions, indicating that *Hypothesis 5* was supported in its entirety at both levels.

At the junior secondary level, 22 (91.6%) out of the 24 respondents above the rank of superintendent were positive about TAG as compared to 115 (68.0%) of the 169 respondents at the rank of superintendent or below, showing a significantly positive correlation between rank and perceived support, $\chi^2(1, N=193) = 4.6032, p < .05$.

At the senior secondary level, 51 (35.7%) out of the 143 respondents above the rank of superintendent were positive about TAG as opposed to 75 (71.4%) of the 105 respondents at the rank of superintendent or below, also showing a significantly positive correlation between rank and perceived support, $\chi^2(1, N=248) = 29.5700,$

$p < .001$. Even when the data were controlled for appraisal experience, the predicted difference between the two groups persisted. Table 7.11 summarises the observations, controlled for appraisal experience, in the form of contingency tables.

Table 7.11 Contingency tables showing the relationship between rank and perceived support, controlled for appraisal experience, for junior secondary respondents

Appraised			Non-Appraised		
	(Rank)			(Rank)	
	Above supt	supt.or below		Above supt	supt.or below
Pos	21	92	Pos	1	23
Neg	2	33	Neg	0	21

It may be noted that of the 23 appraised mathematics teachers above the rank of superintendent, 21 (91.3%) as compared to 92 (73.6%) out of the 125 appraised respondents not above the rank of superintendent thought that teacher appraisal in Ghana could help them improve their teaching of mathematics. The difference between the two categories of mathematics teachers, after controlling for appraisal, was however not significant, $\chi^2 (1, N=193) = 2.4629, P > .10$, indicating that, there was an apparently weak association between rank and perceived support among appraised teachers at the junior secondary level. It is worth pointing out however, that after controlling for appraisal, the 'difference' between the proportions of appraised higher ranked teachers and that of their lower ranked counterparts (who had appraisal experience) was still in the predicted direction.

At the senior secondary level (unlike the junior secondary level), when the data were controlled for appraisal experience, *Hypothesis 5* appeared supported within both the appraised and non-appraised categories of mathematics teachers. indicating, once more, the difference between junior and senior mathematics teachers. Table 7.12 summarises the relationship between rank and perceived support for the two categories of mathematics teachers.

Table 7.12 Contingency tables showing the relationship between rank and perceived support, controlled for appraisal experience, for senior secondary respondents

Appraised			Non-Appraised		
	(Rank)			(Rank)	
	Above supt	supt.or below		Above supt	supt.or below
Pos	36	28	Pos	15	47
Neg	75	16	Neg	17	14

For the appraised group, 36 (32.4%) out of 111 higher ranked mathematics teachers were positive about TAG, whereas 28 (63.6%) of the 44 lower ranked ones were so positive $X^2 (1, N=155) = 11.4017, p < .001$. The situation in the case of the non-

appraised group was similar and the corresponding figures were 15 (46.9%) out of 32 and 47 (77.0%) out of 61 respectively, $\chi^2 (1, N=93) = 7.2953$, $p < .01$, with the higher percentages obtained in the non-appraised sample confirming again, the observation made earlier that at the senior secondary level, non-appraised mathematics teachers were generally more positive about TAG than appraised mathematics teachers.

In sum, the results supported *Hypothesis 5*. As predicted, whereas at the junior level, significantly more mathematics teachers above the rank of superintendent than those at the rank of superintendent or below were positive about the potential of TAG to help them to improve their teaching of mathematics, the situation was different at the senior secondary level. At the latter level, a significantly greater proportion of respondents above the grade of superintendent were negative about TAG. This results perhaps underlines the possible effect that summative appraisals can have on teachers' perception of formative appraisals. However, the strong relationship between rank and the other independent variables (see Table 7.17) makes it difficult to determine whether the relationship between rank and perceived support is real or spurious. The above results may particularly reflect the strong relationship between rank and professional status at the senior level. For example, 5 (25%) out of the 20 respondents above the rank of senior superintendent interviewed were positive about TAG. This percentage is nearly the same as the percentage of professional interviewees (4 out of 17) who were positive about TAG.

7.11 Gender

The sixth hypothesis tested in the study was about gender differences in perceived professional support. It predicted that at both junior and senior secondary levels, female mathematics teachers would view the potential of TAG to help them improve their teaching of mathematics differently from male mathematics teachers. The results obtained were apparently unsupportive of this hypothesis for, at both levels, no significant differences were found between males and females about their views about TAG. At the junior secondary level, 16 (67%) out of the 24 female mathematics teachers and 121 (71.6%) out of the 169 male mathematics teachers were positive about TAG. As mentioned above, the difference between female and male respondents with regard to their views about TAG was not significant, $\chi^2 (1, N=193) = 0.0664$, $P > .70$.

At the senior secondary level, the corresponding figures (indicating positiveness towards TAG) were 13(54.2%) out of the 24 females and 113(50.4%) out of the 224

male respondents. Here too, the difference between males and females in terms of their views about TAG was not significant, $\chi^2(1, N=248) = 0.0173, p>.80$. As mentioned several times in this thesis, it is difficult to interpret null results and great care ought to be taken in commenting on the above figures. This point is supported even further by the fact that of the 5 female mathematics teachers interviewed (2 from the junior secondary level and 3 from the senior secondary level) 2 (40%) were positive about TAG. This proportion was almost the same as that of their male counterparts who were positive about TAG. Specifically 13 male mathematics teachers (40.6%) out of the 32 who were interviewed were positive about the potential of TAG. Consequently, no further analysis of the above data could be justified. Nevertheless, the data may be the starting point of further research, looking, for example, at gender differences in performance appraisal ratings.

7.12 Professional Status

Hypothesis 7 predicted that at both levels, professional mathematics teachers would be less positive about the potential of TAG to help them to improve their teaching of mathematics. The initial findings, as far as professional status is concerned, were that *Hypothesis 7* was supported at the senior secondary level but not at the junior secondary level. Null results were obtained at the latter level but at the former level, the relationship between professional status and perceived support was, on the face of it, very strong and in the predicted direction.

At the junior level, 15 (68.2%) out of the 22 'professional' respondents were positive about TAG whereas 122 (71.3%) out of the 171 non-professionals were positive, $\chi^2(1, N=193) = 0.0034, p>.95$. The situation at the senior level was, as mentioned above, very different. At that level, only 51(36.4%) out of the 140 professionals were positive about TAG as compared to 75 (69.4%) out of the 108 non-professionals, resulting in an apparently strong association between professional status and perceived support, $\chi^2(1, N=248) = 25.2854, p<.001$.

As in the case of *rank*, even when the data were controlled for appraisal experience, the difference between the two groups with regard to the results under discussion persisted. Table 7.13 summarises the observations at the junior secondary level, controlled for appraisal experience, in the form of contingency tables.

Table 7.13 Contingency tables showing the relationship between professional status and perceived support, controlled for appraisal experience, for junior secondary respondents

Appraised (Pro. status)			Non-Appraised (Pro. status)		
	Pro	Non-pro		Pro	Non-pro
Pos	10	103	Pos	5	19
Neg	3	32	Neg	4	17

It may be noted that at the junior level, the proportion of respondents who were positive about TAG in the appraised category at this level were nearly the same. Of the 13 appraised professional mathematics teachers 10 (76.9%) as compared to 103 (76.3%) out of the 135 appraised non-professional respondents were positive about teacher appraisal in Ghana and thought the latter could help them to improve their teaching of mathematics. There was apparently no difference between the two categories of mathematics teachers, after controlling for appraisal, $\chi^2 (1, N=148) = 0.0061, P>.90$. It is worth pointing out that one of the cells had a frequency of less than 3. This makes it rather unsafe to draw any firm conclusions about the appraised group.

It may be observed that out of the 45 mathematics teachers who had no appraisal experience, 9 (20%) were professionals. Of the latter 5 (55.5%) were positive about TAG. This proportion when compared with the 19(52.8%) out of 36 non-professionals in this category , showed an apparent lack of association between professional status and perceived support among this category of respondents (i.e. non-appraised junior respondents), $\chi^2 (1, N=45) = 0.0223, P>.80$. Here too one of the cells had a frequency of less than 5.

It is perhaps worth reiterating that, at the senior secondary level, when the data were controlled for appraisal experience, *Hypothesis 7* appeared supported within both the appraised and non-appraised categories of mathematics teachers, probably indicating the difference between junior and senior mathematics teachers with regard to the relationship under discussion. Table 7.14 summarises the relationship between rank and perceived support for the two categories of mathematics teachers at the senior secondary level.

Table 7.14 Contingency tables showing the relationship between rank and perceived support, controlled for appraisal experience, for senior secondary respondents

Appraised (Pro. status)			Non-Appraised (Pro. status)		
	Pro	Non-pro		Pro	Non-pro
Pos	34	30	Pos	17	45
Neg	71	20	Neg	18	13

For the appraised group, 34 (32.3%) out of 105 professional mathematics teachers were positive about TAG, whereas 30 (60%) of the 50 non-professionals were so positive $\chi^2 (1, N=155) = 9.5493, p < .005$. The situation in the case of the non-appraised group in terms of significance was similar and the corresponding figures were 17 (48.6%) out of 35 and 45 (77.6%) out of 58 respectively, $\chi^2 (1, N=93) = 7.0150, P < .01$, with the higher percentages obtained in the non-appraised sample confirming, as in the previous cases, the observation made earlier that at the senior secondary level, non-appraised mathematics teachers were generally more positive about TAG than appraised mathematics teachers.

It may be recalled that the formulation of Hypothesis 7 (in chapter 5) was based on teachers' and appraisers' perceptions of mathematics as well as their expertise in mathematics and its teaching. It is interesting to observe that although *Hypothesis 7* was supported at the senior secondary level only, there was no apparent difference between the reasons professional teachers gave for the importance of mathematics as a school subject and those given by their non-professional counterparts or their appraisers. In fact, at both the junior secondary and the senior secondary levels, nearly all the appraisers and the teachers thought school mathematics is an important subject because of its utilitarian value. At the junior secondary level, 175(90.7%) of the 193 teachers cited the utilitarian value of mathematics as the reason that justifies the status of mathematics as compulsory subject in the school curriculum. Also at the senior secondary level, 217 (87.5%) of the 248 teachers saw mathematics as something that is "used in everyday life".

The appraisers also thought mathematics is an important subject because of its "everyday uses". At the junior secondary level, 27(93.1%) out of the 29 appraisers cited the utilitarian value of mathematics and 12 (80%) out of the 15 appraisers at the senior level also cited it. The only other reason cited by both the teachers and the appraisers is that mathematics trains the mind through mental calculations.

The implication is that, to the extent that one's perception of school mathematics reflects one's philosophy of mathematics, the present study did not find any significant differences between the mathematical philosophies of mathematics teachers and those of their appraisers. Nor were there any significant differences found between professional mathematics teachers' philosophies and those of their non-professional counterparts. The implication is that the present study did not find any relationship between mathematics teachers' perceptions of mathematics and their perceived support as the item on teachers' perception of mathematics could not discriminate between the respondents. The relationship between professional status and perceived support that

was found at the senior secondary level (in the study) was probably due to the differences between professionals and non-professionals in their levels of expertise in mathematics and its teaching.

The difference between junior secondary and senior secondary mathematics teachers with regard to the relationship being examined, may be due to the difference between the proportion of professionals at the two levels. Indeed, as in the case of gender, the tiny proportion (11.4%) of professional respondents at the junior level makes any conclusion about the relationship between professional status and perceived support at the junior secondary level appear unsafe. The tentative conclusion therefore is that whereas *Hypothesis 7* appeared supported at the senior secondary level, there was not sufficient data at the junior level to enable safe conclusions to be drawn notwithstanding any claim that the data were representative of the proportion of professional mathematics teachers in the country.

As in the case of the discussion involving gender, the situation at the junior secondary school in terms of supply of professional mathematics teachers may be of interest in further research looking at say the relationship between the supply of mathematics professionals and perceived organisational support. It is important to point out however, that only 4 of the 17 professional mathematics teachers (14 from senior level and 3 from junior level) interviewed were positive about the potential of TAG as a formative process. Specifically, two each from each level were positive. Even so, one cannot draw any firm conclusions about the relationship between professional status perceived support at the junior secondary level.

To summarise the discussion so far, the relationship *between* each of the seven independent variables and the dependent variable was investigated separately. Considered separately, six of the seven variables (i.e. all but gender) were significantly related to the dependent variable - perceived support - at the senior secondary level. At the junior secondary level, only three variables namely, appraisal experience, last appraiser and rank were so related to perceived support. Nevertheless, the intercorrelations between the independent variables make it difficult to determine whether or not the correlation between each one of them and the dependent variable was real or spurious. Therefore the second part of the chapter looks at the relationships between the independent variables and also *between* different combinations of them *and* the dependent variable, using multivariate procedures.

FURTHER ANALYSIS

Readers may have noticed that in the chi-square analyses presented above, no more than two of the independent variables were used at a time. This means that the chi-square analyses provided no means of examining the combined 'effect' of the independent variables on the dependent variable. It also means that they provided no means of disentangling the web of correlations that appeared to exist between the independent variables in order to find the effect each of them had on the dependent variable 'on its own'. It therefore seemed necessary to re-examine the variables discussed above using procedures that would take into account not only the relationships between the various independent variables, but also those between a combination of the latter and the dependent variable. Thus, in an attempt to throw more light on the relationships between the main (dependent and independent) variables discussed above, as well as find out how the independent variables affect the dependent variable directly or indirectly, multiple regression as well as linear discriminant function analyses were done.

It may be recalled that, for the purpose of clear interpretation of the results of the present study, the multinomial scales of the measures of some of the independent variables were collapsed into two categories. As far as the seven main independent variables are concerned, the variables so collapsed were *last appraiser*, *mathematics teaching experience* and *rank*. These variables were still dichotomised in the further analysis for the reasons given (in chapter 5) in the formulation of the hypotheses involving them. Admittedly, by dichotomising an independent variable that can take on a range of values, there is the chance of losing considerable variance, which could mean lowered correlations with the dependent variable. Yet, as mentioned at the beginning of this chapter, it is considered safer for the purpose of the present study to fail to establish a relationship that exists, than to claim a relationship that does not exist.

In view of the above, the three variables mentioned above were dichotomised along with the other independent variables. The independent variables were coded using the so-called dummy variables in which 1's and 0's were assigned to the responses depending on whether the respondents (who gave those responses) 'possessed' or 'did not possess' a characteristic the variable sought to measure. For example, those who had been appraised were assigned 1, and those who had not been appraised were assigned 0. Similarly, those who were last appraised by Ghana Education Service officials (GESOs) were assigned 1, and those who were either appraised last by other persons or who had not been appraised at all, were assigned 0. The other codes were:

1 for those who had had training as appraisees, 0 for those who had not; 1 for those who had taught mathematics for more than five years, 0 for those who had not; 1 for teachers above the rank of superintendent, 0 for those not above that rank; 1 for males, 0 for females (not in anyway suggesting that mathematics teaching is a male activity!); and finally, 1 for professional mathematics teachers, 0 for non-professionals.

It is worth pointing out here that as one of the objectives of using multiple regression analyses is to explain the variance of the *dependent variable*, the latter was not partitioned as before, but was instead used as a continuous variable taking on the full range of values - 0 to 3 - in all the regression equations.

7.13 Relationships Between the Variables of the Study

It may be recalled that certain causal inferences were made in chapter five regarding the relationships between some of the independent variables. Specifically, it was proposed that rank is affected by appraisal experience, appraisal training, mathematics teaching experience and professional status. The above variables as well as the other three variables namely, appraisal experience, respondent's last appraiser and gender were also proposed to be related to perceived support. It was also proposed that professional status affects mathematics teaching experience. Additionally, appraisal experience is proposed to correlate with appraisal training, last appraiser and professional status whereas mathematics teaching experience is proposed to correlate with gender since most of the 'experienced' mathematics teachers in Ghanaian secondary schools were found to be male in the pilot study. It is important to point out that as perceived support was taken as the dependent variable (as explained in chapters 2 and 4), it was proposed that perceived support would be affected by all the independent variables either directly or indirectly in various ways. Figure 7.1 (below) shows the theoretical model being tested.

As shown in the figure (and by way of summary), the model proposed that rank(X5) affects perceived support (PS) and is affected by appraisal experience(X1), appraisal training(X3), mathematics teaching experience(X4) and professional status(X7). The above variables were also proposed to affect perceived support (PS) both directly and indirectly through rank; and the variables last appraiser(X2) and gender(X6) were also hypothesised to affect perceived support directly. It was also proposed that professional status (X7) affects mathematics teaching experience (X4). These causal inferences as well as the hypothesised correlations are tested in the analyses done in this section. Not only that, the causal inferences would also influence the way the

variables would be used in all the analyses.

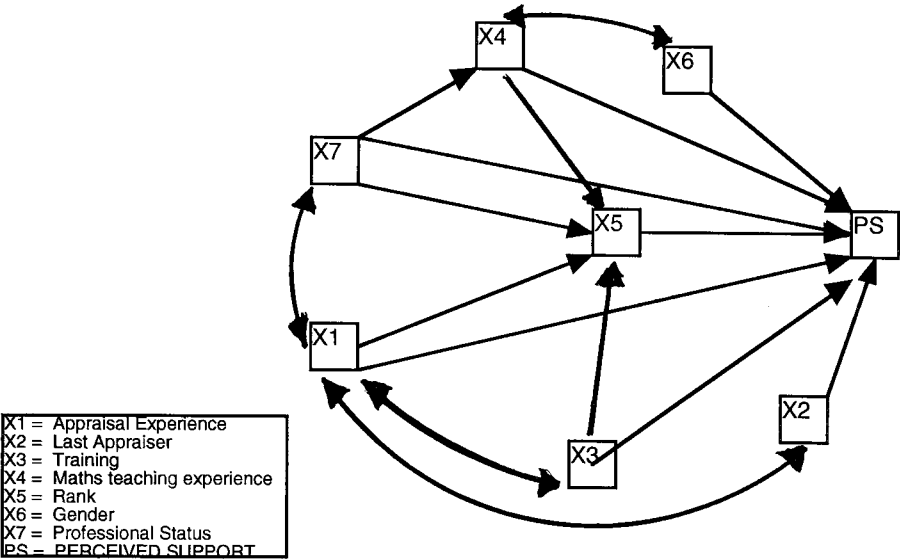


Figure 7.1: Causal model showing proposed relationships between the variables used in the study

It must be emphasised that the above model was used to investigate the proposed causal relationships and not to ‘prove’ their existence. As Wright observes:

... the method of path coefficients is not intended to accomplish the impossible task of deducing causal relations from the values of the correlated co-efficients. It is intended to combine the quantitative information given by the correlations with such qualitative information as may be at hand on causal relations to give a quantitative interpretation. (Wright, 1934, quoted in Kerlinger & Pedhazur, 1973, p.305).

Table 7.15 (below) gives the means and standard deviations of the seven main independent variables as well as the dependent variable. In addition to the descriptive statistics reported in Table 7.15, the correlations between the variables were also computed. Tables 7.16 and 7.17 (below) give the intercorrelations between the independent variables and between the latter and the dependent variable at the junior and senior secondary levels *and* for the combined data respectively

Table 7.15 Summary statistics for the main variables used in the study

Variable		Junior Secondary (n=193)		Senior Secondary (248)		Combined Data (441)	
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Appraisal experience	(X ₁)	.77	.42	.63	.48	.69	.47
Last appraiser	(X ₂)	.69	.46	.44	.50	.55	.50
Training as appraisee	(X ₃)	.45	.50	.31	.46	.37	.48
Maths teaching expe.	(X ₄)	.35	.48	.60	.49	.49	.50
Rank	(X ₅)	.12	.33	.58	.50	.38	.49
Gender	(X ₆)	.88	.33	.90	.30	.89	.31
Professional status	(X ₇)	.11	.31	.57	.50	.37	.48
Perceived support	(X ₈)	2.00	1.00	1.54	1.11	1.74	1.09

Table 7.16 Intercorrelations between the main variables used in the study for junior and senior secondary levels

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	<u>X₈</u>
Appraisal experience (X ₁)	-	.69*	.38*	.48*	.36*	.08	.29*	<u>-.30*</u>
Last appraiser (X ₂)	.82*	-	.31*	.40*	.30*	.01	.33*	<u>-.24*</u>
Training as appraisee (X ₃)	.40*	.38*	-	.43*	.40*	.10	.38*	<u>-.26*</u>
Maths teaching exp.. (X ₄)	.38*	.38*	.44*	-	.71*	.15*	.47*	<u>-.42*</u>
Rank (X ₅)	.17*	.22*	.29*	.45*	-	.13*	.48*	<u>-.48*</u>
Gender (X ₆)	-.06	-.08	.09	.08	.04	-	.15*	<u>-.09</u>
Professional status (X ₇)	-.15*	-.15*	-.03	-.03	.01	.08	-	<u>-.55*</u>
<u>Perceived support (X₈)</u>	<u>.26*</u>	<u>.26*</u>	<u>.16*</u>	<u>.06</u>	<u>.20*</u>	<u>.06</u>	<u>.03</u>	-

Note: senior secondary correlation above diagonal; junior secondary correlations below diagonal

*significant

main dependent variable and correlations with the other variables underlined

Table 7.17 Intercorrelations between the main variables used in the study for the combined data

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	<u>X₈</u>
Appraisal experience (X ₁)	-	.						
Last appraiser (X ₂)	.75*	-						
Training as appraisee (X ₃)	.40*	.36*	-					
Maths teaching exp.. (X ₄)	.39*	.30*	.38*	-				
Rank (X ₅)	.19*	.12*	.24*	.64*	-			
Gender (X ₆)	.02	-.04	.09	.12	.10*	-		
Professional status (X ₇)	.07	.04	.13*	.37*	.50*	.13	-	
<u>Perceived support (X₈)</u>	<u>-.05</u>	<u>.01</u>	<u>.05</u>	<u>-.27*</u>	<u>-.31*</u>	<u>-.04</u>	<u>-.41*</u>	-

*significant

main dependent variable and correlations with the other variables underlined

As shown in Table 7.16 there were a number of highly significant intercorrelations between the independent variables, particularly at the senior secondary level. Of particular importance at that level were the high correlations between professional status and the other independent variables. Another variable which correlated significantly

with the other independent variables at both junior and senior secondary levels was last appraisal experience. Indeed, previous researchers have found significant relationships between most recent performance appraisal ratings and employee reactions to various appraisal related dimensions (see Russell and Goode, 1988, for example). Finally, gender did not correlate significantly with the dependent variable at either level, an observation which confirms the chi-square analyses involving gender reported in the last section.

To investigate the relationships between the seven main independent variables of the study (with variates X_1, X_2, \dots, X_7) and the dependent variable, both within and between the two groups of teachers, three multiple regression analyses were done - one at each level and one involving all the 441 teachers who took part in the study. In order to find out how much of the variance of the dependent variable is “explained” by the combined effect of all the seven main independent variables, the latter were entered in a regression equation in the order they were listed in the correlation tables above (i.e. starting with appraisal experience and ending with professional status). The table below gives the variance (R^2) explained at each level together with their F-statistic as well as the level of significance of the variance accounted for.

Table 7.18 **Total variance of the dependent variable “explained” by the seven independent variables**

Level	Total R^2	F-ratio	Significance
Junior secondary	.1239	3.7380	$p < 0.001$
senior secondary	.3719	20.2960	$p < 0.001$
Combined data	.1996	15.4234	$p < 0.001$

At the junior secondary level, the multiple correlation coefficient (R) was .3520 and its square (R^2) was .1239. The F ratio was 3.7380, which at 7 and 185 degrees of freedom is highly significant. Approximately 12 per cent of the variance of perceived support was accounted for by the seven variables, a figure perhaps too small for comfort (albeit significant), but which nevertheless, reflects the high intercorrelations between the seven variables. Moreover, these variables were mainly categorical variables which means that their values did not vary over a substantial range.

At the senior secondary level, the seven variables combined explained 37.2 per cent of the variance of the dependent variable - a much bigger proportion than was obtained at the junior secondary level, but perhaps also too small for a researcher’s liking although it also reflects the nature of the variables and the high intercorrelations between them. Here too, the proportion of variance accounted for was very significant, $F(7, 240) = 20.2960, p < 0.001$. Finally, when the data at both levels were combined, an R^2 of

20.0 percent was obtained which was also very significant, $F(7,433) = 15.4234$, $p<0.001$. After these initial analyses, an attempt was made to examine the individual independent variables in terms of their relationship with the dependent variable, this time controlling for *all* the six other variables.

The analyses were, as in the case of finding the total variance explained by the independent variables of interest, done for each level as well as for the combined data. In each case, in an attempt was made to find out which of the independent variables were more related to the dependent variable than others. The incremental variance (ΔR^2) of each of the independent variables was calculated, by entering each variable last in a regression equation involving all the seven variables. In other words, the ‘magnitude’ of the effect of each of the seven variables was determined by using the other six as control variables. Table 7.19 shows the ΔR^2 for the variables and their beta weights at each level as well as for the combined data.

Table 7.19 Incremental variance for each of the seven independent variables

Variable	Junior Secondary	Senior Secondary		Combined Data	
		Beta	ΔR^2	Beta	ΔR^2
Appraisal experience (X ₁)		.13	.01	.14	.01
Last appraiser (X ₂)		.17*	.02*	.08	.00
Training as appraisee (X ₃)		.04	.00	.03	.00
Maths teaching expe. (X ₄)		-.17	.02	-.06	.00
Rank (X ₅)		.20*	.03*	-.20*	.02*
Gender (X ₆)		.08	.00	.03	.00
Professional status (X ₇)		.07	.00	-.42*	.12*
significant				-.34	.09*

The above table shows that at the junior secondary level, only two of the variables namely, *last appraiser* (X₂) and *rank* (X₅) added significantly to the regression when each was added last to the regression equation. At the senior secondary level too, two variables - *rank* (X₅) and *professional status* (X₇) - added to the regression in a similar manner. When the data were combined, again two variables added significantly to the regression. These were *rank* and *professional status*. The above results clearly reflect the high intercorrelations between the main variables of the study. They thus probably indicate that the above variables (which added significantly to the regression at the various levels in the manner described above) could act as proxies for the other variables. As mentioned in the discussion of *Hypothesis 1*, the variable *last appraiser* could act as a proxy for *appraisal experience* at the junior secondary level. Indeed, in the interviews the teachers gave, it appeared particularly at the junior secondary level that the teachers’ perceptions about the benefits of appraisal were influenced by who appraised them most of the time. Although the junior secondary teachers were generally positive(with a few exceptions) about the appraisal system and its potential to

help them to improve their work, all the 8 who were appraised last by Ghana Education Service officials were positive about TAG. On the other hand, over half of the senior secondary mathematics teachers who had been appraised last by their head or head of department were positive about the potential of the appraisal system, whereas all the 3 “seniors” who had just attended the promotion interviews were negative.

The next stage in the multi-variate analysis was to determine the path co-efficients for the model in Figure 7.1. In order to obtain path co-efficients for the causal model two regression analyses were done. First, *rank* was regressed on the four variables proposed to affect it; and then, *mathematics teaching experience* was regressed on professional status. The path co-efficients were obtained by simply standardising the regression co-efficients (see Kerlinger & Pedhazur, 1973.).

7.13.1 Rank as a Dependent Variable

In line with the model presented above, rank was regressed on the four variables namely, *appraisal experience*, *training*, *mathematics teaching experience* and *professional status*. The variables were entered in the following following order: X_1 - X_3 - X_7 - X_4 . Using the above order and the stepwise method, the regression equation at the junior secondary level was:

$$Y' = .01 + .00X_1 + .11X_3 + .44X_4 + .02X_7.$$

Only the coefficient of X_4 was statistically significant, suggesting that only the proposed effects of *mathematics teaching experience* on rank was confirmed at the junior secondary level. Considering that rank was very significantly related to perceived support at the junior secondary level, the above equation could suggest that mathematics teaching experience may have had indirect effect on perceived support through rank at the junior secondary level.

The regression equation at the senior secondary level was:

$$Y' = .09 + .01X_1 + .07X_3 + .62X_4 + .19X_7$$

Here, the coefficients of X_4 , X_7 and the intercept were all significant at the 1% level. Thus, unlike the junior secondary level, two of the proposed causal links between the four independent variables and rank were supported by the data. Specifically, both *mathematics teaching experience* and *professional status* had significant effect on rank. The interpretation could be that at the senior secondary level, professional status had both direct and indirect (via rank) effects on perceived support. Also any effect of mathematics teaching experience on perceived support might be of an indirect nature rather than of a direct one. In other words, mathematics teaching experience may have affected perceived support through rank at the senior level too.

In any case, the above data confirmed the difference between junior and senior secondary levels in terms of the effect of professional status on rank. Thus at the junior secondary level, most mathematics teachers are non-professional mathematics teachers (as defined in the present study) but professionals in other subject who are teaching the subject as a result of the shortage of mathematics teachers. These teachers can still be promoted provided they serve the required number of years in the GES and satisfy the other requirements for promotion such as passing the promotion interview. Hence, at the junior secondary level, teachers above the rank of superintendent might have taught mathematics for more than five years even if they were not professional mathematics teachers. On the other hand, senior secondary mathematics teachers above the rank of superintendent may not only have taught mathematics for over five years, they may have been professional mathematics teachers as well.

Still using rank as a dependent variable, when the data were put together, the full regression equation was:

$$Y' = .02 - .03X_1 + .00X_3 + .52X_4 + .30X_7$$

Here, only the coefficients of X_4 , X_7 were statistically significant. The interpretation is similar to the one made at the senior secondary level. Any effect of mathematics teaching experience on perceived support appeared to be an indirect one through rank. Also, in addition to the apparently strong direct effect of professional status on perceived support, the former may also have had an indirect effect on perceived support through rank. The results also indicate that professional status is a strong determinant of rank. In other words, it confirms that most (senior) secondary mathematics teachers above the rank of superintendent are professional mathematics teachers. Indeed, there was a strong correlation between rank and professional support ($r = .50$), when the data were combined.

7.13.2 Mathematics Teaching Experience as a Dependent Variable

The second regression analysis involved mathematics teaching experience and professional status. In other words, it was hypothesised that one's professional status would determine one's mathematics teaching experience. The (three) regression equations for the junior secondary, senior secondary and the combined data were respectively: $Y' = .00X_7$; $Y' = .33 + .47X_7$; and $Y' = .35 + .37X_7$.

As may be expected, the coefficient of X_7 was not significant at the junior secondary level. It was significant at both the senior secondary level and for the combined data. Thus, the above equations indicate that there was no direct effect of professional status

on mathematics teaching experience at the junior secondary school. This confirms the observation made earlier that at the junior secondary level, the majority of the mathematics teachers were not mathematics specialists but might have taught the subject for long periods as a result of the acute shortage of professional mathematics teachers in Ghana.

At the senior secondary level, the situation was different in the sense that most of the non-professional mathematics teachers are hired on temporary basis and this means that those who have taught the subject for longer periods are either professional mathematics teachers or other qualified teachers whose specialist area is not mathematics, albeit the latter category of teachers are mostly found in junior secondary schools. As may be expected, when the data were combined, mathematics teaching experience appeared to be affected by professional status. Thus taking all secondary mathematics teachers in Ghana as a group, *professional status* may be said to affect *perceived support* both directly and indirectly through *mathematics teaching experience* and *rank*.

As a result of the above findings, the original model used to investigate the relationships between the variables was modified and the “new” causal relationships were tested. All the coefficients of the variables in the modified models were statistically significant. Figures (7.2, 7.3 and 7.4) below show the modified causal models (with path coefficients).

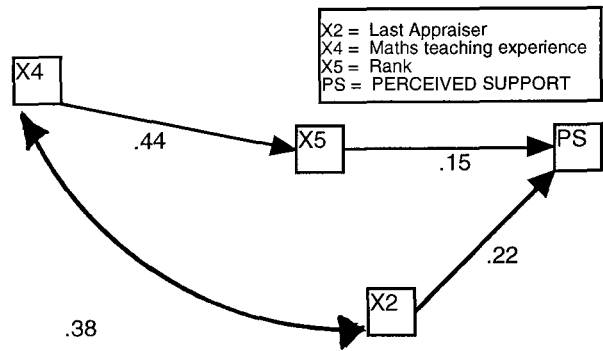


Figure 7.2: Causal model showing relationships between the variables used in the study at the junior level.

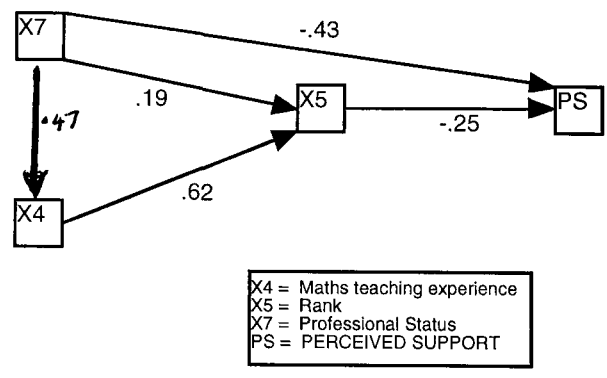


Figure 7.3: Causal model showing relationships between the variables used in the study at the senior level.

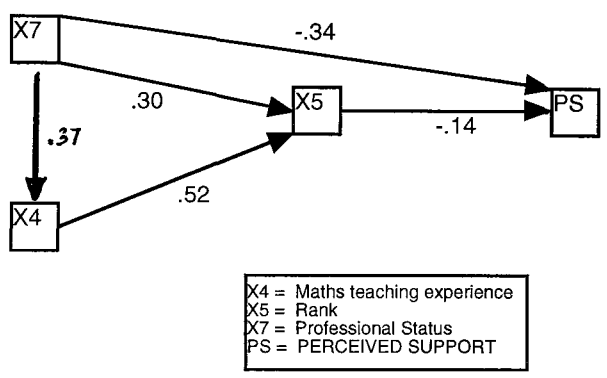


Figure 7.4: Causal model showing relationships between the variables used in the study for the combined data

It is interesting to note that the path co-efficients in all the diagrams (above) appear to endorse the strengths of the variables which contributed significantly to the regression involving *perceived support* when added last to the regression equation (see table 7.26). As mentioned above, these variables could act as proxies for the other variables (which did not contribute much to the regression) in the sense that the removal of the latter from the regression equation would not reduce the total variance explained substantially. The analysis in this part so far confirms that the difference between junior secondary respondents and their senior level counterparts with regard to their perceptions of TAG as a formative process may be explained in terms of their level of expertise in mathematics and its teaching. The next section attempts to classify the respondents into two groups : those teachers who saw in a positive light and those who saw it in a negative light.t

7.14 Discriminant Analysis

One other way of asking the same question which was investigated in the last section is : which of the variables used in the study could discriminate between mathematics teachers who were positive about TAG and those who were negative about TAG? This is the the question of classification which involves the use of discriminant function analysis - a multivariate technique for studying the extent to which different populations overlap one another or diverge from one another (Fisher, 1936).

The linear discriminant function analysis is like the multiple regression analysis in many ways. Each of them is a linear function (of individual variables) that gives the smallest probability of misclassification of individuals in different populations. With only two populations involved, as in the case of the present study, discriminant function analysis amounts to multiple regression analysis with the dependent variable taking only two values. In other words, if the main dependent variable of the present study is dichotomised into positive and negative values (as was done in the case of the chi-square analyses) the procedures used in the multiple regression analyses above, would apply in the case of discriminant analyses being considered here. Put differently, the analyses being considered here are just an ‘extension’ of the multiple regression analyses discussed above.

In that sense, the only thing left to do now is to find out how the variables combine to classify correctly or otherwise, the respondents in the present study into two group of mathematics teachers - those with positive perceptions of the potential of TAG and who may be able to improve their teaching of mathematics with the help of TAG; and those with negative perceptions of TAG and who as a result may not consider relying on the system to help them to improve their teaching of mathematics.

To begin with, each of the variables was examined to see how best it can, on its own, discriminate between the above groups of teachers on the basis of their scores on the dependent variable. Put differently, the discriminant power of each variable was calculated for each of the three sets of data (i.e. junior secondary, senior secondary, and the combined sets). The discriminant power of each variable was arrived at by finding the percentage of “grouped” cases correctly classified by the variable on its own, using the “stepwise” procedure on the SPSS discriminant analysis programme. The table below gives the discriminant power of each of the variables of interest.

Table 7.20 Discriminant power of the main independent variables

Variable		Junior Secondary % classified correctly	Senior Secondary % classified correctly	Combined Data % classified correctly
Appraisal experience	(X ₁)	70.98	61.69	-
Last appraiser	(X ₂)	70.98	58.06	-
Training as appraisee	(X ₃)	70.98	57.66	-
Maths teaching expe.	(X ₄)	-	62.90	59.64
Rank	(X ₅)	70.98	67.35	64.40
Gender	(X ₆)	-	-	-
Professional status	(X ₇)	-	66.13	66.44
Level(Junior/senior)				59.64

The above table shows that, at the junior secondary level, each of four of the seven main independent variables could, on its on, correctly classify 71 percent of the respondents into two groups - positive and negative - in terms of their actual ‘scores’ on the dependent variable. Specifically, each of the four variables predicted that all the 193 respondents at the junior secondary level would be positive about the potential of TAG to help them to improve their teaching of mathematics albeit, in actual fact, 57 respondents were negative. This means that all these 57 respondents were misclassified by each of the four variables ‘on its own’. None of the remaining three variables namely, *mathematics teaching experience*, *gender* and *professional status* could, on its own, classify any of the respondents. In other words, they were too weakly related to the dependent variable to classify any of the respondents - an observation which appears to confirm the results reported in the last section.

At the senior secondary level, and in much the same way, each of the six variables that correlated significantly with the dependent variable at that level (when chi-square values were used) could, on its own, assign respondents to the two groups with some degree of success. On the face of it, *rank* was the best single variable, classifying correctly 67 percent of the respondents on its own, while *training*, was relatively poor by itself. As expected, *gender* on its own did not qualify for analysis at this level too. For the combined data, the variables, *mathematics teaching experience*, *rank*, *professional status* and *level* (only used for the combined data) were the only ones that qualified for analysis, with *professional status* emerging as the best single variable for correctly classifying 66 percent of all the 441 respondents.

After these initial analyses, all the seven independent variables were used in the discriminant analysis, again using the stepwise variable selection method. At each level, the hierarchy for entering the variables in the stepwise analysis was the one established above under the multiple regression analyses. The following table shows the variable(s) which qualified for analysis at the various stages (of the stepwise

procedure) at the ‘three’ levels, as well as the percentage of “grouped” cases correctly classified.

Table 7.21 Percentage of grouped cases correctly classified

	Junior Secondary	Senior Secondary	Combined
Number in negative group (0)	56	122	176
Number in positive group (1)	137	126	262
Variables included in analysis	X ₂ , X ₅	X ₅ , X ₇	X ₅ , X ₇
Group 0 correctly classified	<u>5</u>	<u>75</u>	<u>75</u>
Group 1 correctly classified	<u>134</u>	<u>91</u>	<u>225</u>
Total correctly classified	72.2%	67%	68%

The above table shows that at the junior secondary level, X₂ and X₅ (i.e. last appraisal source and rank) qualified for analysis, again confirming the ‘importance’ of respondents’ last appraisal experience at that level, as far as the present study is concerned. This shows that X₂ and X₅ acted as proxies for the other variables at the junior secondary level.

At the senior secondary level, X₅ and X₇ (i.e. rank and professional status respectively) were the two variables which qualified for inclusion in the analysis and which, between them, classified correctly and significantly, 67 percent of the respondents into the above groups. It may be recalled that X₅ by itself correctly classified the same percentage, suggesting (erroneously?) that it is the main discriminating variable at senior secondary level. This result probably highlights the high correlations between rank and the other six variables, particularly between rank and professional status.

When the data were combined, *professional status* and *rank* qualified for inclusion in the analysis. The two variables correctly classified 68 percent of the grouped cases - just about 1.5 percent more than the proportion professional status classified correctly by itself, suggesting once again that professional status is one of the most important determinants of Ghanaian secondary mathematics teachers’ perception of the potential of the appraisal system.

7.15 Conclusion

It can be said in conclusion that, all the analyses done in this chapter suggest that the discrimination between senior secondary mathematics teachers who are positive about

the validity of the formative aspect of teacher appraisal in Ghana (TAG) and those who are negative is almost exclusively due to their *professional status* and *rank*. Stated differently, knowledge of a senior secondary mathematics teacher's professional status and rank appears to be enough to enable one to predict correctly, the teacher's perception of the validity of the appraisal system in the GES 67 percent of the time. Thus, on the basis of the above analysis, the probability that a professional senior secondary mathematics teacher above the rank of superintendent (in any of the sampled regions in Ghana) would be negative about the potential of the appraisal system to help them improve their work is about 70 percent.

At the junior secondary level, rank appears to be the most important determinant of mathematics teachers' perception of the potential of TAG to help them to improve their teaching of mathematics. At this level, the probability that a mathematics teacher above the rank of superintendent will be positive about the potential of TAG is also about 70 percent. Whether or not this percentage is enough to warrant any action from the appropriate authorities would depend on a number of factors, including which aspect(s) of the appraisal process influences mathematics teachers' perceptions about TAG most. This finding thus provides an opportunity for further research looking at say the magnitude of the effect of the various aspects of teacher appraisal systems on teacher's attitude to those systems.

As far as the present system is concerned, to the extent that perceived impact of teacher appraisal affects the latter's perceived validity, senior secondary mathematics teachers' perceived validity of TAG as a formative process was very low. On the other hand, junior secondary mathematics teachers' perceived validity of TAG as a formative process was found to be relatively high. As pointed out above, the difference between the two groups in their perceived validity of the formative aspect of TAG is almost entirely due to the differences in their level of expertise in mathematics and its teaching.

The next chapter will attempt to examine the validity of each of the two main aspects of TAG (i.e. professional development and promotion) in order to see if any light can be shed on which aspect of the appraisal system could influences secondary mathematics teachers most.

CHAPTER EIGHT

THE VALIDITY OF TEACHER APPRAISAL IN GHANA

8.1 Introduction

In the last chapter, I examined mathematics teachers' perceptions of teacher appraisal in Ghana (TAG) by testing the hypotheses formulated in chapter 5. Specifically, I examined different groups of teachers' perceived validity of TAG as a formative system designed to help them improve their teaching of mathematics. This was done to highlight the fact that this study is mostly concerned with teacher appraisal as a formative process. The tentative conclusion drawn was that professional mathematics teachers were less positive about the potential of TAG to help them improve their teaching of mathematics than non-professional mathematics teachers. As most of the professionals were found at the senior secondary level, the above finding means that whereas junior secondary mathematics teachers' perceived validity of TAG as a formative process appeared to be high, that of their senior secondary counterparts was relatively low.

In this chapter, I will examine the relationship between teachers' perceptions of teacher appraisal (both as a formative process and as a summative process) and those of appraisers in an attempt to throw some light on how similarities and differences between these perceptions can affect the potential of TAG to help mathematics teachers improve their practice. I will also examine what actually goes on in Ghana by way of appraisal for both formative and summative purposes. This will be done to find out how the appraisal system in Ghana 'fits' the theoretical "model" discussed in chapter 4. Put differently, an attempt will be made in this chapter to examine separately the validity of TAG as a formative process and its validity as a summative process, taking into account the views of both teachers and appraisers about TAG and how teacher appraisal is done in Ghana.

The chapter is organised into TWO parts as follows: in part A, I will examine the validity of TAG as a formative process and in part B, I will examine TAG's validity as a summative process. In the next and final chapter, I will draw on all the evidence gathered so far on teacher appraisal in Ghana in an attempt to draw conclusions about the validity of the whole process of teacher appraisal in Ghana. I will then make

recommendations as to how the system can be improved to help mathematics teachers improve their teaching of mathematics in Ghanaian secondary schools.

A THE VALIDITY OF TAG AS A FORMATIVE PROCESS

As mentioned a number of times in this thesis, formative appraisal is the aspect of teacher appraisal which is of most interest to me and which the present study consequently concentrates on. This section attempts to provide evidence with which the validity of TAG as a formative process may be examined. Evidence presented in this part consists mainly of what goes on in Ghana by way of helping mathematics teachers to improve their teaching of mathematics and what both mathematics teachers and appraisers say about the formative aspect of TAG. For the purpose of structuring this part, the latter will be divided into two sections. The first section will look at what valid appraisal for formative purposes might include. It will thus summarise the validity criteria for formative appraisal discussed in chapters 3 and 4. The second section will discuss what the criteria established in the first section could mean in practice for the GES. It will then examine how formative appraisal is done in the GES and discuss some of the factors that can affect the validity of TAG as a formative process.

8.2 Criteria for Evaluating the Validity of Formative Appraisal

Regarding what factors might be used to judge the validity of formative appraisal, chapter 4 looked at a number of criteria that may be considered for the purpose of identifying the professional needs of teachers in order to help them improve their practice. These criteria, which highlight the view that the appraisal process should help teachers to improve their practice rather than make judgements on such practice, are summarised here. As far as the appraisal of mathematics teaching is concerned, it was argued first that in order to identify the teacher's professional needs and help them to improve their practice, the appraiser should know both mathematics and its teaching, and must be well trained in the appraisal of mathematics teaching. Here the appraiser could be a peer as in peer-appraisal (discussed in chapter 3) or any other person, notably the teacher's superior. The second criterion was that the criteria employed in the appraisal ought to be related to the construct (i.e. mathematics teaching effectiveness) being measured. The third criterion was that formative appraisal must be conducted in an atmosphere that will encourage the appraisee to reveal her or his professional needs. Finally, the fourth criterion was that feedback on observed

lessons ought to be a vital part of formative appraisals.

The next section examines the relevance of the above criteria to the present study and the extent to which they are likely to be met in the formative appraisal of mathematics teachers in Ghanaian secondary schools.

8.3 Relevance of the Validity Criteria to the Present Study

8.3.1 Appraiser's knowledge of mathematics, its teaching and its appraisal

With regard to the first criterion (i.e. the appraiser's knowledge of mathematics, its teaching and its appraisal), it is important to emphasise that this criterion was chosen because the appraiser's knowledge of mathematics, its teaching and its appraisal could help influence her or his ability to identify clearly the professional needs of the teacher. Indeed, the identification of the teacher's professional needs constitutes an important step towards helping the teacher to improve her or his teaching of mathematics. However, if the objective of the appraisal system is to help mathematics teachers to improve their teaching of the subject, then appraisers may be required, in addition to identifying the teacher's needs, to 'help' the teacher in order to achieve that objective. Considering that in Ghana, education officers are charged with the responsibility of the professional development of teachers (Gokah, 1993, Ministry of Education, 1994), the validity of teacher appraisal as a system designed to help teachers develop professionally may be judged in terms of the ability of supervisors and inspectors to provide '*effective assistance*' to teachers. Here, effective assistance is being emphasised as a key function of formative appraisal considering the lack of alternative means of providing opportunities for teachers to develop professionally in Ghana. In a country where public libraries are found in only the regional capitals and a few other towns, circuit officers may be the only people that many teachers can rely on for professional development. But the question is, are appraisers of mathematics teachers in the position to offer this assistance? What is the quality of the assistance appraisers can offer?

The notion of "zone of proximal development" (ZPD) (Vygotsky, 1978, 1986) emphasises the opportunities of carefully structured dyadic interaction whereby an 'expert' attempts to enhance a learner's development by providing support for action beyond the latter's current capability. Vygotsky recognises a 'distance' *between* the level of potential development one can reach with the help of a more capable peer or an 'expert' *and* the level one can attain through one's own effort. It must be mentioned

that Vygotsky's view of human learning, and the developmental experience of being and acting in cultural context, challenges the traditional view of mathematics as value free, objective and divorced from everyday personal concerns. However this does not suggest that one can help others to engage in mathematical activity without necessarily being an expert in mathematics or its teaching. The ZPD concept rather suggests that those who help others develop in *mathematics* ought to be more capable in mathematics and its teaching than those they help.

As Ball (1988) points out, "knowledge of mathematics is obviously fundamental to being able to help someone else learn it" (p.12). One must however mention that research in the 70s (e.g. Eisenberg, 1977; Begle, 1979) provided little support for a direct relationship between teachers' knowledge of mathematics and student learning. Nevertheless, it is equally important to mention that the inadequate measures of knowledge and relatively limited research methodology used in those early studies may have concealed any relationship that existed between teachers' knowledge of mathematics and their students' learning of the subject. As Fennema and Franke (1992) point out, no attempt was made in most of the early studies to measure the relationship between the formal mathematics that teachers knew and what they taught. Studies within the last decade or so (e.g. Carpenter et al, 1989; Fennema et. al. 1989) which have measured teachers' subject matter knowledge through their teaching have underlined the importance of the teacher's knowledge of mathematics.

As mentioned in the previous chapters, knowledge of mathematics refers not only to emphasis on cognitive processes and understanding of facts, concepts and principles and ways in which they are connected and organised, but also to epistemological knowledge about the nature of mathematics (Ball, 1988, 1991; Even, 1993). Such knowledge as well as knowledge of the "ways of formulating and presenting (mathematics) that makes it comprehensible to others" (Shulman, 1986, p.9) may require a number of courses in mathematics and its teaching. This could, in effect, mean that one should be a specialist in the subject at the appropriate level before one can clearly identify mathematics teachers' professional needs and help them to meet those needs. The question to ask here is: what did the present study reveal with regard to the appraisers' expertise in mathematics teaching and its appraisal?

It was mentioned in chapter 6 that 44 Ghana Education Service Officials (GESOs) who appraise mathematics teachers at either the junior or senior secondary level - and who are referred to in this thesis as "appraisers" - took part in the study. Of these, 29 were circuit officers who appraise mainly junior secondary mathematics teachers as well as teachers of other subjects. The remaining 15 appraisers were responsible for

appraising teachers at the senior secondary level. Although at the latter level, emphasis is placed on subject specialism and that where possible, GESOs are supposed to appraise teachers who teach the former's specialist subjects, most of the officials who had appraised mathematics teachers were not mathematics specialists. The table below shows the subject specialist areas of the appraisers who participated in the study (*Appraiser questionnaire - AQ, item 3*).

Table 8.1 Subject specialist areas of appraisers.

Subject	Junior secondary (Frequency)	Senior secondary (Frequency)	Total
Arts (Languages, Humanities)	7	2	9(20.5%)
Business Studies/Accounting	4	0	4(9.1%)
Education	10	1	11(25%)
General	2	2	4(9.1%)
Mathematics	3	5	8(18.2%)
Physical Education	0	1	1(2.0%)
Science	3	4	7(16.0%)
Total			44(100.0%)

The above table shows that only 8(18.8%) of the appraisers sampled were mathematics specialists. Even at the senior secondary level where, as mentioned above, emphasis was laid on subject content knowledge of the appraisers (Gokah, 1993), only 5 (33.3%) of those who had appraised mathematics teachers were mathematics specialists. What is more, appraisers' response to the item " *Have you ever been trained in the appraisal of mathematics teaching?*" (*AQ, item 9*) showed that not all the non-mathematics specialists had been trained in the appraisal of mathematics teaching. As many as 15 (41.6%) of the 36 non-specialists had not been trained. Even of the 21 non-specialists who had received training of some sort, 7 did not think the level of training they had received was enough to equip them to supervise mathematics teachers with confidence, although they thought they could handle supervision in many other subject areas with confidence (*AQ, item 9a*).

Of the ten appraisers interviewed, only four had been trained in the appraisal of mathematics teaching. Even so, the interviews revealed that in all cases, the training took one form: observation of mathematics lessons followed by discussion of how each officer "rated" the lesson. There was only one of the appraisers interviewed who had been trained more than four times. The others had been trained once or twice. The six interviewees who had not been trained explained that although they had no specific training in the appraisal of mathematics teaching, they used their experience in other subjects to appraise mathematics teachers. They however admitted that appraising secondary mathematics teachers was different because of the nature of mathematics. One of them said:

I must admit that secondary mathematics is different from primary maths so I think my experience is somehow limited, especially when it comes to supervising a teacher who knows more mathematics than me. I don't have the confidence to supervise this teacher.

In fact, 7(70%) out of the 10 appraisers interviewed stressed the importance of the mastery of mathematics 'content' as a prerequisite for good supervision in mathematics teaching. On the whole, only half of the appraisers sampled thought they were somehow equipped for the task of helping mathematics teachers to improve their work, assuming the training programmes laid emphasis on that role. This view was shared by the mathematics teachers sampled in the study. The teachers also held the view that the GES officials who appraise their work were not always well versed in the teaching of mathematics or well trained in its appraisal.

To find out what teachers actually thought of their appraisers regarding the variable under discussion, item 5 of MATAQ (i.e. the teacher questionnaire) was used to collect their views about the mathematics teaching expertise of their appraisers. The items in the table below were given in response to the item : *“Ghana Education Service Officials (GESOs) who appraise me/other maths teachers are well versed in the teaching of mathematics”*.

Table 8.2 Teachers' opinion of the mathematics teaching expertise of appraisers

Response	Value	Junior secondary (Frequency)	Senior secondary (Frequency)
Never	1	11 (5.7%)	31(12.5%)
Seldom	2	87(45.1%)	97(39.1%)
Often	3	68(35.2%)	96(38.7%)
Always	4	27 (14.0 %)	24(9.7%)
Total		193(100.0 %)	248 (100.0 %)
Mean		2.58	2.46
Standard deviation		0.80	0.83

The above table shows that the two groups of teachers involved in the study did not differ much in the proportions who chose the various response categories. For example, if responses “never” and “seldom” are taken as negative, and “often” and “always” are taken as positive, then 98(50.7%) out of the junior secondary teachers and 128(51.6%) of their senior secondary counterparts were negative about their appraisers' mathematics teaching expertise. Thus less than 50 percent of the respondents at either level thought GESOs often had mathematics teaching expertise. Although the figures in the above table show that on the average, junior secondary mathematics teachers were slightly more positive than their “senior” counterparts, the

difference between the two means was not significant, $t = 1.5348$, $p > .10$.

At both levels, when the responses for only those who had been appraised were considered, there was no significant difference between the perceptions of the appraised respondents only and those of the entire group. Nor was there any significant difference between the perceptions of junior secondary appraised mathematics teachers and their senior secondary counterparts. The table below shows the summary statistics for those who had been appraised at both levels.

Table 8.3 Appraised teachers' opinion of the mathematics teaching expertise of appraisers

Response	Value	Junior secondary (Frequency)	Senior secondary (Frequency)
Never	1	9(6.1%)	16(10.3%)
Seldom	2	68(45.9%)	71(45.8%)
Often	3	53(35.8%)	53(34.2%)
Always	4	18(12.2%)	15(9.7%)
Total		<u>148(100.0%)</u>	<u>155(100.0%)</u>
Mean		2.54	2.43
Standard deviation		0.78	0.80

Here too less than 50 per cent of the respondents at each level were positive about the mathematics teaching expertise of the appraisers. In sum, considering that at each level the mean score was less than 3, one may conclude, even if tentatively, that the teachers sampled in the present study thought their appraisers often did not have enough mathematics teaching expertise.

With regard to teachers' opinion about the level of training appraisers had received in the appraisal of mathematics teaching, teachers were asked to respond to item 7 of MATAQ which stated: "*GESOs who appraise me/other mathematics teachers are trained in the appraisal of mathematics teaching*". The table below gives the summary statistics of the responses to item 7.

Table 8.4 Teachers' opinion of appraisers' level of training in the appraisal of mathematics teaching

Response	Value	Junior secondary (Frequency)	Senior secondary (Frequency)
Never	1	26(13.5%)	38(15.3%)
Seldom	2	59(30.5%)	80(32.3%)
Often	3	60(31.1%)	87(35.1%)
Always	4	48(24.9%)	43(17.3%)
Total		<u>193(100.0%)</u>	<u>248(100.0%)</u>
Mean		2.67	2.54
Standard deviation		1.00	0.83

As shown in the table, at the junior secondary level, 108(56.0%) were positive about the level of training they thought appraisers had in the appraisal of mathematics teaching. The corresponding figure for the senior secondary respondents was 130(52.4%). Here too, a comparison of the mean scores shows that the difference between the two groups of teachers in terms of their perception of the level of training their appraisers had had for the above purpose was not significant, $t = 1.3842$, $p > .10$. As was done above, the comparison was confined to those who had been appraised. The table below shows the summary statistics for the appraised respondents.

Table 8.5 Appraised teachers' opinion of appraisers' level of training in the appraisal of mathematics teaching

Response	Value	Junior secondary (Frequency)	Senior secondary (Frequency)
Never	1	14(9.5%)	23(14.8%)
Seldom	2	49(33.1%)	52(33.5%)
Often	3	46(31.1%)	53(34.2%)
Always	4	39(26.3%)	39(25.2%)
Total		<u>148(100.0%)</u>	<u>155(100.0%)</u>
Mean		2.74	2.54
Standard deviation		0.95	0.95

As may be expected, there was no significant difference between the perceptions of those appraised (irrespective of the level) and those of their non-appraised counterparts. Again, here too, the mean score was less than 3 at each level, which could also indicate that on the whole, teachers were rather negative about the level of training their appraisers' had received in the appraisal of mathematics teaching.

In addition to the above perceptions, the other evidence gathered on appraisers' expertise in mathematics teaching and its appraisal seems to suggest that the criterion under discussion could prove difficult to meet under the present teacher appraisal system in Ghana. Indeed, as shown below, the appraisers sampled in the study felt that they could not give as much help to mathematics teachers as they would have liked to. This is in spite of the fact that, the majority of the appraisers stressed the importance of formative appraisal and how they went about helping teachers to improve their work. This emphasis was noticed in both the questionnaire responses and the interviews. Also during the visits I made with some of the appraisers to see how they work, many officers appeared to recognise that each teacher had different professional needs and that each teacher must be appraised differently.

In fact, over 70 percent (31 out of 44) of the appraisers sampled indicated that they

devoted not less than half of their work to “helping teachers to improve their work” when asked to indicate what other aspects of appraisal (apart from promotion) their work involved (AQ, item 5a). However, a closer examination (discussed below) confirmed that mathematics teachers did not receive as much attention as teachers of the other subjects did.

Although the promotion of teachers is not the subject of this part of the chapter, it is important for the purpose of the present discussion, to point out that only 5 of the appraisers sampled thought they devoted more than half of their work to promotion. The table below gives the percentages appraisers associated with promotion. This was in response to the item: “What percentage of the appraisals you do is associated with promotion?” (AQ, item 5).

Table 8.6 Percentage of appraisers’ work related to promotion and their frequencies.

<u>Percentage</u>	Junior Secondary	Senior secondary	Total
0	2	2	4(9.1%)
20	4	6	10(22.7%)
30	5	1	6(13.6%)
40	3	2	5(11.5%)
50	10	4	14(31.8%)
70	2	-	2(4.5%)
80	2	-	2(4.5%)
100	1	-	1(2.3%)
Total			44(100.0%)

It may be noticed from the above table that 24 (82.8%) out of the 29 appraisers at the junior secondary level, and all the appraisers at the senior secondary level indicated that 50 percent or less of their work was associated with promotion. Thus, in all, 39(88.6%) of the 44 appraisers sampled devoted half or more of their work to other purposes. Other purposes cited included *confirmation* (of newly trained teachers as qualified teachers after serving a probationary period of 1 year), *grading of schools*, *appointment of headteachers* and *helping maths and other teachers to improve their work*. For the purpose of stressing the amount of time appraisers reported to have spent on formative appraisal, I will concentrate on the 39 who devoted 50 percent or less of their work to promotion. The table below shows the purposes cited by these 39 appraisers.

Table 8.7 Purposes accounting for 50 percent or more of appraisers' work and their frequencies (f).

Purpose	JSS(f)	SSS(f)	Total
Appointment of head	1	2	3(7.7%)
Confirmation	1	0	1(2.5%)
Confirmation & helping (maths) teachers to improve...	2	0	2(5.2%)
Helping teachers to improve...	20	11	31(79.4%)*
Other (e.g. grading of schools)	0	2	2(5.2%)
Total	24	15	39(100.0%)

* This number constitutes 70.5% of all the 44 appraisers sampled.

At the junior secondary level, 20 (83.3%) out of the 24 appraisers who devoted less than half of their work to promotion indicated that they spent at least half of their time helping teachers to improve their work, and 2(8.3%) cited the latter purpose together with confirmation. At the senior secondary level, 11(73.3%) out of 15 cited the purpose under discussion on its own. As mentioned above, 31(70.5%) out of all the 44 appraisers sampled indicated that they devoted half or more of their work to helping teachers to improve their work.

However, many of these appraisers (who indicated that they devoted at least half of their work helping mathematics and other teachers to improve their work) concentrated more on teachers of other subjects than on mathematics teachers. The interviews revealed that very little time was spent by many of the appraisers on helping mathematics teachers. A teacher who had indicated that he helped mathematics teachers admitted that the help was not as much as he would have liked:

...We officers here were trained by the Regional Director about two years ago, but from time to time Mr X (the only mathematics specialist among 8 officers) also trains us...When we have any (mathematics) problems that we can't solve, we discuss it with Mr X and he helps us...We also help him in other subjects....So we all work like a team. Sometimes too we invite Mr X to visit the schools with us...I mean my circuit with me. He doesn't stay in his circuit alone...No, because he is the only maths specialist in this office....except in the primary schools where I for one can observe maths lessons without any help. As for the JSS (junior senior school) maths, I must admit that I can't help much because some of the topics are new to me....Yes I admit that the help we give is far from adequate...

Thus, apart from the primary school where this appraiser and perhaps many like him felt confident "helping" mathematics teachers, when it came to dealing with secondary mathematics teachers, many of the appraiser needed help themselves!

Indeed, when asked what they would do to help a mathematics teacher who had great

difficulty in updating lesson notes in mathematics and who was always found using 'previous' mathematics lesson notes (*AQ, item 19*), only 9(20.5%) - including the 8 mathematics specialists - thought they could help the teacher directly by training her or him on how to prepare lesson notes in mathematics. Nine (9) appraisers said they would refer the teacher to a mathematics specialist (presumably a colleague with expertise); 16(36.4%) said they would recommend an in-service training (INSET) course for the teacher and 10(22.7%) said they would simply ask the head to take the "old" notes away from the teacher! Put differently, 35(79.5%) of the appraisers thought they would need help of some kind before they can help a mathematics teacher in need of help.

Four (4) appraisers - 2 from each level were much more open about their inability to help mathematics teachers to improve their work. One of them was interviewed in detail about his views about the appraisal process. He said:

We are officers but we can't be masters in all subjects. Our work is to advise teachers on how to discharge their duties in a professional manner. When I was first appointed an officer in 1989, there were maths organisers at the district offices whose work it was to help teachers to improve their teaching of maths...Now these organisers have been redeployed by the GES as basic education examiners and what nought...We know maths is important and that is why they were employed in the district offices...Now they don't even go round anymore. We have our own subject areas, and although I advise teachers on how to handle questions relating to methodology, I can't help them much in the technical sense...that is the actual maths problems...I can't help them in that. That was the work of the organisers....Yes, I observe maths lessons but I just look at the way the children respond to the teacher...I may not know the answer to a particular problem but I can tell whether or not the children are enjoying the lesson...I base my judgement on the teacher's methods and the children's participation...I also look at the amount of exercises the teacher has given...

This appraiser went on to say that although he had received training in how to observe mathematics lessons, he did not think the training was enough to enable him to help mathematics teachers as he would have liked to do. He even 'confessed' that he visited most schools in the afternoons in an attempt to "avoid the maths lessons".

It is interesting to observe that although the appraiser under discussion had actually observed mathematics teachers' lessons and had in some cases written reports on them, he still thought his work did not involve helping mathematics teachers to improve their work. The implication here is that this appraiser thought it was (and still is?) not enough to observe a teacher's lesson and write comments on them if one really wants to help the teacher. To him, to be able to help the teacher would be "to be in the position

to correct his or her mistakes and also to teach him or her the correct way (sic) of handling the subject”.

The point being made here is that although 31 appraisers thought they devoted at least half of their work to helping (mathematics?) teachers, those interviewed admitted that they helped teachers of other subjects more than they helped mathematics teachers. It is hardly surprising therefore that 27(61.4%) of the 44 appraisers thought that the appraisal of mathematics teachers differed from that of teachers of other subjects (*AQ, item 8*). Many appraisers thought the difference was due to the "fact" that most of the teachers did not know enough mathematics themselves, the implication being that teachers of other subjects 'knew' their subjects more than mathematics teachers 'knew' mathematics. One remarked that "it is important for maths teachers to know the subject matter as this made supervision easier". Such views appear to underline the lack of mathematics expertise among appraisers in the GES. This also appears to support the view that identifying a mathematics teacher's needs in order to tailor appraisal criteria to those needs may depend on the appraiser's knowledge of mathematics. One appraiser commented:

There are some topics in the modern maths (syllabus) which I do not know. A teacher may be treating one of these topics during an inspection. If it happens so, the inspector becomes a mere on-looker.

With such attitude towards the appraisal of mathematics teachers, one may suggest even if temporarily that many appraisers in the GES may not be able to identify mathematics teachers' needs let alone give them any effective assistance to enable them improve their work.

It can be said in conclusion that the present study indicated that the appraisal system in Ghana hardly meets the first criterion. Appraisers' level of expertise in mathematics means they might find it extremely difficult to identify mathematics teachers' professional needs and/or help them to improve their teaching of mathematics. This finding suggests that it might even be more difficult to meet some of other criteria for either summative or formative appraisal.

8.3.2 Relating appraisal criteria to the underlying construct being measured

Appraising a teacher for formative (or indeed summative) purposes means measuring the teacher's '*(in)ability*' to perform a task that he or she ought to perform. In other words, appraising a teacher in order to cater for her or his professional needs is tantamount to measuring a *construct*. Here the construct could be the teacher's

‘effectiveness’ or her or his ‘competence’ with regard to the performance of particular skills. Thus one way of examining the validity of appraisal of teachers in the GES would be to look at how appraisers measure the above construct. What criteria are used to measure this? How are the criteria related to the underlying construct of effective teaching? Have the criteria been validated as measures of the construct? These are but a few of the questions that might help one to comment on the validity of TAG as a formative process.

I will consider mainly the criteria appraisers use to evaluate mathematics teachers' work and make inferences about whether or not they are related to the construct they are designed to measure. I will examine the above by looking at the things appraisers' look for in the mathematics classroom. It is indeed reasonable to suggest that what appraisers look for in a mathematics lesson could be the things they consider important in mathematics teaching. These things could arguably provide a window into the appraisers' conception of mathematics teaching as well as into the underlying construct with regard to their appraisal of mathematics teaching.

Appraisers' perception of mathematics teaching

In order to get at the appraisers' criteria for measuring mathematics teaching effectiveness, they were asked to respond to the item: “*Would it be possible to give me 5 things you look for in the classroom when observing a maths teacher's work*”? (AQ, item 12). Appraisers' responses to this and their frequencies are given in the table below.

Table 8.8 Things appraisers look for in a mathematics lesson

Response	Junior secondary (Frequency) n = 29	Senior secondary (Frequency) n = 15	Total
Scheme of work (e.g. Lesson notes)	12(41.4%)	3(20%)	15(34.1%)*
Varied methods of solving maths problems	20(69.0%)	11(73.3%)	31(70.5%)
Students participation	10(34.5%)	9(60%)	19(42.3%)
Teachers' knowledge of maths	24(82.8%)	13(86.7%)	37(84.1%)
Output of work by students	16(55.2%)	5(33.3%)	21(47.7%)
Use of teaching aids	23(79.3%)	12(80%)	35(79.5%)
Practical activities	3(10.3%)	5(33.3%)	8(18.1%)
assessment of students' work	17(58.6%)	10(66.7%)	27(60.9%)
Presentation of lesson	13(44.8%)	4(26.7%)	17(38.6%)
other	7(24.1%)	3(20%)	10(22.7%)
Total			220(500.0%)

* Total frequency as percentage of Total number of appraisers (i.e. 44)

As shown in the table, at both junior and senior secondary levels, the four most popular things appraisers look for when observing a mathematics lesson are the teacher's

knowledge of mathematics (84.1% of the 44 appraisers cited this), the use of teaching aids (79.5%), the use of different methods to solve mathematics problems (70.1%), and assessment of student’s work. Each of the above was selected by over 50 percent of the 44 appraisers. An interesting observation was that at both the junior and senior secondary levels, the order of ‘popularity’ (in terms frequency) of the four most important things appraisers take into account when observing a mathematics lesson was the same.

Furthermore, the differences between the respective proportions of appraisers whose responses fell into the various categories were not significant. For example, 24(82.8%) out of the 29 appraisers at the junior secondary level considered “*teacher’s knowledge of mathematics*” an important factor in the teaching of mathematics. This view was shared by 13 (86.7%) out of the 15 appraisers at the senior secondary level. The proportions at both levels were nearly the same. This was the case for all the four categories, which makes it reasonably safe to conclude, on the face of it, that the two groups of appraisers share similar views about mathematics teaching.

The following table shows the similarities between the frequencies of the four most popular things the appraisers cited at the two levels. In each case, the frequencies are compared response by response and chi-square procedures used to determine similarity or difference in the response frequencies.

Table 8.9 Comparison between JSS and SSS appraisers’ perceptions of mathematics teaching

Response	JSS (n = 29)	SSS (n = 15)	Chi-Square	p
Teachers’ knowledge of maths	24	13	0.0010	ns
Use of teaching aids	23	12	0.0029	ns
Varied methods of solving maths problems	20	11	0.0023	ns
Assessment of students’ work	17	10	0.0029	ns

As mentioned above the table indicates that appraisers at both levels did not differ in terms of the numbers whose responses fell into the response categories under discussion. This is an important finding because it suggests the existence of an underlying conception of the appraisal of mathematics teaching shared by the appraisers at both levels. It is important to point out that the criteria (i.e. knowledge of mathematics *and* its teaching) have been found to be good predictors of effective mathematics teaching in a number of studies (e.g. Borko and Livingston, 1989). Moreover, the above criteria suggest that appraisers pay attention not only to teachers’ knowledge of subject matter, but to their pedagogical content knowledge as Shulman (1986) describes it. In other words, by looking at different methods of solving

mathematics problems, appraisers expect teachers to have at hand “a veritable armamentarium of alternative forms of representation”(Shulman, op. cit., p.9).

This is clearly in line with the aims of mathematics teacher education in Ghana. For example, among the aims of the training of basic education mathematics teachers is “ to extend the (teacher) student’s own mathematical ability to a level significantly beyond that which he or she is likely to teach mathematics (NTTC, 1992, p.1). Thus the would-be mathematics teacher is expected to acquire a “ sound understanding of the basic mathematics necessary to become efficient and effective teacher of mathematics” (ibid.).

With the alternative methods of presenting mathematics to students, it is hoped that the weaknesses of individual methods may be overcome. If many different methods are used, this can arguably cater for the different conceptions of students. In other words, the appraisers' criteria seem to put the student at the centre of mathematics teaching and learning. Indeed, that appraisers in the sample saw increase in pupil learning as the ultimate goal of appraisal is supported by their responses to item 15 of the appraiser questionnaire. The item asked appraisers to indicate what they would describe as good mathematics lesson. The table below shows the responses that emerged.

8.10 Appraisers’ description of a good mathematics lesson

Response	Junior Secondary n = 29 (Frequency)	Senior secondary n = 15 (Frequency)	Total
Pupils participate in the lesson	12(41.4%)	4(26.6%)	16(34.6%)
Pupils are able to apply the concepts correctly	11(37.9%)	7(46.7%)	18(40.9%)
Teacher satisfied with his/her performance	1(3.4%)	3(10.3%)	4(9.1%)
Good presentation (e.g. logical steps)	1(3.4%)	1(3.4%)	2(4.5%)
Other	4(13.8%)	-	4(9.1%)
Total			44(100.0%)

The above table shows that at both levels, appraisers preferred lessons in which pupils participated in the lesson and applied the concepts taught correctly. The implication is that appraisers preferred child-centred mathematics lessons and thought (rightly) that success of such lessons would depend on the teachers’ knowledge of mathematics and its teaching.

Indeed, the advice and guidance nearly all the appraisers I went round with gave mathematics teachers somehow reflected the above criteria. Some of the appraisers (presumably those who felt confident in mathematics) taught mathematics lessons to pupils usually in a class different from the one the teacher who was being appraised for promotion taught. Again these lessons appeared to reflect particularly the importance of child-centredness and the use of teaching aids in mathematics lessons. Extracts

from the reports of six officers support the point that the type of help appraisers gave was somehow based on the criteria the appraisers identified as relevant to effective mathematics teaching.

Appraiser 1.

The teachers in the schools visited were asked to teach some topics in mathematics while the officer observed them. After the lesson, the teachers were given professional guidance as to how they should go about the topics. The officer also gave some demonstration lessons on some of the topics teachers are not conversant with, e.g. Integers, Rational Numbers, Geometric figures in the primary schools and Transformations in the JSS...

Appraiser 2

... the officer on his part gave professional guidance to the teachers on modern methods of handling the subject (mathematics). More emphasis was laid on practical ways of teaching the subject through the use of teaching aids, games and play...instead of dwelling on theoretical aspects...which made many pupils hate the subject. The main aim was to help develop mathematical thinking in children...

Appraiser 3

In order to achieve his aim of making mathematics more practical., the officer gave a “demonstration lesson” at all the centres on the “Teaching of Fraction”. Teaching aids like bottle tops, oranges, sets of objects, etc. were used to explain the concept of what a fraction is. Games like “Grabbing”, “Shade-in-Game” and “What and Why” were used in the teaching of equivalent fractions which form the basis for the teaching of addition and subtraction of fractions. On the whole, the lessons were very successful and enjoyable...

Appraiser 4

The officer made brief visits to some schools to find out the output of work, mainly in mathematics exercises. The lesson notes of mathematics teachers were also inspected to see whether they were following the syllabus. Topics in the textbook which they (the teachers) were not familiar with were also noted and problems facing them were discussed for solution...

Appraiser 5

The officer visited the following schools to look at the teaching and learning of mathematics in the schools. He also gave demonstration lessons and other professional guidance. The schools involved were...

Appraiser 6

The officer organised a workshop for selected primary and junior secondary schools. During the workshop, teachers were taught how to use games to make learning easier, methods of teaching some geometric concepts, the use of mathematical puzzles and preparation of learning and teaching aids. Participants enjoyed the workshop very much.

In line with what was said in chapter 4, the present study found the existence of an underlying concept of the appraisal of mathematics teaching. Considering the above criteria, one can say that they reflect the construct of effective mathematics teaching. Yet whether or not appraisers in the GES can measure teachers' knowledge of mathematics reasonably accurately using the above criteria is another matter. Appraisers' ability to measure mathematics teaching effectiveness using the above criteria would depend to some extent on their expertise in mathematics and its teaching, which was the subject of the last section.

In sum, one can say that from the way the appraisers sampled in the present study talked about their work and actually did the latter, one can conclude that effective mathematics teaching appeared to be the underlying construct of the appraisal of mathematics teaching for formative purposes. This leads to the conclusion that the criterion under discussion was apparently met by the formative aspect of TAG. One of the factors which can affect the successful application of the criteria appraisers identified as capable of measuring mathematics teaching effectiveness could be the atmosphere within which the appraisal is conducted. In other words, using the criteria to measure the underlying construct successfully may require the appraiser to conduct the appraisal in an atmosphere which would be considered friendly by the appraisee. The importance of the atmosphere within which appraisals are done is discussed in the next section.

8.3.3 Conducting appraisals in a friendly atmosphere

The third criterion was that formative appraisal must be conducted in a friendly atmosphere to enable appraisees to reveal their professional needs. This criterion is what Tharp and Gallimore call *intersubjectivity*. Good 'assistance', the authors argue, requires that the person 'helping' and the 'learner' achieve some measure of intersubjectivity. They posit:

In joint activity, the signs and symbols developed through language, the development of common understanding of the purposes and meaning of the activity, the joint engagement in cognitive strategies and problem solving are all aspects of interaction that influence each participant (Tharp and Gallimore,

1988, p89.).

Here, the appraiser becomes a colleague rather than a superior. If the threat that usually characterises authoritative evaluations is seen by the appraisee to be eliminated, an environment may develop in which a 'dialogue' may occur. The appraiser may then be in the position to identify the teacher's professional needs. This model of appraisal appears to fit the peer-appraisal model discussed in chapter three. Indeed, there are writers such as Wise et al (1984) and Duffy (1990) who argue in favour of this collegial approach to appraisal. For example, in their study of effective practice in the USA, Wise et al (op.cit.) stated, among other things, that there is a need for high degree of teacher involvement in the supervision and assistance of their peers; and Duffy (op. cit.) suggests an overtly collegial model in which members of a department jointly undertake to observe one another, to record events in lessons and to discuss in an open and non-defensive way, exactly what they have observed. If superiors act as peers in this type of appraisal teachers may see the environment in a positive light.

Furthermore, if the environment is seen as friendly especially by the appraisee, the latter and the appraiser may understand each other's point of view and compromises can be made much easier and much quicker. Thus the environment has to reflect the formative nature of the appraisal. This environment may be different from the one obtained in summative appraisals. This is because in summative appraisal relationships, the appraiser and the appraisee may sometimes not understand each other's point of view because of the judgement nature of such relationships.

Relating this to the present study, one would expect GES officials to respect teachers and treat them as colleagues working towards the same goal rather than as adversaries, as the literature (e.g. Bame, 1991) seems to suggest. One would thus expect appraisers to discuss with teachers in detail their professional goals and frustrations and to explore new and 'effective' ways of achieving learning goals of both teachers and pupils. This criterion may also involve frequent meetings between say a circuit officer and mathematics teachers to find out what each teacher's needs are.

The present study revealed that appraisers (with whom I went round schools to see how they work) generally treated teachers - particularly those senior teachers who were of the same rank as the appraisers - with some respect by for example, asking their opinions about how lessons could be improved. Yet, in many cases, the teachers were either too shy to discuss their professional needs with the appraisers or simply displayed subservient attitude in what was clearly a "superior-subordinate" relationship between the appraisers and them.

In fact, in a society where there is so much respect for authority (and age) and where teachers are aware of the wide powers of GES officials, it was not surprising that many teachers, especially those in the junior secondary schools, appeared to be extremely humble in their interaction with appraisers. Specifically, teachers are aware that reports written about them by GES officials are capable of affecting their future career at least in terms of promotions. Teachers generally saw appraisers as their superiors and perhaps thought that what an officer learnt about the teacher could be used when summative judgements about the teacher were required. Put differently, in most of the schools that I visited with the appraisers, even teachers whose work was not being inspected for promotion purposes felt somehow threatened by the presence of the appraisers. The conflict in teachers' minds as a result of appraisers' roles as both helpers and judges, appeared to affect the atmosphere in which some teachers were appraised for formative purposes. Indeed, as Porter et al (1975) point out, a source of potential conflict in performance appraisal is the common practice of using the *same* person(s) to conduct both formative and summative appraisals. This conflict could adversely affect communication between appraisers and teachers.

With regard to the present study, perhaps appraisers were not seen by teachers as concentrating more on the role of helpers when appraising their work for professional development purposes. One may argue that the situation would somehow be different if appraisers saw teachers more often. In that case teachers may get more used to their appraisers and be able to differentiate between appraisals for promotion and other summative purposes and those for formative purposes. Yet the evidence obtained showed that teachers were not appraised often enough to let them get used to appraisal sessions.

Indeed, when asked whether mathematics teachers were appraised often enough, all the appraisers who were sampled answered in the negative. Nearly all the appraisers interviewed explained further that since they appraised teachers of the other subjects as well as those who teach mathematics, there was not enough time to see the work of mathematics teachers as often as they would have liked to. One appraiser observed:

Whenever I visit a school, I usually inspect the work of three teachers or even more...Not all of them teach mathematics...Even before subject teaching was introduced at the JSS (level), one teacher taught say mathematics, English, cultural studies and so on, and I inspected this teacher's work in all the subjects...Sometimes too, the mathematics period may be in the morning so when I visit in the afternoon, the teacher concerned may have taught mathematics already so I can't inspect his or her work in mathematics... That is why I say mathematics teachers are not appraised as often as I would like...

and the subject is important so I think we have to see the (mathematics) teachers more often...We have to see more mathematics teaching...

The appraiser went on to say that although teachers of other subjects were also not appraised often enough, he thought it was important that more attention was paid to mathematics in particular because "mathematics is everywhere". The point being stressed here is not whether or not the appraisal of mathematics teaching is different from that of other subject. It is that at both levels, teachers were not appraised often enough to minimise any anxieties they might experience when they met with their appraisers. This could be a serious limitation of the appraisal system as a formative process especially because, as pointed out in chapter 3, the managerial method appears to be the only method of appraisal employed in the GES.

It can be said in conclusion that the use of the appraisal system in Ghana for both summative and formative purposes (using the same appraisers) make it extremely difficult for the system to meet the criterion under discussion. That is, the atmosphere in which formative appraisals were conducted was in most cases too formal to be considered friendly by teachers.

8.3.4 Post-observation conference

Observation of lessons is a major means of obtaining evidence of a teacher's performance (Darling-Hammond et al 1983; Graham et al, 1985). It was argued in chapter 4 that if classroom observation is used for staff development, its form may differ from the form it takes when it is used to collect evidence for summative purposes. Indeed if the goal of the observation is growth-oriented, then the focus needs to shift more towards teacher development rather than making judgements about teachers' work. Put differently, the observation process ought to be conceived by both the observer and the observed as a collaborative problem-solving situation. Yet a collaborative situation develops best when there is a high degree of communication existing among the parties involved. This is the main reason why post-observation conferences are vital in formative appraisals. As Wragg et al (1996) point out, feedback sessions after classroom observations are a key element of teachers' professional development. Arguably, the most crucial interpersonal link between the teacher and the appraiser occurs when the teacher is provided with information on her or his performance. If growth is to occur, it is most likely to begin with this communication.

Relating this to the observations in the GES, one would expect appraisers to make post-

observation conferences an essential part of appraisal for professional development. As teachers may not be informed in advance of appraisals for professional development, it is possible that an appraiser may visit a teacher’s classroom in the middle of a mathematics lesson. If the appraiser observes such a lesson, it may be necessary to give the teacher some feedback on the lesson. In other words, even if time prevents appraisers from meeting with teachers before an observation, a meeting after an observed lesson is essential. In the present study, the views of teachers and appraisers about post-observation conferences indicated that most appraisers meet with teachers after an observed lesson.

Teachers' views about feedback after an observed lesson

Item 11 of the teacher questionnaire was used to collect teachers’ views about the subject under discussion. The item read: “ *GESOs who appraise me/other mathematics teachers hold meetings with me/other mathematics teachers after an observed lesson*”. At both junior and senior secondary levels, teachers thought appraisers often held meetings with them after an observation. The table below shows the responses teachers gave in answering the above item.

Table 8.11 Teachers’ views about post-observation conferences

Response	Value	Junior secondary (Frequency)	Senior secondary (Frequency)
Never	1	5(2.6%)	35(14.5%)
Seldom	2	19(9.8%)	30(12.1%)
Often	3	61(31.6%)	80(32.3%)
Always	4	108(56.0%)	102(41.1%)
Total		193(100.0%)	248(100.0%)
Mean		3.41	3.02
Standard deviation		0.77	1.06

As shown in the table, at the junior secondary level, 169(87.6%) thought appraiser held meetings with mathematics teachers after their lessons have been observed. The corresponding figure for the senior secondary respondents was 182(73.4%). Thus at each level, over 70 per cent of the respondents thought appraisers provided teachers with feedback on observed lessons .

As was done in the previous cases, the data for appraised respondents were considered separately . Table 8.12 (below) shows the summary statistics for the appraised respondents. As may be expected, at both levels, over 75 percent of the appraised respondents (90.5% at the junior level and 75.5% at the senior level) thought they often met with appraisers after an observed lesson.

Table 8.12 Appraised teachers’ views about post-observation conferences

Response	Value	Junior secondary (Frequency)	Senior secondary (Frequency)
Never	1	4(2.7%)	20(12.9%)
Seldom	2	10(6.8%)	18(11.6%)
Often	3	46(31.1%)	48(40.0%)
Always	4	88(59.4%)	69(44.5%)
Total		148(100.0%)	155(100.0%)
Mean		3.47	3.07
Standard deviation		0.74	1.04

It is important to point out that although the item used to collect teachers’ views about the subject under discussion did not differentiate between appraisals for formative and summative purposes, it is reasonable to say that teachers generally thought post observation meetings formed part of both formative and summative appraisals. In fact, the teachers interviewed confirmed that this was the case. Thus, appraisers always gave teachers feedback after an observed lesson irrespective of the purpose of the appraisal. As discussed below, the teachers' perceptions of post-observation meetings were shared by the appraisers.

Appraisers’ perceptions about feedback after classroom observation

Appraisers’ views about post-observation conferences were collected with item 14 of the appraiser questionnaire. The item asked: “*After classroom observation of a maths lesson, how does the teacher get to know how he/she performed in the lesson?*” (AQ, item 14). All the 44 appraisers indicated that they held a meeting with a teacher soon after the lesson had ended. This claim was confirmed in the appraisals that I observed. Indeed, the appraisers I observed in the present study did not underestimate the importance of post-observation conferences. In each of the appraisals - either *formative and summative*- there was a post-observation conference usually in the head’s office immediately after the lesson being observed had ended. In other words, there was immediate feedback to teachers after the lesson. As the appraisers I went round with were doing promotion inspections, most of the lessons I observed were for summative purposes. Even so, there was no difference between the post-observation conferences following lessons for promotion purposes and those following lessons for professional development. As mentioned in the last section the same appraisers were used for both purposes. The description below therefore covers both formative and summative observations.

It is somehow easy to summarise the ways different appraisers conducted the post-observation conferences whether they were for formative or summative purposes.

Perhaps the only difference is the number of appraisers who saw a teacher's work. It is worth mentioning that for promotion observations, there were at least two appraisers involved in the observation. In the usual formative 'supervision', only one appraiser was involved. Nearly all the appraisers led the discussion in an informal manner, starting with the general behaviour of the pupils of the school in which the observation took place. Teachers were often asked questions about the general environment of the school. This was presumably done to put the teachers at their ease. There was only one appraiser who was rather formal from the outset, reading out some points he had put down during the lesson.

In nearly all cases, the 'formal' part of the discussion started with the teachers evaluating themselves as to how the lesson went. The purpose, as I learnt later, was to let the teachers have a chance to express their feelings and thoughts about the circumstances which might have contributed towards the 'success' or 'failure' of the lesson. It was also hoped that this would encourage more independent judgement and evaluation by the teacher and reduce the danger of the latter being influenced by the appraiser's perceptions of the lesson. I found this quite interesting because as mentioned in the last section, most of the junior secondary mathematics teachers were extremely humble in their interaction with the appraisers and would endorse whatever the appraisers said. Encouraging teachers to evaluate themselves gave them some control over the discussion.

After the teacher had completed the "self evaluation", the appraisers went through a number of points they had jotted down. In cases where there were at least two appraisers the latter went through their list in turn. As most of the appraisers were not mathematics specialists, the points they discussed with teachers were general points about class management. However, some appraisers occasionally commented on 'technical' points such as the teachers' use of certain mathematical concepts. For example, there were a couple of times when a particular appraiser (an accounting specialist) pointed out some inaccuracies in teachers' lessons. In one of such cases, the teacher had described a *bar chart* as a *histogram* and this particular appraiser picked that up at the post-observation conference.

In nearly all cases, the appraisers gave positive feedback to the teachers on their performance before making suggestions for improvements. As one appraiser explained, "this strategy was intended to boost the teachers' confidence and also to allow us to approach the teachers' weaknesses through their strengths". He explained further that approaching 'weaknesses' through 'strengths' made teachers more receptive to suggestions which were designed to improve their practice. As mentioned

above, the advice appraisers gave were generally about class management, teachers' questioning, pupil involvement and monitoring of pupils' progress. The post-observation conferences lasted between 30 minutes and 1 hour.

When the observation was for promotion purposes, before the appraisers could draw up a complete picture of the whole lesson and make (summative) judgements about the teacher's work, they (i.e. the team) collated the data collected during the lesson and the post-observation conference. This means that the appraisers took into account the teachers' explanations regarding the success or failure of the lesson into account in their judgements. Therefore as far as formative appraisals are concerned, the conclusion that can be drawn is that, from the evidence gathered on post-observation conferences, the latter form part of appraisals for professional development. Thus the criterion under discussion was met by the appraisal system. There is no gainsaying that the quality of the feedback teachers would receive would depend to some extent on the expertise of the appraiser and/or the teacher's areas of needed improvement.

8.3.5 Summary of the validity of TAG as a formative process

Four main criteria that appraisals for formative purposes might include were discussed and the extent to which they were met by the teacher appraisal system in Ghana was inferred. All the criteria relate to the ability of the system to help mathematics teachers improve their practice. Two out of the four criteria examined in the first part of this chapter were met by the appraisal system. Specifically, the appraisers seemed to apply consistently a set of criteria that put the child at the centre of mathematics teaching and learning. The criteria were clearly related to the construct - effective mathematics teaching - which the formative appraisal of mathematics teaching ought to measure. Also the appraisers did not only recognise the importance of feedback in the appraisal process, they strived to give teachers immediate feedback on their work.

However, the main problem seems to be the lack of mathematics expertise among the appraisers. It may be recalled that most of the appraisers were not mathematics specialists and some thought they might even find it difficult to teach the subject at the junior secondary level. Surely, if an officer appraising a mathematics teacher at the junior secondary level is not confident to teach mathematics at the latter level, then it will be difficult, if not impossible, for such an appraiser to adequately comment on both the teacher's mastery of the subject matter and her or his methods of instruction, as the appraisers claimed to do (regardless of the purpose of the appraisal). This lack of expertise in mathematics teaching and its appraisal among the appraisers means that the

first criterion was not met by the appraisal system. Also the criterion relating to the atmosphere within which formative appraisal ought to be conducted appeared difficult to meet because of the dual purpose of the appraisal system in the GES. In sum, it was observed that although different appraisers might have viewed their role of helping mathematics teachers to improve their work differently, they generally seemed to hold the view that they were not well equipped for that role. This view was shared by the mathematics teachers who took part in the study. The tentative conclusion therefore is that formative appraisals in the GES is far from valid.

As stated at the beginning of this chapter, the second part of this chapter (i.e. Part B) discusses the validity of summative appraisal in the GES.

B THE VALIDITY OF TAG AS A SUMMATIVE PROCESS

In the first part of this chapter I examined the validity of teacher appraisal in Ghana (TAG) as a formative process by comparing teachers' and appraisers' perceptions of TAG as a formative process as well as comparing how formative appraisals are done in Ghana with the "model" discussed in chapter 4. In this part, I will examine TAG's validity as a summative process.

As mentioned in chapters 1 and 3, summative appraisal is mainly concerned with providing an overall judgement of value or quality about the appraisee's work. As far as the present study is concerned, summative appraisal is mainly used to inform decisions regarding the promotion of teachers. I will therefore concentrate on that purpose in the evaluation of the validity of TAG as a summative process. As I did in the case of TAG as a formative process, I will look at what criteria valid summative appraisal might include, the implications of these for promotions in the GES, and how teachers are actually promoted in the GES. The section below summarises the relevant criteria discussed in chapter 4.

8.4 Criteria for Evaluating the Validity of Summative Appraisal

The first criterion that was considered to be vital in the evaluation of summative appraisal was credibility. The importance of this criterion as a key factor in summative appraisal was stressed in chapter 4. It was pointed out that expertise is an important dimension of credibility. As far as the present study is concerned, expertise refers to

the appraiser's knowledge of mathematics, especially if judgement is to be made about the teacher's classroom work.

In fact, it was argued in chapter 4 that whether appraisal is for formative or summative purposes, the appraiser ought to (be seen to) make the 'right' decisions about the teacher's performance. Thus, as far as promotion of teachers is concerned, the evidence collected about the teacher's performance should point to the 'truth', relevance or justice in the light of the underlying construct (e.g. "competence") the appraisal is meant to assess. The second criterion that will be considered for the evaluation of summative appraisals in the GES is that appraisal for summative purposes ought to include as much of the teacher's relevant work as possible. This should be done in order to meet at least the content validity criterion of *deficiency* discussed in chapter 4. The third criterion, which is arguably a derivative of the last one, is that both appraisers and appraisees should be clear about the criteria to be used for the appraisal. The fourth and final criterion concerns the use of multiple methods/instruments to collect data about the teacher's work. This criterion is related to but not the same as the second criterion because sampling enough of the teacher's work may improve the content validity of the appraisal but may not necessarily validate the underlying construct of the appraisal. The use of multiple instruments may both improve the content validity of the appraisal and overcome some of the weaknesses the individual instruments may have.

Other relevant factors that may be considered in the examination of the validity of the summative aspects of TAG include the criterion that the whole process ought to be seen by appraisees to be fair and uniform for all appraisees, and the one that adverse social consequences of the appraisal should not be traced to the invalidity of the appraisal (Messick, 1989). Reference will be made to these and other relevant criteria in the discussion of the four main criteria listed above.

As was done in part A, the next section looks at the relevance of these criteria and how they are used to evaluate the validity of TAG as summative process.

8.5 Relevance of the Validity Criteria to the Present Study

8.5.1 Credibility

As mentioned above, credibility in teacher appraisal may include the appraiser's knowledge of the technical aspects of teaching and especially knowledge of the subject

area of the teacher to be appraised. As far as the appraisal of mathematics teachers is concerned, the appraiser's knowledge of mathematics and its teaching is of paramount importance particularly if the appraiser is to make judgement about the teacher's classroom work. If on the other hand the appraiser is not required to make any judgement about the teacher's mathematics teaching, then there might be very little emphasis on the former's expertise in mathematics. Even so, if the criterion that summative appraisal designed to give an overall judgement ought to take into account as much of the teacher's relevant work as possible is not to be violated, then the appraiser's knowledge of the appraisee's subject is vital.

This could help avoid a situation where the appraiser might fail to detect errors in the teacher's work which could have adverse consequences for students. Similarly, such knowledge could help avoid a situation where, for example, the teacher who deserved promotion was not promoted because the appraiser did not understand the teacher's work. Legal challenges are more likely to follow false negative decisions, when promotion is denied to an applicant who feels deserving. This may be more the case if the appraisee doubts the credibility of the appraiser. Each of the above situations can indirectly impact the community in which the teacher works. Such situations may be avoided if the appraisee is aware that the appraiser *knows* the former's work. As Messick (op. cit) points out, if the adverse social consequences of a test can be empirically traced to the sources of the test invalidity, this could jeopardise the validity of the test use.

An example regarding appraisers' lack of expertise in mathematics and its teaching is a case in which three GES officials were observing a teacher's work for promotion. The teacher was teaching *Quadratic Expressions* in a junior secondary form 3 class. He had written boldly on the blackboard the expression: X^2+rX+r which he claimed was the general expression of the type of *quadratics* he was considering. He then tried to guide students to find the values of "the first r and the second r " from given word problems. For example one word problem read: "I am thinking of two numbers whose sum is 8 and whose product is 15. What are the numbers?" The teacher called one of the pupils to lead the class to solve the problem. The pupil's working was as follows:

$$r = 3+5 = 8$$

$$r = 3 \times 5 = 15$$

$$\text{Answer} = X^2+8X+15$$

The teacher's reaction was: "good, let's clap for him". Several pupils were called and nearly every one of them got the "answer" right. At the post-observation conference, none of the appraisers mentioned anything about the above (general) expression. Later on when during an informal chat with the teacher, I asked him about the expression, he

said he copied it from the pupils' textbook. I asked him to fetch the book and when he brought it the expression was : $X^2 + pX + r$. He promised to correct the "mistake" in the next mathematics lesson. It is hardly surprising that none of the appraisers commented on the error. In fact, none of them was a mathematics specialist. Nor was the teacher.

This leads to the second issue that most of the mathematics teachers in Ghanaian secondary schools are non-mathematics specialists . Some of these might lack either the prerequisite knowledge in mathematics or the level of training required to enable them to teach the subject 'effectively', or in some cases, both. These teachers are hired as a result of the acute shortage of mathematics teachers in Ghana, to teach the subject to pupils in the lower forms in both junior and senior secondary schools. There is always the danger that these teachers may feel too comfortable teaching at these lower levels to acknowledge their shortcomings in both mathematics 'content' and 'methodology'. As Trethowan (1987) rightly points out, nothing is perhaps more challenging than dealing with a teacher who is genuinely or apparently unaware that her or his performance is of concern:

It is perfectly possible that a teacher believes that the standard of discipline or the quality of ... work which he or she is producing is what the school [or department] requires... No improvement programme can be effective until the teacher acknowledges that a problem exists. (Trethowan, op. cit., p. 89).

It is important to note that this stage of making the teacher aware of a performance shortfall can be a traumatic one for all concerned. This is the reason why the appraiser's judgement ought to be reasonably accurate. Yet the appraiser's judgement may be accurate only when he or she is in the position to understand what the teacher is teaching.

Another example of a typical classroom observation of a mathematics lesson in the junior secondary by an official from the GES will elucidate this point. The following is an extract of the discussion about a lesson on *ratio and proportions* in the junior secondary school form 1. The teacher was a non-specialist mathematics teacher, although he had completed the 3-year post secondary (Initial Teacher Training) course. The appraiser was also not a mathematics specialist. He was an Agricultural Science specialist who had been a GES official for 17 years.

Appraiser: How was the lesson?

Teacher: Sir, you mean...

Appraiser: I mean how did you find the lesson. Was it successful?

Teacher: (hesitant). Sir, the children are very weak in maths. They don't know anything. This is not the first time I have treated this topic with them but still when I asked them questions I could see they couldn't answer them.

Appraiser: So how do you assess yourself?

Teacher: Sir, I think they didn't understand the lesson well...only one of them was able to answer most of the questions. I used the necessary teaching aids but they still didn't understand it well.

Appraiser: Well, yes you are right. They didn't understand the lesson...you failed to teach them the *total ratio* method. The question about the 500 oranges ...you should have explained that since there were two people sharing and their ages were 12 and 13, the ratio is 12:13 and the total ratio is 25. In that case when they share 500 oranges, they can use that total ratio as the divisor and multiply what they get by their respective ages to get the answer...

In fact, the teacher had tried to guide the pupils to establish the concept the appraiser was talking about. He had asked two of the pupils with ages 12 and 13 respectively to work out how many oranges each of them would get if they shared 50 oranges (using 50 stones as oranges). He then instructed them to pick the number of stones which corresponded to their ages. The first pupil picked 12 stones and the second picked 13 stones as instructed. The teacher instructed them to pick the same quantities again and they did. He then asked them to count how many "oranges" each had. The younger pupil counted 24 and the other one counted 26. He then put this question to the whole class : If Mary and Stephen share 500 oranges according to their ages, how many oranges will each of them get? He didn't have enough stones so the pupils were 'stuck'.

At this point he ran into all sorts of difficulties trying to guide the pupils to solve the problem. He began to panic. Two pupils were sent out to fetch more stones but the teacher ran out of time and could not make use of the stones. In fact, the two pupils who had gone to fetch more stones were not back yet when the "change lesson" bell rang. The appraiser's conclusion was that the lesson was not successful because the teacher failed to use a particular method. He had decided that it was not successful for the above reason and only wanted the teacher to confirm what he thought.

The point is, the teacher perhaps did not want to teach them the "total ratio method"

(yet). My observation was that if we were not in the class watching every movement the teacher made, he probably would get his message across. At worst, he would ignore the “change lesson” bell and continue the mathematics lesson till he achieved his objectives for the lesson. That is however not to say that classroom observation is not useful. What in my view is as important as (if not more important than) who does the observation, is what the observers look for and how they look for it. In the above example, the appraiser was looking for a particular method which was arguably given in another form. He failed to recognise the form and concluded that the teacher failed to use “the” method for the type of problem he was trying to solve.

The implication of the appraiser’s judgement could be that he was using a particular criterion - “the use of total ratio method” - to measure the teacher’s ‘competence’. The teacher failed to use a particular method, therefore he was incompetent! A better conclusion, in my view, would be that the teacher’s preparation before the lesson was not adequate. Yet, the officer did not mention anything about preparation. This is only one of the many examples where in my view, the appraiser’s judgement was not accurate. Such inaccurate judgements cannot be appropriately interpreted as measuring the underlying construct of the appraisal in question.

The level of expertise among GES officials with regard to mathematics teaching and its appraisal has been discussed in part A above and will not be repeated here. However, it is worth pointing out that appraisers’ lack of expertise in mathematics could create a gap between what the appraisers ought to do in both formative and summative appraisals and what (mathematics teachers think) appraisers actually do. This could pose a threat to the validity of promotion inspections and consequently to decisions such inspections inform. In fact the threat may be serious if the lack of expertise compels appraisers to rely on appraisal criteria which may not reflect mathematics teachers’ classroom work. The next section looks at the importance of relating the appraisal criteria to the teachers’ work.

8.5.2 Sampling of teacher’s relevant work

The difficulty in determining what constitutes relevant aspects of a teacher’s work to include in summative appraisal is well documented (e.g Turner & Clift, 1988, Powney, 1991). The difficulty pertains to both the criteria to be used and how they can be measured reasonably accurately. Of course, teachers need to demonstrate basic academic ‘ability’. Yet when academic ‘ability’ is the only quality assessed in summative appraisal, the underlying assumption could be that basic information is all

that teachers need to know. But what about the decisions that teachers make in the interest of students? If promotion is to reward 'good' practice, then it is important to identify the kinds of evidence that constitute good practice and base the appraisal on them. It is important to emphasise that the identification of such evidence is not the subject of the present study.

However, if one is to make judgement about the content validity of an appraisal system, one has to be clear about what characteristics the appraisees are usually required to possess. This might help one to make decisions about which criteria are relevant and which are not. Arguably teaching is not very different from other professions such as the medical profession, where the use of complex skills that are more than mere routines is the order of the day. If it is possible to identify items of knowledge, skills and understandings which constitute 'good' practice in such professions (or is it?), then it may not be impossible to clarify at least some of the characteristics which jointly constitute professional performance in teaching, albeit it is an extremely difficult task.

A number of educational bodies and authors have attempted to identify some of these characteristics. For example, DES (1991) and Webb (1993) both seem to suggest that apart from the requisite disciplinary knowledge any teacher would need to possess, there are three key components which contribute to good practice. These are preparation for teaching, engaging in teaching, and professional development. Preparation for teaching may include constructing schemes of work, preparing notes and other teaching materials, and selecting procedures for assessing students' work. Engaging in teaching involves the implementation, through communication with students, of what has been prepared. Professional growth might include activities to gain further knowledge and skills as a teacher, seeking feedback from students and colleagues and efforts to improve course design and the curriculum (DES, op. cit).

Barber and Brighouse (1992) also provide some of these characteristics, namely, 'good' planning and presentation, appropriate choice of lesson, 'good' organisation, a balance and variety of activities for pupils, and engaging pupils' interest, participation and involvement in learning. Surely, it would be near impossible to track down the many various criteria which researchers and various educational bodies have produced. However, typical of such criteria are check-lists based on a mixture of teacher characteristics, classroom techniques and the use of judgements.

In any case, as argued in the next section, if checklists are to be employed in the appraisal process, then it is important that both appraisers and appraisees are clear about such checklists. Arguably, both the appraisers and the appraisees ought to agree on the

list and/or any other issues that will form the basis for the appraisal. This is very important in cases where the job description is particularly diverse and the appraisal is for summative purposes.

Relating the criterion under discussion to the present study, one could examine the criteria used to appraise teachers in the GES for promotion in order to find out how relevant they are to the teacher's work and how they are measured. The list of criteria for promotion in the GES has been described in chapter 5. However, it is worth reproducing the list, which GNAT (1987) gives as: "efficiency, qualifications, seniority, experience, sense of responsibility, initiative, general behaviour and where relevant, his (sic) powers of leadership and expression" (paragraphs 20 & 21). One may argue that on the face of it the list appears to be 'comprehensive' enough to cover most if not all of the aspects of the teacher's work. Yet the question is how much of the teacher's work is actually covered in appraisal for promotions? Put differently, how are teachers' work sampled for promotion in the GES?

It may be recalled that chapters 2, 5 and 7 discussed the different types of promotions in the GES. However, for the purpose of the present discussion, a brief summary is given here. For promotion from the lowest rank (of *teacher*) to that of *assistant superintendent* or from assistant superintendent to *superintendent*, the candidate may choose to attend 'prescribed' and 'promotion' courses, followed by work inspection in her or his fifth/fourth year (respectively) of her/his present rank. Prescribed courses precede promotion courses. One's attendance of a promotion course is meant to depend on one's "performance" at a prescribed course (Obeng, 1995). Alternatively, the teacher could sit promotion examinations in mathematics, English language, elementary education and 'general paper', followed by work inspection in the fourth year (e.g. Appendix B8). As mentioned in the previous chapters, a teacher with a rank of *superintendent* normally gets promoted to the rank of *senior superintendent* unless her or his work has been found to be very unsatisfactory.

Promotions from the rank of senior superintendent upwards to the rank of director are by recommendations and promotion interviews. In theory, a teacher with the rank of senior superintendent or above qualifies to attend an interview for promotion every three years, but in practice promotions at those levels are somehow limited by the vacancies available because some teachers serve for up to 6 years in one rank! A number of teachers who took part in the present study had been senior superintendents for over 6 years.

The question here is: do the criteria and procedures used in appraisal for promotion at both the junior and senior secondary levels meet the criterion under discussion (i. e. covering enough of the teacher's work)? At the junior secondary level, it can be said that although no prescribed or promotion courses were being run at the time of the study, analysis of training programmes for the previous years' courses indicated that the courses concentrated on many different aspects of the teacher's work. For example, the programmes indicated that teachers participated in simulation exercises and played different roles (e.g. as teachers, as pupils, as parents, etc.). They also had the opportunity to learn how to prepare teaching aids and were required to make decisions in different simulated situations. Teachers interviewed confirmed that all the above activities actually take place at promotion and prescribed courses.

Additionally, those who opt to take promotion examinations are, as pointed out in chapter 7, given training to enable them pass the promotion examination. Here too, considering that mathematics teachers are assessed in mathematics and other subjects, one can say the examination covered some relevant part of mathematics teachers' work. Besides, the use of a mixture of instruments (examinations and observations) to collect data for promotion at the lower ranks can arguably improve the coverage of teachers' work at the junior level. This may have contributed to the rather positive attitude junior secondary mathematics teachers generally displayed towards the formative aspect of TAG discussed in chapter 7.

The situation at the senior ranks was quite different. At that level, teachers were generally unhappy about how promotions are done in the GES. There appeared to be a credibility gap between what criteria appraisers claimed to use for promotion and what mathematics teachers perceived were being used. In fact, the evidence gathered indicated that the criterion under discussion was not met at the senior secondary level. This is because most of the mathematics teachers at this level were above the junior ranks. They therefore could not make use of the choice provided at the junior level between the sitting of promotion examinations and the attendance of prescribed courses. The only route available to them was the promotion interview, which one attends after one's application for promotion (Appendix B10) has been accepted. As discussed below, the interviews did not sample enough of the teachers' work. Furthermore, they did not appear to measure the underlying construct in the appraisal for promotion in the GES. A short description of how the promotion interviews were conducted will elucidate this point.

The promotion interviews I observed were all panel interviews. The usual membership at such interviews was between four and six, with one of the panel members acting as a recorder. All but one of them were selected from various directorates of the GES - headquarters, regional and district, with the remaining one representing the GNAT. All the panel members (with exception of the recorder) asked questions at different times and the questions which were put to an applicant did or did not reflect the latter's work. In fact, a great proportion of the questions that were asked in the interviews that I observed (in different regions of Ghana) were on school administration and current affairs - mainly on the economic community of West African states (ECOWAS). At the time of those interviews, Ghana's president Rawlings had just been given an unprecedented one-year extension of the chairmanship of the ECOWAS and this dominated the interviews.

Generally, the sort of questions asked were open in the sense that they allowed the applicant to expand say a point of view about an issue raised by an interviewer. Not only that, the applicants were also allowed to express 'feelings' as well as facts. In other words, the applicants could, in theory, express their opinion freely about any issue the interviewers raised irrespective of whether or not they agreed with the interviewers. Any differences between their opinions and those of the interviewers were not to adversely affect the interviewee's chances of passing the interview.

Each interviewer scored the applicant's performance using "guidelines" provided by GES. First, the panellists looked at how the candidate was dressed, which they called "appearance", and which carried 10 marks. Questions about the candidate's work and those about the GES, GNAT, school administration, oral skills and so on carried 80 marks. Finally, questions on current affairs carried 10 marks. At the end of the interview, the recorder called out the factors and each interviewer stated her or his marks for each of the relevant factors. The average of the scores of each factor became the applicant's score for that factor. Each applicant's score was the sum of all the average scores for the relevant factors.

All the different panels that I observed at work organised and conducted the interviews in the same way, as the procedure had been laid down by the GES. This confirmed the appraisers' claim that promotion interviews are conducted in the same way throughout the whole country although the questions (which are formulated by the panel members before the interview) may be different for each candidate and may also differ from panel to panel. In terms of *procedure* one could say the interviewers appeared to apply the guidelines consistently albeit, this consistency did not in my view extend to the *content* of the interview.

There is no gainsaying that the validity of the promotion interviews depends to some extent on the purpose(s) of the interviews. If indeed the interviews aim to measure the applicant's *performance* over the years and make judgements as to whether or not he or she really deserves the promotion (as the invitation to attend the interview appears to presume), then there was a major shortfall in the type of questions the applicants were asked. As mentioned above, most of the questions did not reflect the applicant's classroom work at all. Asked why general knowledge questions dominated the interviews, an officer who served on one of the interview panels said:

...We consider the teacher's work generally... I mean classroom work and other work outside the classroom... you know at this level, the teacher is supposed to know not only his (sic) subject area, but also everything about the GES and GNAT and current affairs. Therefore, we ask questions on all these areas...I said, he has to know more than (the classroom work). He has to be an all round teacher...You see at this level we expect teachers to know a lot about administrative work because they can become assistant heads or senior housemasters and they should be able to solve problems... They should be able to solve problems in the classroom, problems in the school, problems in the home and so on. In fact, we are looking for an all round teacher. He shouldn't only concentrate on his subject area... One thing is that most of the people who fail the interview concentrate only on their subject areas and that's why they fail. Even some teachers with master's degrees fail because they think the other areas like current affairs and issues concerning the GES are not important. They say why should I worry about problems in the GES when I have my classroom work to do ... But you see things don't work like that in the GES. We want teachers who can solve problems... Well, most of these teachers when they fail at the first sitting, they go back and study the other things well so that they are able to pass the second time round...

When asked whether mathematics teachers' knowledge of the subject matter and how they do their work as a mathematics teacher alone cannot help them to pass the promotion interview, the above officer said: "No. These two things are not enough". Although he admitted that the way the interviews are conducted is likely to have negative impact on (mathematics) teaching, he still maintained that it was important that teachers excelled in "all areas". He argued:

... Yes, we know that certain categories of teachers are frustrated by the way the interviews are done, especially those teachers who don't consider areas other than their own areas important. Most of these teachers complain about the interview. Such frustrations can affect the performance of these teachers but there isn't much we can do about it... That is the GES policy... that all teachers who get promoted are well versed in other areas outside their own areas too. We want an all-round teacher. There is also another category - the non-professionals. According to a GES policy, non-professionals cannot go

beyond the grade of senior superintendent. Such teachers are also frustrated by the system but I think they have themselves to blame... We want professionals in the education service so those who enter the service must either be professionals from Cape Coast (University) or take the opportunities that are being provided by the GES to turn themselves into professionals. For example, there is this diploma in education sandwich course. They take this course and within 2 years, they have become professionals. Many teachers don't take the opportunity, yet they complain about promotions...

The officer rightly argued that although academic qualifications are important in the teaching profession, they are not enough to make one a good teacher and since the GES was committed to rewarding good teachers, other factors had to be taken into account. Even so, not asking a mathematics teacher or indeed any teacher enough questions about their classroom practice leaves one in doubt as to what the purpose of the promotion interview is. This is because the interview is supposed to be an occasion when the 'continual' appraisal of an applicants' performance is summarised to find out whether or not they should be promoted (GNAT 1981). That the interviews did not reflect the purpose for which they were designed was shared by all the six heads interviewed.

They all said that it was not in their power to tell how promotions should be conducted. All they were required to do as heads was to recommend those teachers they thought were due for promotion. They all agreed the way the interviews are conducted had negative effects on teachers' work. They even implied that they usually noticed a change in teachers' attitude to work after they had attended the interviews. The change would depend on how the interviews were conducted. One head thought the best way forward would be to use the heads' reports alone for promotion purposes. She said:

If they don't trust that we can do that job, why then do they entrust us with so many children? We didn't become heads just like that. We trained to become heads and every head should be capable of giving accurate description of his or her teachers' work at anytime and for any purpose. It's unfortunate that most of these people are ...not the right people for a job like this. Well, that is Ghana Education Service...maybe people like you can do something about it. They take suggestions when they come from abroad.

One of the heads was actually appraising mathematics teachers on her staff (who were on a post graduate diploma sandwich course) on behalf of the Cape Coast University. This head admits that some of the mathematics teachers on the staff have degrees in mathematics, yet she still thought she could "supervise" them:

...Fortunately, I studied education at both the diploma and degree levels...we were taught methodology in all subject areas so it is normally not difficult for me...at least if I have the textbook at hand and I am able to read through...I think the most important thing is the methodology...the steps which the teacher is going to use to sell out the ideas...so normally it is not very difficult but in cases where I think I need the help of a specialist, I call some of the teachers to come in and help...Right now we have graduate teachers who are taking a course in post graduate diploma in education at the University of Cape Coast...I must admit that when it comes to mathematics, some of these teachers have higher qualifications than I have but with my background in education, I am not found wanting...

Admittedly, people like this head may not be able to sample enough of the mathematics teacher's work, yet with the appropriate training such people may have the confidence to question mathematics teachers about their classroom work at promotion interviews. This can surely improve the content (if not the construct) validity of the interviews.

This is the point one of the heads raised. He said he was not against the idea of using a panel for the promotion interviews. What he thought what was important was the expertise of those who form the panel. This view has been echoed by many observers of selection procedures in education. For example, Riches and Morgan (1989) have argued for the use of panel or board interviews but as Morris (1982) rightly observes, if the panels are poorly selected and untrained the outcomes of such interviews will be unsatisfactory. It is possible that some teachers fail the interview because they are not asked the relevant questions.

A comparison between the types of questions asked in the interviews I observed and those asked in the previous years revealed that questions asked in the previous years were also mainly 'general' questions. Some questions had very little to do with mathematics teachers' work. A few examples will suffice. Below are some of the questions the interviewers asked two of the mathematics teachers and one of the circuit supervisors who had passed the promotion interview in 1993 (all at the 'first sitting').

Mathematics Teacher 1

- * What are the duties of a headteacher?
 - * What is the role of the Ghana National Association of Teachers?
- (No question on mathematics teaching).

Mathematics Teacher 2

- * What are the causes of environmental degradation?
 - * What are the causes and solutions of students unrest in schools?
- (No question on mathematics teaching).

GES Officer

* When on a visit to a school what do you do?

* Are you happy about the way your reports are handled?

(Both questions were on officer's work)

The above examples may be extreme cases, yet it is no exaggeration to suggest that the interviewers for some reason avoided asking mathematics teachers enough questions about their classroom work. Although the mathematics teachers under discussion passed the promotion interview, they expressed dissatisfaction about the way interviews were (and are still) conducted. As may be expected, the officer who was interviewed along with the mathematics teachers was positive about the interviews.

In fact, some mathematics teachers expressed anger about the promotion interviews. An extract of an interview given by one such teacher will illustrate the point:

Me.. So with the report (appendix B9) and the form (appendix B10) you were invited to the interview. And what happened at the interview?

Teacher.. It was a bogus interview.

M.. Why?

T.. There were four people asking questions. I think most of the questions were irrelevant. Well, I know with the position I am applying for, they think that I can be made a head of an institution - for example, a senior secondary school - so they asked me questions about preparation of time tables, how to run a school and so on. Those questions were okay, but some of the questions were not good at all.

M.. Could you give examples of the questions you think were not good?

T.. Yes. For instance they asked me "what is toxic waste?". What is the connection between this and my work as maths teacher? They also asked "if you are in a school and the students are planning a demonstration against the head, what will you do about it?". Questions like these, I don't think they are good questions. I know that we have to read wide and know a lot of things as teachers but something like toxic waste should not be discussed at the interview. I am not saying that I don't know what toxic waste is but I am saying it is not good to ask a maths teacher such questions.

M.. Did they ask you any questions about maths or its teaching?

T.. [Angrily] No. They didn't ask even a single question about maths teaching. That is what annoyed me. Another bad thing is that they were all asking questions at the same time. They were just bombarding me with questions. I think they deliberately wanted to provoke me. Even at one stage, one of them said to the other three "look I think this gentleman is wasting our time". After that

statement, I lost interest in the interview... I was not happy any more.

M.. How long do you have to wait for the result?

T.. I think this one has taken too long. I attended the interview last year. I think in November last year (1994) but I have not heard from them.

M.. What is that supposed to mean?

T.. They are only delaying the results, but I am waiting. I am not the only one involved from this school. Mr Addy [a colleague who is also a mathematics teacher] also attended on the same day and faced the same panel. We are both waiting... In fact, if I fail, I will take the matter up.

M.. How?

T.. In fact I will write an article in the Daily Graphic [a Ghanaian newspaper] and describe the whole interview and even mention the names of the members of the panel.

M.. Is that all one can do?

T.. I will also write a letter to "blast" [insult] them. I will write to the headquarters about my interview.

M.. If you write to the headquarters, is it possible to get the decision of the panel reversed?

T.. No. They wont do that but at least they will know that the general public will be following the way they do their work so they will be more careful and do the interviews in a proper way.

The above discussion shows that the criteria for promotion at the junior ranks in the GES appeared to cover some aspects of the mathematics teacher's work. At the senior ranks, to where the promotion interview is the only route, the situation was different. Here not much of the mathematics teacher's work (especially at the senior secondary level) appeared to be covered by the appraisal. Besides, some of the questions asked at the interview are generally not relevant to mathematics teaching. If promotions are to reward 'good' practice or effective teaching, then some of the questions ought to reflect the criteria the literature on effective teaching highlights. Yet this did not appear to be the case in the interviews that I observed. This situation could adversely affect the content validity and hence the construct validity of summative appraisals at the senior secondary level where most teachers are aspiring to gain promotion to the "senior" ranks.

Another important factor that can affect the validity of summative appraisals is the clarity of the criteria used in the appraisals. This factor is the subject of the next section.

8.5.3 Transparency of criteria for summative purposes

It was argued in chapter 4 that if the appraisal for promotion is to be valid, then it might be necessary to make the operational definitions of the measurement criteria clear to both teachers and appraisers. It is only then that judgements based on them can be legally defensible (Messick, 1989).

With regard to promotions in the GES, I will look specifically at the match and/or mismatch between mathematics teachers' perceptions of promotions in the GES and that of their appraisers. I will examine how similarities and/or differences between these perceptions can affect the validity of the promotion system. The main question to ask (and answer) here is : are both mathematics teachers and their appraisers clear about the criteria that are used (to appraise teachers) for promotion in the GES? In answering this question, I will compare what factors teachers think appraisers consider for promotions in the GES with the factors appraisers actually use for promotions in the Service. The difference between the two sets of factors could help describe the degree of transparency of the criteria employed for promotion purposes in the GES. I will also investigate whether teachers actually agree to the use of the criteria.

With regard to the above question, item 14 of the *teacher questionnaire* and item 21a of the *appraiser questionnaire* were used to collect teachers' and appraisers' views respectively of how teachers are promoted in the GES. The items required both teachers and appraisers to rank the same factors which (the GES considered for promotion purposes). The only difference between teachers and appraisers as far as the ranking of the factors was concerned was that whereas in the case of the appraisers they ranked the factors in the order they would consider them when dealing with a teacher's claim for promotion, the teachers ranked the factors according to the importance they thought appraisers attached to them for promotion purposes.

As shown in Table 8.1 (in part A) only 40 out of the 44 appraisers who took part in the study indicated that their work involved promotion of teachers. This means that only 40 appraisers (27 at the junior secondary level and 13 at the senior secondary level) ranked the factors under discussion. The table below shows how the factors were ranked by the appraisers.

Table 8.13 Appraisers' rankings of the factors considered by the GES for the promotion of teachers

	RANK(JSS)				RANK(SSS)			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th
	(Frequency)				(Frequency)			
1. Academic qualification	8	12	3	2	4	5	1	1
2. Age	0	0	0	0	0	0	0	0
3. Experience	1	3	12	3	1	2	5	3
4. Extra curricular act's	0	0	0	0	0	0	0	0
5. Personality	0	0	0	5	0	0	0	5
6. Professional qualifica.	17	9	1	0	6	1	4	0
7. Reports by head/HoD	1	2	6	10	2	4	0	10
8. Service to the com.	0	0	0	0	0	0	0	0
9. Teacher's self reports	0	0	0	0	0	0	0	0
10. Teaching skills	0	0	5	7	1	1	2	2
11. Other	0	1	0	0	0	0	1	1

Table 8.16 shows that at both junior and senior secondary levels, appraisers ranked *professional qualification* first more than they did any other factor. At the junior secondary level, 17(63.0%) out of the 27 appraisers who devoted part of their work to promotion ranked that factor first. The corresponding figure at the senior secondary school was 6(46.1%). *Academic qualification* was ranked second more than any other factor at both levels. *Experience* and *reports* (by head/HoD) were ranked third and fourth respectively in the same manner at both levels. The most popular set of rankings that emerged at both levels was professional qualification, academic qualification, experience and reports. Using the way these are numbered in the list above, the set that emerged was 6-1-3-7.

In addition to the percentages reported above, weights were used to calculate the choice score (CS) of each of the factors in the above list. To arrive at the CS for each factor, weights of 4,3,2 and 1 were used as multipliers of the frequencies of the first, second, third and fourth ranks of the factor respectively and the individual products summed up. For example, when the data for the two levels were combined, academic qualification was selected *first* 12 times (i.e. 8 at the junior level and 4 at the senior level) ; was selected *second* 17 times; *third* 4 times; and *fourth* 3 times. This means that the CS of academic qualification was $(12 \times 4) + (17 \times 3) + (4 \times 2) + (3 \times 1) = 110$. Similarly, the CS of professional qualification was $(23 \times 4) + (10 \times 3) + (5 \times 2) + (0 \times 1) = 132$. The CS of experience was $(2 \times 4) + (5 \times 3) + (17 \times 2) + (6 \times 1) = 63$; the CS of reports by head/HoD was $(3 \times 4) + (6 \times 3) + (6 \times 2) + (16 \times 1) = 58$; the CS of teaching skills was $(1 \times 4) + (1 \times 3) + (7 \times 2) + (9 \times 1) = 30$; the CS of personality was $(0 \times 4) + (0 \times 3) + (0 \times 2) + (5 \times 1) = 5$; and finally the CS other factors was 6. Each of the other 'unselected' factors had a CS of 0.

The table below gives the CS of all the factors.

Table 8.14 Appraisers' choice scores (CS)

Factor	CS
1. Academic qualification	110
2. Age	0
3. Experience	63
4. Extra curricular activities	0
5. Personality	5
6. Professional qualification	132
7. Reports by head/HoD	58
8. Service to the community	0
9. Teacher's self reports	0
10. Teaching skills	30
11. Other	6

The CS scores shown in the above table *confirmed* the appraisers' perceived order of importance of the factors reported in Table 8.16. This order was therefore used in conjunction with the above weights to calculate a "Standard" Promotion Perception Score (SPPS) which was then used to calculate each appraiser's promotion perception score (APPS). This is how the standard score was arrived at: *professional qualification* was assigned a weight of 4 - because it had the highest CS; *academic qualification* was assigned a weight of 3 - because it had the second highest CS; *experience* was assigned a weight of 2 - to reflect its CS; and using the same criterion, *reports* had a weight of 1. This resulted in SPPS of 10 (i.e. 4+3+2+1).

This means any appraiser who ranked the factors in the order : *professional qualification - academic qualification - experience - reports* , had APPS of 10. The APPS of other appraisers reflected their deviations from the "standard order". Specifically, professional qualification was assigned a weight of 4 only when it was ranked first. If it was ranked second, third or fourth, the corresponding weight would be 3, 2 or 1 respectively. Similarly, academic qualification was assigned a weight of 3 when it was ranked either first or second. If it was ranked third or fourth, the corresponding rank would be 2 or 1 respectively. In the same vein, experience was given a weight of 2 only when it was ranked first, second or third. If it was ranked fourth, it was given a weight of 1. Finally, reports attracted a weight of 1 provided it was ranked at all. It is important to point out that factors outside the four named above were each assigned a weight of 0. For example, the order 1-3-7-6 had APPS of 8 (i.e. less than 10) although all the four factors are involved; whereas the order 7-3-1-6- had APPS of 6; and the order 5-9-6-1 was given APPS of 3! The table below shows the APPS for the 40 appraisers whose work involved promotion of teachers.

Table 8.15 Appraisers' promotion perception scores

APPS	Junior secondary	senior secondary	Total
0	-	-	-
1	-	-	-
2	-	-	-
3	-	1	1(2.5%)
4	-	2	2(7.5%)
5	1	-	1(2.5%)
6	1	1	2(5.0%)
7	7	2	9(22.5%)
8	8	2	10(25%)
9	5	2	7(17.5%)
10	5	3	8(2.3%)
Total			40(100.0%)

As may be expected, very few of the appraisers had an APPS of less than the mid-point of the above range. If an APPS of more than 5 is taken as a *high score* and that of 5 or less is taken as a *low score*, then as many as 36(90%) of the appraisers whose work involved promotion of teachers had high scores. This high-low dichotomy is used below to describe the match or mismatch between appraisers' perception of promotion in the GES and that of mathematics teachers. It is interesting to note that 26(96.2%) of the junior secondary appraisers and 10(76.9%) of the senior secondary appraisers had high scores. The difference between these proportions was not significant, $\chi^2(1, N=40) = 1.8234, p>.20$. Thus, the appraisers at both levels had similar perceptions with regards to the factors the GES considers for promotion purposes.

As the appraisers were the ones who actually used the factors in promotion decisions, their "standard order" (described above) was used to calculate each teacher's promotion perception score (TPPS). The table below gives teachers' promotion perception score with their corresponding frequencies.

Table 8.16 Teachers' Promotion Perception Scores (TPPS)

TPPS	Junior secondary	Senior secondary
0	-	-
1	1 (0.5%)	2 (0.8%)
2	2 (1.0%)	4 (1.6%)
3	8 (4.2%)	3 (1.2%)
4	8 (4.2%)	10 (4.1%)
5	16 (8.3%)	15 (6.1%)
6	29 (15.0%)	31 (12.5%)
7	52 (26.9%)	64 (25.8%)
8	32 (16.6%)	66 (26.6%)
9	35 (18.1%)	40 (16.1%)
10	10(5.2%)	13(5.2%)
Total	193 (100.0%)	248 (100.0%)

For comparison purposes, the same high-low dichotomy used to describe appraisers' perception promotion scores above was used here. In other words, a TPPS of more

than 5 was taken as a *high score* and that of 5 or less was taken as a *low score*. Using this dichotomy, 158(81.9%) out of the 193 junior secondary teachers and 214(86.3%) of their senior counterparts, had high scores. As was obtained in the case of the appraisers, the difference between the two groups in terms of their scores was not significant, $\chi^2(1, N=441) = 1.2934, p>.25$.

As indicated above, the main objective of asking both the appraisers and teachers to rank the same factors was to investigate the difference between teachers and appraisers in terms of their perceptions of promotions in the GES. The use of the same SPSS to calculate the APPS and the TPPS made this possible by comparing teachers' scores with those of the appraisers. The frequencies of the various scores formed the basis of the comparison. The table below gives teachers' and appraisers' PPS (in bracket) with their corresponding frequencies.

Table 8.17 Teachers' and appraisers' Promotion Perception Scores (T/APPS)

TPPS (APPS)	Junior secondary	senior secondary
0	- (-)	- (-)
1	1 (-)	2 (-)
2	2 (-)	4 (-)
3	8 (-)	3 (1)
4	8 (-)	10 (2)
5	16 (1)	15 (-)
6	29 (1)	31 (1)
7	52 (7)	64 (1)
8	32 (8)	66 (2)
9	35 (5)	40 (2)
10	10 (5)	13 (3)
Total	193 (27)	248 (13)

As may be expected, at each level, the difference between the two "groups" was not significant. At the junior level, the proportions of teachers and appraisers with high scores were 81.9 percent and 96.9 percent respectively, and as mentioned above, the difference between these proportions was not significant at the 5% level. The chi-square value was 2.6294. At the senior secondary level, the high score proportions were 86.3 percent and 76.9 percent for teachers and appraisers respectively, also indicating no significant difference between the two "groups", $\chi^2(1, N=261) = .2872, p>.50$. Thus, at both junior and senior secondary levels, teachers' perception of the factors appraisers take into account when considering a teacher's claim for promotion appeared to be reasonably 'accurate'. Put differently, there was an apparent match between appraisers' perception and teachers' perception of the factors influencing promotion decisions in the GES. Thus the transparency criterion was met at both levels.

Also an interesting finding is that at both levels, teachers appeared to agree to the use

of the factors discussed above. Item 4 of the teacher questionnaire (Appendix A1) stated: *Please list the 4 most important factors which you yourself think should be taken into account when the Ghana Education Service is considering YOUR claim for promotion.* Nearly every teacher's list was the same as the list discussed above, suggesting that teachers were somehow happy about the use of the latter for promotion purposes. In sum, the criterion under discussion was met at both levels.

8.5.4 Multiple methods/instruments for data collection

The fourth criterion that may be used to examine the validity of TAG as a summative process is the use of multiple methods and/or instruments in the summative appraisal. Although this criterion may be a necessary requirement in both formative and summative appraisal, it is imperative that it is given consideration in summative appraisal. For example, when observations are used for formative purposes, a small number of observations of any of the teacher's lessons might produce profitable suggestions and discussion. As far as summative appraisal is concerned, the main objective of using multiple methods or instruments is to ensure that enough of the appraisee's work is sampled in order to avoid any adverse social consequences that can be traced to the (content) invalidity of the appraisal.

As Mehrens (1987) points out, high stakes decisions place greater demands on the quality of the data on which such decisions are based. In general, the more data that are collected the better the decision is likely to be. Multiple sampling may include using different assessors to measure the same construct. For example, different appraisers may observe a mathematics teacher's work before judgement is passed on her or his teaching 'ability'. It may also include a single appraiser making several observations of the teacher's work on different occasions. Following Mehrens (op. cit.) one can argue that increasing the number of observations of a teacher's classroom work could increase the reliability of the overall judgement on that teacher's teaching. Indeed, Rowley (1978) demonstrated that more observations do produce higher reliability in some classroom measures, particularly when the circumstances under which the observations are taken are relatively similar.

However, as Darling-Hammond et al (1983) point out, the relationship between the number of observations and reliability is not a simple linear one. It would appear that increasing occasions of observations increases reliability in different degrees, depending on the particular measure being measured. Even so, a small number of observations may not be representative of the teacher's performance to enable a summative judgement to be made on such performance.

Relating the above discussion to summative appraisal in the GES, it can be said that although gathering more data might not always result in better decisions, using a single observation of a teacher's lesson to make decisions about her or his promotion prospects might violate the deficiency criterion of the content validity of the observation. Even if one takes into account the cost of gathering data relative to the improvement in the decisions that may result from the data, it would still be reasonable to expect appraisers to observe a teacher's work more than once before they can pass any judgement on the work. This could at least improve the content validity of the observation.

Yet, as mentioned above, the present study showed that the promotion interview appears to be the only instrument used to collect data for the promotion of teachers to certain ranks in the GES. What is more, teachers are interviewed only once! Also at the junior secondary level, most teachers are observed just once. In fact, in all the cases I went round with the appraisers, the teachers were observed only once for periods ranging from 30 minutes to one hour. In other words, the appraisers' judgements were based on a single lesson in each case. Asked why this was the case, one appraiser said:

... I know one lesson is not enough but the problem is, we do not have time to sit and observe one teacher several times or longer than say 1 hour. We are supposed to supervise all the subjects in the curriculum and we are expected to go to all the schools in the circuit. In fact we are expected to be at all the places at the same time. This is very difficult. I remember there was a time - just last term - when we had the inspectors from headquarters, about nine of us would visit a school and each one had one aspect of the work to look at. During that time, we could see that our work was very effective. We spent just three hours in one school and we could do so much. The work we did in those three hours would have taken one person maybe three days to do. We don't have enough time to do our work properly. Another problem is mobility. Now at the (District) office, out of seven circuit supervisors, only Mr Hudu and myself have motorbikes. The rest have to rely on public transport and that is difficult. I wish we could find more time to do our work properly. Sometimes even if we use our own money for public transport, we are not reimbursed. Sometimes, you spend about 2000 cedis (about £1) on transport and the office will give only 1000 cedis (about 50 pence) or even less. We also have our problems but we are always told there is no money. What can you do?

It is clear that the above appraiser was aware that the rather low frequencies of observations invalidated the observation exercise, yet he did not seem to be in a position to do anything about it. The unfortunate situation is that a teacher's fate could depend on a single observation which could, for various reasons, go wrong! The

problem is exacerbated by the fact that the *observation form* (Appendix B9) the appraisers' use is too flexible to allow objective judgements to be made about a teacher's work. Of course, appraisers could argue that the teachers had completed promotion courses and that there is no need to observe their lessons many times. But can such a view be defensible? If the promotion examinations are capable of measuring 'good practice' then what are the observations for? There is clearly a validity problem here, and the Ministry of Education (1994) appears to indicate that this problem is caused by lack of money rather than by professional incompetence:

...circuit officers have been retrained and many have motor bikes, although the lack of recurrent funds for fuel has kept many from carrying out school visits. (Ministry of Education, op. cit., p.18)

A year or so after the above observation had been made, there did not seem to be any improvement in the transportation problems facing the officers. Considering that the majority of the appraisers are not well trained in the appraisal of mathematics teaching, there is no gainsaying that appraisals for promotions in the GES leaves a lot to be desired! This situation appears to have affected the morale of some of the appraisers. One appraiser remarked:

I have decided not to take part in promotion inspections anymore...I inspected the work of a teacher who was due for promotion...the lesson was on quadratic equations in JS3 (junior secondary form 3)..The lesson was so poor...I asked him to prepare the lesson and teach it again not on the same day....I said he should prepare and invite us to see the lesson again. When I came back to the office, I informed the AD (Assistant Director) about this teacher...I was in the office two weeks later when this teacher came in to collect his letter of promotion....No, he didn't teach the lesson again and I don't know who recommended him for promotion. That wasn't the only time this had happened. When I suggest that a maths lesson wasn't taught well and that the teacher concerned should not be promoted, I don't hear anything again from anybody...The next time I see the teacher in the office I know he has come to collect his letter of promotion...

This appraiser happened to be the only mathematics specialist among a team of 8 circuit officers in one of the districts sampled. Perhaps his colleagues did not always share his view about how mathematics should be taught. In fact, after going round with officers in this district to see how they do their work, I came to the conclusion that the appraiser under discussion was not exaggerating! He made it clear to me that he had decided to visit schools in his circuit only to help teachers, especially mathematics teachers, to improve their work. The only part of his work which he thought was associated with promotion was his participation in the courses run for teachers to enable them pass the promotion examinations in mathematics.

To summarise the discussion so far, the evidence provided (with regard to summative appraisal in the GES) seems to suggest that the data about mathematics teachers which are used for promotion in the GES are being collected by observers with very little or no expertise in the collection of such information. This problem is aggravated by the flexibility of the *observation form* (Appendix B9) and logistics problems in the GES. Lack of resources has meant that although classroom observation remains the main way of collecting information about teachers' work at the junior ranks, some appraisers are usually not in the position to visit a teacher more than once before judgements are passed on their work. Finally, promotions at the senior ranks appear to be done in a rather haphazard manner since some of the questions teachers are asked in the interviews bear very little or no relevance to their work as mathematics teachers.

8.6 Conclusion

In the first part of this chapter, I discussed the validity of the teacher appraisal system in Ghana as a formative process - designed to help mathematics teachers improve their work. I did this by specifically comparing teachers' and appraisers' perceptions of the appraisal process as a tool for professional development as well as by comparing how formative appraisal is done in the GES with the theoretical framework discussed in chapter 4. The data suggested that mathematics teachers and appraisers both agreed that the latter were not always well trained to be able to identify teachers' professional needs in order to help them improve their work.

It was also argued that the use of the appraisal system for both formative and summative purposes (using the same appraisers) coupled with other social factors made it difficult for both teachers and appraisers to see members of the other group as colleagues. This appeared to make it difficult for appraisers to conduct formative appraisal in a friendly atmosphere. In other words, the atmosphere within which formative appraisal is conducted particularly at the junior secondary school did not appear to encourage mathematics teachers to reveal their professional needs to their appraisers mainly due to the appraisers' dual role as both "judges" and "coaches". Some teachers might have hidden their professional needs for fear that appraisers might use those needs for summative decisions.

Perhaps the main finding as far as formative appraisal is concerned was that the lack of expertise among appraisers with regard to mathematics teaching and its appraisal meant that only two of the criteria discussed in the theoretical framework could be seen to be

met by the appraisal system. Put differently, appraisers' lack of expertise meant that teacher appraisal in Ghana as a formative process did not 'fit' the theoretical framework. This led to the conclusion that teacher appraisal in Ghana as a formative system is far from valid.

The second part of the chapter looked at the validity of the appraisal system as a summative process. Here too, similar findings were made with regard to mismatch between the theoretical framework and how summative appraisal is done in the GES, although with regard to teachers' and appraisers' perceptions about promotions in the GES, teachers appeared to be clear about the factors appraisers use in determining a teacher's promotion prospects and appeared to agree with those factors.

Specifically, the gathering of information about mathematics teaching was being done by observers with very little or no expertise in the collection of such information. Not only that, lack of resources meant that although classroom observation remains the main way of collecting information about teachers' work, appraisers are not able to visit mathematics teachers as often as they should do before passing judgements on their work. At the senior ranks, the promotion interview appeared to be the only instrument used to decide teachers' fate. The way the promotion interviews are done clearly violates the content validity criteria of deficiency. The implication is that appraisers might not be able to measure accurately the construct (i.e. 'good' practice) underlying summative appraisals in the GES. As Lehner (1979) points out, 'scores' produced by inaccurate observations can hardly be valid. Indeed, as the validity of any appraisal system is at least the total validity of the observations, scores and instruments employed in the system (Black & Champion, 1976; Johnston & Pennypacker, 1980), the above findings lead to the tentative conclusion that the validity of teacher appraisal in Ghana leaves much to be desired. It is perhaps worth pointing out that as both formative and summative aspects of the teacher appraisal system in Ghana were found to be invalid, it is difficult to find out which aspect of the appraisal system influences teachers' perception of TAG most. Such investigation could be the subject of a future study.

The next chapter draws on all the evidence presented in chapters 7 and 8 as well as any other relevant evidence, such as the analysis of official documents as well as the literature on the teacher appraisal system in Ghana, to make final conclusions about the appraisal system in the Ghana Education Service. The chapter will also make recommendations as to how the appraisal system could be improved to help mathematics teachers improve their work.

CHAPTER NINE

CONCLUSIONS

9.1 Introduction

In this chapter, I will review the aims of the study and the methods employed in pursuance of those aims. I will also review the main findings of the present study as well as those of the studies that informed the former. As is done in other similar studies, I will both acknowledge the limitations of the study and suggest ways of improving the present teacher appraisal system in Ghana. Finally, I will assess the contribution of this study to mathematics education and make suggestions for future research.

To begin with, it is important to recall the aims of the study. These aims were stated in chapter 1. In that chapter it was mentioned that the study aims to:

- a) identify the nature and purposes of Teacher Appraisal in Ghana (TAG);
- b) examine the validity of existing methods of TAG specifically by:
 - i ... examining the potential of the appraisal system to help mathematics teachers improve their teaching of mathematics;
 - ii... finding which variables are significantly related to Ghanaian secondary mathematics teachers' views of teacher appraisal in Ghana and its ability to help them improve their teaching of mathematics;
- c) identify the implications of any changes in the existing teacher appraisal systems for Ghana's educational policies.

As a starting point of the present enquiry, I looked at the development of education in Ghana, concentrating on the current education reforms programme (chapter 2). The programme was introduced in 1987 to halt the deterioration of the education system following the decline of Ghana's economy in the mid-1970s. The programme focused on reducing the length of pre-university education from 17 to 13 years and at the same time improving the quality and relevance of education. One of the measures adopted in pursuance of the above goals was the 'rejuvenation' of the teacher appraisal system in order to help improve teaching quality, and consequently improve pupil learning. It was the aim of the present study to assess the ability of the appraisal system to help mathematics teachers improve the quality of their teaching.

Having identified what the enquiry was about, I reviewed the relevant literature on performance appraisal both within and outside education. A summary of the review is given below.

9.2 The Literature Review

As one of the methods of assessing the ability of teacher appraisal in Ghana (TAG) to help mathematics teachers improve their work was to look at teachers' perceived validity of the system, I first reviewed the literature on employees' perceptions of the support they receive from their respective organisations. I then went on to look at a review of the literature on teacher appraisal generally as most of the studies on teacher appraisal did not concentrate on teachers of specific subjects (chapter 3). Nevertheless, I also made an attempt to relate the general teacher appraisal studies to the appraisal of mathematics teaching by drawing on studies on mathematics teacher education (e.g. Leinhardt, 1989). Therefore, important studies as far as the present study is concerned were:

- i) those concerned with employees' perceptions of the support they receive from their respective organisations ; and
- ii) those that investigated the relationship between mathematics teachers' content and pedagogical content knowledge and their teaching of mathematics.

The findings of the relevant studies are summarised below.

Studies relating to perceived organisational support

It was mentioned in chapter 5 that perceived organisational support refers to employees' evaluations of the extent to which the organisation values their contributions and cares about their welfare. Both outside and within the field of education, such perceived organisational support was found to correlate with improvement in employee job performance. For example, O'Reilly and Chatman (1986) found a positive correlation between perceived support and job performance. Mowday et al (1982), like O'Reilly and Chatman, also found that positive perceived organisational support led to employees' strong involvement in the organisation which included performance that went beyond the employees' contracted obligations. Still outside the world of education, Buchanan (1974) also found a positive correlation between perceived support and commitment to the organisation.

It may be observed that in all the above studies, positive perceived support was found to lead to actions for which the individual received no immediate reward but which benefited the organisation as a whole.

In education, Eisenberger et al (1986) found perceived organisational support to be positively related to job attendance among private high school teachers. In a later study, Eisenberger et al (1990) confirmed that perceived support was associated with job performance. Similar findings were made by Bidwell (1955) who concluded that teachers who saw the behaviour of a school administrator as being consistent with their expectations were more committed than those who thought the administrator's behaviour did not match their expectations. Montgomery (1984) also found an improvement in teacher performance as a result of teachers' positive perceptions of a teacher appraisal system.

Finally, in two recent studies on school teacher appraisal (Barber et al, 1995 ; Wragg et al, 1996), the researchers reported that school teacher appraisal in the U.K. had positive impact on teacher performance. In both studies, the researchers reported that the teachers who took part in the study were generally happy about the appraisal system being studied. On the other hand, both Bame (1991) and Nyoagbe (1993) reported that the teacher appraisal system in Ghana left much to be desired. Both researchers reported that teachers were not very happy about the appraisal systems in Ghana. Thus in all the above studies in education, the researchers' conclusion about the impact of the appraisal system reflected the teachers' perceptions of the system.

Relevant studies in mathematics education

With regard to mathematics education, Brown and Borko (1992) examined a number of the studies (e.g. Livingston & Borko, 1989) of expert and novice teachers in mathematics and science. They concluded that the studies provided a fairly consistent set of findings and conclusions about differences in (mathematical) content knowledge, (mathematical) thinking and action in the (mathematics) classroom. In most of the studies that Brown and Borko (op.cit) reviewed "expert teachers displayed more pedagogical knowledge, content knowledge and pedagogical content knowledge than novices" (213). In one of such studies, Leinhardt (1989) found that expert teachers had plans which contained more detailed information, spent less time in transitions from one lesson component to the other and more consistently distributed their time among lesson components. Experts were also found to give better explanations of new materials in that they contained more critical features and fewer errors. Novices, on the other hand, often did not complete their explanations.

Furthermore, Yen (1991) observed that findings from several of the research on the expert - novice paradigm confirm the importance of strong preparation in the 'content' of one's subject area prior to the teaching of the subject. Finally, Carter et al (1987) concluded

that mathematics and science teachers' levels of expertise are associated with their classroom practices . Expert teachers were found to be more efficient than novice teachers.

Relating the findings of the *expert-novice* studies to the appraisal of mathematics teachers, it was concluded that the professional development of mathematics teachers depends to a large extent on the expertise of those who provide them with professional support. That is, the potential of an appraisal system to help mathematics teachers improve their teaching of mathematics depends on their appraisers' expertise in mathematics, its teaching and its appraisal. Put differently, the validity of formative appraisal of mathematics teachers rests heavily on the mathematics expertise of their appraisers, as appraisers who are 'novices' in mathematics and its teaching can offer little or no help to mathematics teachers generally and to 'expert' mathematics teachers in particular.

MAIN FINDINGS AND DISCUSSION

The main findings of the study are organised into four sections according to the (sub)aims of the study. The first section focuses on the findings relating to the purposes of teacher appraisal in Ghana; the second section concentrates on the findings relating to the validity of TAG as a formative process; the third section looks at the findings relating to TAG as a summative process ; and finally, the fourth section discusses the findings regarding the variables which are related to mathematics teacher's perceptions of teacher appraisal as a formative process .

9.3 Expressed Nature and Purposes of Teacher appraisal in Ghana

Throughout this thesis, the two main purposes of appraisal have been identified as formative and summative. Formative appraisal aims at the professional development of the teacher by identifying the latter's areas of needed improvement and providing her/him with the opportunity to improve those areas. Summative appraisal on the other hand, aims to assess the teachers' performance with a view to making decisions about promotions, merit pay and/or dismissals.

The literature on teacher appraisal in Ghana indicates that the appraisal system is designed to serve both purposes. This dual role of the appraisal system has recently been confirmed by the Ministry of Education:

“It is clear that for there to be improved learning, teachers must be made to feel accountable. The first responsibility for this lies with the school headteacher ... and at the next level, with circuit supervisors and district officials ... What is needed are management and supervisory methods which on (the) one hand strengthen the hand of discipline against headteachers and teachers who are not performing, and on the other hand, recognise, support and develop those headteachers and teachers who are doing well. (Ministry of Education, 1994 , p.18)

The dual role of the appraisal system often creates confusion as teachers are most of the time not aware of what purpose they are being appraised for. This confusion appears to confirm the fears of writers like Powney (1991) who hold the view that no appraisal can serve both purposes. Bame (1991), for example, comments on the dilemma the dual role poses in the Ghanaian education setting:

We noted that (the) majority of both the teachers and headteachers acknowledged the usefulness of some aspects of the supervision carried out by officials, in that it helped teachers to improve their teaching. But at the same time they indicated that in the course of the supervision the officials always tried to find fault with, and more often than not give unfair criticisms of teachers’ work and often failed to offer teachers ideas and practical demonstrations which would help them in their teaching. (Bame, op. cit., pp.114-115)

The present study also found that in line with the Ministry of Education’s stand on appraisal, the system was, at the time of the study, being used for both staff development and the assessment of performance for promotion and other related purposes. In fact, not only was the appraisal system used for both accountability and professional development purposes, the same set of officers were used for both purposes. As shown below, this clearly invalidated the appraisal system.

9.3.1 Methods of appraisal

Chapter 3 discussed the pros and cons of the various methods of appraisal and concluded that a mixture of methods would go a long way to strengthen the validity of the appraisal as no single method can validly ‘assess’ the teacher’s work for all purposes. As Whyte (1986) rightly observes, “... joint or multi-assessment (of performance) offers the advantage of triangulation, or several different and independent views of the same individual’s performance” (p.153).

The present study found in confirmation of Gokah’s (1993) observation that only the managerial appraisal method was being used in the appraisal of mathematics teachers in

9.4 Potential of Teacher Appraisal in Ghana

The extreme difficulty in divorcing teachers' perceived validity of teacher appraisal in Ghana (TAG) as a formative process from their perceived validity of TAG as a summative process was pointed out in chapter 7. This difficulty meant that teachers' perceived potential of TAG to help them improve their work may have been influenced by their perceptions of TAG as a summative process. In spite of the above difficulty, an attempt was nevertheless made to examine separately the validity of TAG as a formative process and its validity as a summative process.

It was hoped that the separate examination of the validities of the two purposes would throw more light on teachers' perceptions of the appraisal system as a formative process. The summary of the findings are given in the next two sections.

9.4.1 Teacher Appraisal in Ghana as a formative process

Four main criteria for formative appraisal were used to examine the validity of TAG as a formative process. The criteria were derived from research on teacher effectiveness generally and those on mathematics teaching effectiveness in particular. The criteria which were discussed in chapter 4 are given below.

- i) The appraiser of mathematics teaching should know both mathematics and its teaching and should be trained in the appraisal of mathematics teaching.
- ii) The criteria employed in the appraisal of mathematics teachers ought to reflect the construct (i.e. mathematics teaching effectiveness) that is being measured.
- iii) Formative appraisal must be conducted in an atmosphere that would encourage the teacher to reveal her or his professional needs.
- iv) Feedback on observed lesson(s) should be a vital part of formative appraisal.

Two out of the four criteria [i.e. criteria (ii) and (iv)] were met by the appraisal system. That is, the appraisers seemed to consistently apply a set of criteria which reflected the above construct the system ought to measure. They also did (and were seen to) give feedback to teachers immediately after observation of their lessons.

The first criterion (i) was not met because most of the appraisers seemed to lack the expertise in mathematics and its teaching. Of the 44 appraisers sampled, only 8 (18.8%) were mathematics specialists and only 9 (20.5%) including the latter thought that they

were well equipped to be able to help mathematics teachers improve their teaching of mathematics. The majority of the appraisers thought they would need help (e.g. from their mathematics specialist colleagues) before they could help secondary mathematics teachers improve their work.

The third criterion (iii) relating to the atmosphere within which formative appraisals are conducted was not met because the same set of appraisers were used for both formative and summative appraisals. This meant that teachers felt rather uneasy anytime they saw the appraisers in their schools. Teachers therefore might feel reluctant to reveal their professional difficulties to the officers for fear that such difficulties might be used for summative purposes. This finding confirms Duke's (1990) observation that using the same appraisal scheme for both summative and formative purposes creates tensions between the two purposes and tends to confuse teachers as to what the purpose of the appraisal is. Duke (op. cit.) therefore argues that it is essential to completely separate growth-oriented (i.e. formative) and accountability-based (i.e. summative) appraisals. *As far as the present study is concerned, the appraisal system's failure to meet two of the four criteria listed above led to the conclusion that the formative aspect of the teacher appraisal system is not valid.* In other words, the system as it stands cannot help mathematics teachers to develop professionally.

9.4.2 Teacher Appraisal in Ghana as a summative process

As in the case of the examination of the validity of teacher appraisal in Ghana as a formative system, four criteria were identified as those that a valid summative teacher appraisal system might include. The criteria were:

- i) The appraiser should be (seen as) a credible person in terms of mathematics teaching expertise.
- ii) Most if not all of the teachers' work should be covered in the appraisal.
- iii) The criteria used in the appraisal should be transparent.
- iv) Multiple methods/instruments should be used for data collection.

Here, only one of the four criteria (i.e. criterion iii) was met by the appraisal system at both levels. Both groups of teachers as well as appraisers were clear about the factors appraisers take into account when considering a teacher's claim for promotion. Furthermore, teachers were clear about, and agreed to, the order of importance appraisers attach to the above factors. However, the other three criteria were not met, particularly at the senior secondary level. This is because the gathering of information about

mathematics teaching was being done by appraisers who lacked the expertise for making summative judgements about mathematics teaching. The credibility of appraisers in collecting data for summative purposes was therefore questionable.

Besides, lack of resources meant that judgements were usually passed on teachers' work after one or two hours of observation. Additionally, the promotion interview which provided the only route to the ranks above senior superintendent did not sample enough of the mathematics teacher's relevant work. Interviewers tended to avoid asking mathematics teachers questions about their classroom practice. This means that most part of the mathematics teacher's work was not covered by the interview.

Regarding the fourth criterion (iv), the different methods used at the junior secondary level for promotion purposes (i.e. courses, inspections and examinations) suggested that the criterion was met at that level. However, at the senior secondary level, the only 'method' used to collect information about teachers' work was the promotion interview. Thus the criterion under discussion was violated at the senior secondary level. In any case, the inability of the system to meet all the four criteria weakened its validity.

As in the case of TAG as a formative process, it was concluded that the teacher appraisal system's ability to measure teachers' work and reward (or punish) them accordingly left much to be desired. The implication is that some teachers who might deserve promotion might not be promoted. Similarly, teachers who may not deserve promotion may get promoted. In sum, it was concluded that TAG as a summative process is not valid.

9.5 Variables Related to Perceived Support.

It was concluded in chapter 3 that different categories of teachers might perceive the impact of teacher appraisal differently. In an attempt to investigate the above conclusion, seven hypotheses were formulated and tested. The tests indicated that mathematics teachers' perceived validity of teacher appraisal in Ghana (TAG) as a formative process varied across different categories of teachers. The above conclusion was therefore supported by the present study.

The hypotheses used in the investigations as well as the results obtained by testing them are summarised below.

Hypothesis 1 stated: *At both the junior and senior secondary levels, mathematics teachers who have been appraised will be more positive about the potential of teacher*

appraisal in Ghana to help them to improve their teaching of mathematics than those who have not been appraised.

Considered separately, this hypothesis was supported at the junior secondary level but not at the senior level. At the latter level, although appraisal experience was significantly related to perceived support, the predicted direction was reversed. Senior secondary mathematics teachers who had been appraised were less positive about the potential of TAG to help them improve their teaching of mathematics than those who had not been appraised. This result signalled a difference between the two (i.e. junior and senior secondary) groups of teachers in their perceptions of TAG as a formative process. This difference showed in all the other results.

Hypothesis 2 stated: *At both the junior and senior secondary levels, mathematics teachers who were last appraised by GES officials will be less positive about the potential of teacher appraisal in Ghana to help them to improve their teaching of mathematics than those who were not last appraised GES officials.*

When this hypothesis was considered separately, it was supported at the senior secondary level but not at the junior level. Here too, although the last appraisal source was significantly related to perceived support at both levels, the predicted direction was reversed at the junior secondary level. The results here not only confirmed the emerging difference between the two groups, they reflected the high correlation between appraisal experience and last appraisal source. As mentioned above, the majority of the respondents who had been appraised were last appraised by GESOs. This suggested that the last appraisal source acted as proxy for appraisal experience. Thus the results obtained in Hypothesis 2 merely confirmed those obtained in Hypothesis 1.

Hypothesis 3 stated: *At both junior and senior secondary levels, mathematics teachers who have been trained as appraisees will be more positive about the potential of teacher appraisal in Ghana to help them to improve their teaching of mathematics than will those who have not been so trained.*

This hypothesis was not supported at either level. Null results were obtained at the junior level whereas the direction of the relationship obtained between training and perceived support at the senior secondary level was opposite to the one predicted. The negative relationship between training and perceived support at the senior level both confirmed the difference between the two groups and reflected the high correlation between training and appraisal experience. Indeed when the data were controlled for appraisal experience, there was no relationship between training and perceived support in either the appraised

or the non-appraised category. Furthermore, when multivariate procedures were used to investigate the relationships between the variables used in the hypotheses, no direct relationship between training and perceived support was found.

Hypothesis 4 stated: *At both junior and senior secondary levels, more experienced mathematics teachers will be less positive about the potential of teacher appraisal in Ghana to help them to improve their teaching of mathematics than less experienced ones.*

This hypothesis was initially supported only at the senior secondary level. Null results were obtained at the junior secondary level. Here too, the results both confirmed the difference between the two groups of respondents and reflected the correlation between appraisal experience and mathematics teaching experience. Again, here too when the data were controlled for appraisal experience, null results were obtained in both the appraised and the non-appraised categories. The multivariate analyses revealed that any relationship between mathematics teaching experience and perceived support was of indirect nature through rank (discussed below). Also the predicted relationship between mathematics teaching experience and professional status (also discussed below) was supported by the multivariate analyses. This means that the apparent relationship between mathematics teaching experience and perceived support at the senior secondary level (before the data were subjected to multivariate analyses) was to some extent due to the correlations *between* mathematics teaching experience *and* appraisal experience, rank and professional status.

Hypothesis 5 stated: *At the senior secondary level, mathematics teachers with higher rank will be less positive about the potential of teacher appraisal in Ghana to help to improve their teaching of mathematics than teachers with lower rank.;*
whereas at the junior secondary level, mathematics teachers with higher rank will be more positive about the potential of teacher appraisal in Ghana to help to improve their teaching of mathematics than teachers with lower rank.

This is the only hypothesis which predicted a difference between the two groups of mathematics teachers and it is the only hypothesis which was supported in its entirety at both levels. Also the multivariate analyses revealed that rank was the only variable which was directly related to perceived support at both the junior and senior levels.

At the junior level, the relationship between rank and perceived support was still positive (whereas it was still negative at the senior secondary level) after the multivariate analyses. At both levels, rank qualified for inclusion in the discriminant analysis. At the junior

secondary level it combined with last appraisal *source* to classify correctly and significantly 72 percent of the respondents into mathematics teachers who were positive about the potential of TAG as a formative process and those who were negative.

At the senior secondary level, the two variables (professional status and rank) were the only variables which qualified for inclusion in the discriminant analysis. The two variables, between them, classified correctly and significantly, 67 percent of the respondents into mathematics teachers who were positive about TAG as a formative process and those who were negative. The results thus confirmed the difference between junior secondary and senior secondary mathematics teachers in their perceptions of TAG as a formative process.

Hypothesis 6 stated : *At both junior and senior secondary levels, female mathematics teachers will view the potential of teacher appraisal in Ghana to help them to improve their teaching of mathematics differently from male mathematics teachers.*

This hypothesis, like Hypothesis 3, was not supported at either level. Null results were obtained at both levels indicating that the study found no gender differences in perceived support. The results were confirmed in the multivariate analyses.

Hypothesis 7 stated : *At both junior and senior secondary levels, professional mathematics teachers will be less positive about the potential of teacher appraisal in Ghana to help them to improve their teaching of mathematics than will non-professional mathematics teachers.*

This hypothesis was fully supported at the senior secondary level but not at the junior secondary level. Null results were obtained at the latter level. Even when the data was controlled for appraisal experience at the senior secondary level, professional status still correlated strongly with perceived support in both the appraised and non-appraised categories of mathematics teachers. Also the multivariate analyses indicated that, like rank, professional status affected perceived support directly at the senior secondary level. It also affected perceived support indirectly through rank. When the data for the two levels were combined, professional status emerged as the single most important determinant of teachers' perceived support, classifying correctly and significantly, 68 percent of the respondents into the above positive-negative "groups". The emergence of professional status as one of the most important determinants (if not the most important determinant) of mathematics teachers' perceived validity of the appraisal system was confirmed by the interviews. Only 4 out of the 17 professionals interviewed were positive about the potential of TAG as a formative process. This ("positive") figure was

lower than any one obtained by comparing teachers who were positive about TAG and those who were negative in the various categories. Thus, the professional teachers interviewed were the category of teachers who were most negative about TAG's potential to help them improve their teaching of mathematics.

This means that in spite of the fact that the GES aims to use the appraisal system to help teachers improve their practice, professional mathematics teachers did not think the appraisal system could help them improve their teaching of mathematics. This finding clearly provides support for the conclusions reached above about the lack of mathematics expertise among the appraisers tending to invalidate the teacher appraisal system in Ghana.

9.6 Implications of changes in the Teacher Appraisal System in Ghana

It seems appropriate, at least in view of the aim of identifying the implications of any changes in the existing teacher appraisal systems for Ghana's educational policies, to quote the present Ghanaian government's proclaimed policy on education. This is the policy being pursued as part of the country's co-ordinated programme of economic and social development policies for the preparation of the 1996-2000 Development Plan.

The overall goal of education policy is to ensure a population in which all citizens, men and women alike, are at least functionally literate and productive. In addition, the education system will have major responsibility for providing the means for our population to acquire the necessary skills to cope successfully in an increasing(ly) competitive global economy.

Success in achieving these objectives will require efficient resolution of the problems that are generally plaguing the education system, particularly at the basic level. These include: poor quality of instruction; shortages of qualified teachers; inadequate facilities and instructional materials; weak administration and management; and limited access, especially for the poor and females. Thus, in the medium term, the education programme will focus on improving the quality of, and increasing access to basic and secondary education. Overall, the medium-term goal will be to establish a firm foundation for re-orienting the entire education system toward the promotion of creativity, science and the acquisition of more flexible basic skills. (Republic of Ghana, 1995, p.50 , original emphasis)

The document containing the above quote also emphasised the "determination" of the government "to upgrade the quality of all teachers at all levels (as well as) increase emphasis on science and technology..."(ibid). These objectives constitute a great challenge to the Ghana Education Service (GES) - which is the body responsible for identifying the professional needs of teachers in order to help them improve the quality of

their teaching thereby raising the quality of pupil learning. They constitute a great challenge not only because of the “problems that are generally plaguing the education system”, but because the present Education Minister has stressed his desire to ensure the achievement of the above goals.

Indeed there has been increased emphasis on science and technology as the key to the national economic recovery programme. Not only that, females are being encouraged to take up courses in science. For example, in his opening address on the occasion of the seminar organised by the Ghana Academy of Sciences on the state of science education in the country (Appendix B12), the Minister highlighted the aims of the Science, Technology and Mathematics Education (STME) programme:

The prevalent notion in our society that studying science, mathematics and technology related subjects and taking up occupations in those fields is the preserve of males is being combated to reverse the notion. The STME programme under which clinics and other activities are organised for girls in basic schools and senior secondary schools and female teachers in teacher training colleges to encourage and motivate them to study science, mathematics and technology related subjects and take up careers in them has been instituted (Sawyer, 1995, pp. 6-7).

Indeed, STME clinics have become a regular affair. Every year between 150 and 200 female students are selected to attend the clinic which lasts about two weeks. As Quaisie (1995) observes, during the two-week clinic the participants interact with female scientists brought in as role models. The students also visit the science departments of the various institutions of higher learning (i.e. the universities and polytechnics) as well as industries and scientific research institutions to see how science is applied in the world of work. The part mathematics is thought to play in all this (i.e. in the application of science and technology) has been highlighted by many writers as well as politicians. For instance, in a report on the first STME workshop held in Accra in January 1987, Harding argued that:

...There is the increasingly important place that science and technology assume in our view of the world and national economic development and survival....Mathematics, in these terms, is an essential tool for the development of both science and technology (Harding, 1987, p.6 my emphasis).

In spite of such pronouncements and actual activities which seem to highlight the importance of mathematics as a school subject, many mathematics teachers in Ghanaian secondary schools are teaching the subject with little or no training in the teaching of mathematics. These teachers, as well as their trained counterparts, are not being given the professional help they need to enable them help pupils learn the subject effectively

and in an efficient manner especially at a time when the period for pre-university education in Ghana has been cut by about four years.

Thus, the GES does not seem to live up to expectation as far as the raising of teaching standards in mathematics (through the appraisal process) is concerned. As mentioned above, many GES officials who appraise mathematics teachers have little or no training in secondary school mathematics teaching or its appraisal, yet they are required to “help” mathematics teachers improve their work. It would be extremely difficult if not impossible for the system of appraisal in the GES (in its present form) to identify which mathematics teachers need professional help, let alone to help them improve their work. This means that in order to help mathematics teachers improve their work, the present (appraisal) system should of necessity be changed.

Important questions to ask here then are: how can the appraisal system be changed to accomplish the task of identifying teachers who need professional help in order to help them improve their teaching of mathematics? What is/are the implication(s) of such changes for Ghana’s educational policies? These are the questions that this section attempts to answer.

It is important to point out that the findings of the present study suggest that teachers who would need help most were the ones who seemed to be positive about the (invalid) appraisal system in its present form. One reason for this irony is arguably the lack of mathematics teaching expertise among those who were generally happy about the system as it stands presently. It may be argued further that it is this lack of expertise (and confidence?) that made these teachers fail to identify the weaknesses of the appraisal system. In other words, the main variable that caused teachers to make the right or wrong decisions about the validity of the appraisal system was their professional status. It follows, in the light of the weaknesses of the system, that mathematics teachers who were negative about the system’s ability to help them improve their work were right in their judgements about the system. The implication is that the views of teachers who were negative about the system can at least help show the direction in which any changes to the present appraisal system should be made.

It must be emphasised however, that knowing (rightly?) that the system of teacher appraisal in Ghana is not valid, and improving your teaching quality are two different things. Professional mathematics teachers may have noticed the lack of mathematical expertise among their appraisers but this knowledge cannot on its own help them to improve their work. In fact, such knowledge can even lead to complacency! Thus, both professional and non-professional mathematics teachers may need help even if the latter

may need more help. A number of ways of providing teachers with the opportunity to improve are suggested below.

1. There is the need to put more emphasis on formative appraisal. This will require a shift from the present emphasis on 'accountability' to professional development. Surely, one does not grow taller simply by being measured constantly. Indeed, both Nyoagbe (1993), and Bame (1991) recommended that there should be restructuring of the supervisory relationship between officials and teachers. They both urged officials to show educational leadership by suggesting new ideas to teachers and by practical demonstrations which will help the teachers discover alternative means of improving their work. This view was shared by most of the mathematics teachers who took part in the study, especially those at the senior secondary level. The majority of the (senior secondary) teachers expressed the need for professional support through formative appraisal processes conducted by competent officials who are capable of raising their confidence in the teaching of the subject.

2. Another way of achieving improvements in the appraisal system is to examine the duties of the appraisers and identify what help can be given to them to enable them help teachers to improve their work. Obviously, the duties of the headquarters, regional and district inspectors/supervisors described in chapters 2 and 6 give a clear picture of the training needs of these people. As far as the appraisal of mathematics teaching is concerned, these officials ought to be conversant with the teaching of mathematics at the pre-tertiary level of the education system. Admittedly, it would be extremely expensive to appoint supervisors subject by subject, yet if the emphasis the government is putting on mathematics, science and technology is to translate into real gains in these fields, then there is the need to train professionals who would help teachers in these areas. Such professionals when appointed should go through a period of intensive training during which time they would be exposed to different uses of appraisal and how they can be applied to suit local conditions. In addition to the pre-service training, they must be given the opportunity to attend international courses and conferences on appraisal both at home and abroad. This can go a long way to boost their confidence in supervision generally and the appraisal of mathematics teaching in particular. Such training programmes can also enhance their image thereby increasing the credibility of the appraisal judgements they make.

3. One important observation regarding the conditions of service of inspectors and supervisors was the problem of transportation. As most of these officers work in the field, the problem of transportation makes it virtually impossible to perform their duties effectively. This problem seriously limits the scope of operation of the officers,

particularly their ability to search for vital information that would enable them to help teachers in need of professional help. In fact, officers have had to travel under circumstances which are not only of great inconvenience but also of great risk to their lives. For instance, I had to walk over six kilometres with two officers on a 'quiet' bush path in order to see the work of a teacher who was due for promotion. We arrived at our destination far behind time to our embarrassment. One of the officers said such lateness was a regular occurrence and that he walked longer distances on far more 'lonely' roads. This was because vehicles to some of the villages in his circuit were not regular. There is indeed an urgent need for a review of the transport arrangement for inspectors and supervisors. Surely, it is uneconomic and wasteful to deny officers whose professional effectiveness is wholly dependent on their being mobile, the means of effective transportation system or the necessary funds for travelling to honour their assignments.

4. Another important observation is that, the findings of the present study call for the reintroduction of mathematics and science *organisers* at the district offices. These organisers were redeployed as part of the reform programme. Many of them are now in charge of the Basic Education Certificate of Education examinations, serving as links between the district offices and the West African Examinations Council. This redeployment has clearly led to a waste of vital "resources"! These specialist officers ought to be responsible for the professional development of junior and senior secondary mathematics and science teachers whereas the present supervisors would concentrate on the general administration of schools by heads and deal with matters relating to allocation and uses of educational facilities.

This means that the organisers must be very well qualified and experienced teachers some of whom may even be drawn from the universities. Should the circuit supervisors need information about mathematics teachers' professional needs, they should collect such information from the mathematics organisers, who will only give such information with the teachers' consent. This will ensure that different sets of officers are used for different purposes of appraisal. This means that mathematics specialists who are employed as interviewers at promotion interviews should not be used for formative appraisals. If it becomes necessary to use such officers for formative appraisals, they should *not* appraise the same teachers for both purposes.

5. With regard to appraisal for promotion and other summative purposes, the GES should train officers who would be able to 'assess' teachers' performance accurately, especially if such assessment would be needed for such summative purposes. Most importantly, the promotion interviews should reflect the type of work teachers do in their classrooms as such a move could encourage teachers to learn more about what is expected

of them as mathematics teachers. It appears that one of the reasons why appraisers at promotion interviews do not attempt to ask mathematics teachers any questions about the subject is their lack of confidence in the subject. This means that if the promotion interview is to reflect mathematics teachers' classroom work, then those who interview them must be mathematics specialists who would understand the various problems facing mathematics teachers in the secondary schools. As mentioned above, such specialists should not be used for formative appraisals especially of the same teachers whom they appraise for summative purposes.

6. Finally, an important change is to integrate individual appraisals with school development planning and in-service training. The current appraisal system focuses on the individual teacher. It is used mainly to influence the performance of individuals without paying due regard to the overall development of the environment within which they work. School-based appraisals will not only help improve teachers' individual work, it would encourage teamwork which could in turn improve the environment within which teachers work.

In sum, the main implication of the above suggested changes is that there should be a shift of emphasis from 'disciplining' teachers as envisaged by the present government's stand on teacher appraisal to providing teachers with the opportunity to develop professionally. Teachers should be encouraged to study privately to improve their content knowledge as well their pedagogical content knowledge in the various subjects they teach. Shifting emphasis to professional development of teachers may require the development of a system of ongoing professional development of teachers through school-based INSET organised especially during the school holidays. Funds should be made available for such school-based professional training/development of teachers. The painful truth is that an under-funded appraisal system could be counterproductive.

9.7 Limitations of the Study

1. The main limitation of the study is the extent to which the findings can be generalised. As mentioned in chapter 6, the study was conducted in four of the ten regions of Ghana and as a result, some of the findings may not apply in the regions that were not sampled. However, the possibility of this happening is limited by the central nature of the education system in Ghana. Besides, the Inspectorate Division of the GES which oversees the appraisal of all teachers in Ghana is under the directorship of one individual who instructs regional and district co-ordinators and facilitators in much the same way.

Another reason why the generalisation of the findings to the appraisal of mathematics teachers in Ghanaian secondary schools may not be a serious problem is that the four regions sampled are the four most prosperous regions in the country and have more basic and secondary schools in them than in the other six put together. In addition to the many secondary schools in the sampled regions, three of the country's four universities and nearly all the other higher institutions of learning (e.g. polytechnics, diploma awarding institutions, etc.) are also found in these regions. These regions therefore very much influence what happens in the other six regions.

2. Another limitation is the way in which the questionnaires were administered, particularly at the junior secondary level. The advantages of putting participants in groups in order to administer the questionnaires in groups may have been gained at a cost. Furthermore, by involving circuit supervisors in the organisation of the survey and in some cases going to the various venues with them to administer the questionnaires, the study may have been biased at that level. This is because some junior secondary teachers may have perceived the survey as being conducted by the GES in spite of the verbal as well as the written introduction suggesting otherwise. Junior secondary participants' responses may therefore have been biased (in favour of the present appraisal system) by the presence of the circuit supervisors. However, these costs were perhaps worth paying considering that it would be almost impossible to conduct any form of study in Ghanaian basic schools without the co-operation of the circuit supervisors. Nor would it be possible to administer all the questionnaires on one-to-one basis considering the constraints of time and resources.

Yet such costs were minimised by both ensuring that teachers did not discuss their responses with their colleagues while completing the questionnaires and asking the teachers not to write their names on the questionnaires. Also, the circuit supervisors assured respondents that they (the supervisors) would not see any of the completed questionnaires. Furthermore, unlike the questionnaire administration, most of the interviews were conducted a day or two after the questionnaires had been completed. As the interviews involved only a few teachers, the circuit supervisors did not have to be present and the interviews were conducted on one-to-one basis. The interview data confirmed that neither the group administration of the questionnaires nor the presence of the supervisors had any substantial effect on the responses of the teachers.

3. The third limitation of the study is the assumptions made regarding causality. Indeed, this is a correlational study, so causality cannot be verified. Rather than (say) longer service as a mathematics teacher leading to a higher rank, the direction of causality could be reversed, as in the case of a teacher who continues to stay in the Service because he or

she has earned promotion. However, the fact that certain categories of teachers cannot be promoted to certain ranks lends support to the theoretical direction of causation involving the two variables. Furthermore, if teachers join the Service before they are exposed to the appraisal system, then one's professional status or rank arguably precedes the dependent variable (i.e. perceived support) in time. Yet, only further research can empirically verify the theorised causal directions made in the present study.

4. Finally, it must be pointed out that not all the assumptions underlying the use of the discriminant analysis were 'fully' met in the present study. However, the assumptions were not seriously violated because there were marked similarities in the relevant statistics among the two groups compared (i.e. teachers positive and teachers negative about the potential of the teacher appraisal system in Ghana). Besides, the analysis confirmed the results obtained by using chi-square and multiple regression analyses. Even so, great caution ought to be exercised in the interpretation of the classifications obtained through the use of the discriminant analysis.

9.8 Contribution of the Study and Further Research

The ways in which expert teachers think and behave have been the focus of the number of studies (e.g. Leinhardt, 1989; Leinhardt and Greeno, 1986). The findings of these studies show that there are differences between expert and novice teachers' subject matter knowledge, their pedagogic content knowledge and their organisation and classroom management capacities. How do these difference influence teachers' attitude to appraisal?

There is lack of studies which examine the effect of such differences on teacher perceptions of professional development programmes. Are expert teachers more or less positive about teacher appraisal systems than novice teachers? What are the implications of the differences between experts and novices for in-service training programmes? These are but only two of the relevant questions regarding the relationship between expertise and staff development. The present study has made a step towards answering the above and related questions.

The study found a dramatic difference *between* teachers with higher academic and professions qualifications in mathematics *and* those with lower academic and professional qualifications in mathematics in their perceptions about a teacher appraisal system which was found to be invalid. Specifically, 'expert' teachers were more negative about the system of teacher appraisal in Ghana than 'novice' teachers. The suggestion is that

teachers' qualifications were related to their judgements about the validity of the teacher appraisal system.

Although studies of expert and novice teachers have made similar findings regarding the differences between the two groups across subject areas (see Brown and Borko, 1992; Yen, 1991), it is not clear whether the findings of the present study can be generalised across subject areas. It is in fact *speculated* that the suggestion regarding the relationship between expertise and perceptions of appraisal may relate more to mathematics teaching than to the teaching of other subjects.

This *speculation* stems from the 'distinction' the appraisers involved in the present study drew between the appraisal of mathematics teaching and that of the teaching of other subjects in the curriculum. The above speculation provides an opportunity for studies into the appraisal of teachers of specific subjects. Such studies can throw more light on the effect of 'context' on the *expertise - attitude* relationship.

Second, the present study predicted that at both junior and senior secondary levels, female mathematics teachers would view the potential of TAG to help them improve their teaching of mathematics differently from male mathematics teachers. The results obtained were unsupportive of this prediction. In the light of the studies which have reported gender differences in attitudes to mathematics (Joffe & Foxman, 1988; Hacket & Betz, 1989), this finding is a very important contribution to mathematics education. The finding also provides an opportunity for further research, looking, for example, at gender differences in performance appraisal ratings.

Third, as far as mathematics education is concerned, the study has provided only limited evidence of the relationship between teachers' expertise and their judgements about the validity of appraisal systems. It did not establish which factors influencing mathematics teaching (e.g. subject matter knowledge, pedagogic content knowledge, etc.) affected teachers' perceptions of the validity of the appraisal system studied. There is therefore scope for extending the work that has been done in this study by concentrating on the relationship between the above factors and teachers' perceived validity of appraisal systems.

Fourth, although the study found a very strong relationship between professional status and perceived support at the senior secondary level, the tiny proportion (11.4%) of professional respondents at the junior level made any conclusion about the relationship between professional status and perceived support at that level appear rather unsafe. There is therefore the need to replicate the study among primary and junior secondary

mathematics teachers with bigger samples of professional teachers. It is indeed possible that the findings of the present study may have been influenced by the relatively high social status of secondary mathematics teachers in Ghana. Another interesting study would be the relationship between the supply of mathematics professionals and perceived support at the primary and junior secondary levels.

Finally, it is important to emphasise that the present study involved a system of appraisal which was being used for both formative and summative purposes. It is possible that teachers' perception of the appraisal system as a formative process might have been influenced by their perception of it as a summative process. It would therefore be of value to replicate the study using a system of appraisal which concentrates on professional development of teachers. The UK appraisal system provides an appropriate setting for such replication.

9.9 Conclusion

The present study involved 193 junior secondary and 248 senior secondary mathematics teachers. In addition, 44 Ghana Education Service officials and 6 heads of secondary schools who appraise mathematics teachers took part in the study. The study showed that the appraisal system is not helping mathematics teachers to improve their work as a result of the lack of mathematics teaching expertise among inspectors and supervisors. This and other factors (e.g. teachers' perceptions) led to the conclusion that the formative aspect of the teacher appraisal in Ghana is not valid. Similarly, the summative aspect of the appraisal system was also found to be invalid.

Regarding mathematics teachers' perception of the appraisal process, highly significant negative correlations were found *between their perceived professional support and rank and professional status* at the senior secondary level; whereas relatively weak positive correlations were found *between perceived support and last appraisal session and rank* at the junior secondary level. The results indicated a dramatic difference between junior secondary and senior secondary mathematics teachers in their perceptions about the potential of the teacher appraisal system in Ghana to help them to improve their teaching of mathematics. Senior secondary mathematics teachers were generally more pessimistic about the potential of the appraisal system than their junior secondary counterparts. This difference reflected the differences in the professional status of the two groups of teachers. This is because the study found professional status to be the single most

important determinant of secondary mathematics teachers' attitude to formative teacher appraisal in Ghana.

The above findings lead to the conclusion that the main way of helping mathematics teachers improve their work through the appraisal process is to make changes in the present system. One way of making such a change is by recruiting mathematics and science specialists in addition to the existing circuit supervisors and inspectors as well as addressing the problems that are plaguing the Inspectorate Division of the Service. In spite of the above limitations of the study, it is my belief that the appraisal system can be improved significantly if serious consideration is given to some of the recommendations listed above.

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APPENDIX A1

[MATHEMATICS] TEACHER APPRAISAL QUESTIONNAIRE (No.....)

Teachers form the key factor in the implementation process throughout the new system of education in this country and indeed, the success of the reforms will depend largely on their competence and commitment. It is therefore important to ensure that teachers are not only ready for the great task ahead but are also ready to take up the opportunities which the new challenge brings with it and develop their professional skills for both their own benefit and that of the students they teach. To achieve this readiness, the appraisal of teaching for promotion and other purposes must be supportive of the ongoing educational reforms as well as the teaching and learning processes.

This questionnaire (which you are being requested to kindly complete) forms part of a teacher appraisal study, with particular reference to the teaching of mathematics, in some pre-university institutions in this country.

The study, which is being conducted independently by a doctoral research student, will enable the researcher to learn about some of the ways in which the teaching and learning of mathematics in this country can be improved.

While thanking you for accepting to take part in this study, the researcher assures you that your answers to the questions will be kept strictly confidential and you as an individual will not be identified by them. No one except the researcher and his university supervisors will see your questionnaire. To ensure complete anonymity, please do **not** write your name on your questionnaire.

By taking part in this study, you will help the researcher to gain clear knowledge of the problems facing Ghanaian teachers generally and teachers of mathematics in particular and (at the appropriate time) this knowledge will be passed on to the appropriate authorities for their action.

Please answer the questions as truthfully and accurately as you possibly can. Please do not discuss the questions with anyone or answer them in a way you think the researcher wants you to answer them. Any opinion expressed must be your own.

Thank you for your co-operation.

+ - = % ! @ < > + - = % ! @ < > + - = %

SECTION I

In this section, we ask you questions about your personal experience with the appraisal process, what you think should be taken into account in considering your claim for promotion and who you think should appraise you as a maths teacher. We hope you will answer all the questions as best as you can.

1. Have you ever been appraised as a maths teacher? Y N

If yes, please state :

- i) the number of times you have been appraised
- ii) the year in which you were first appraised ...19.....
- iii) the year in which you were **last** appraised ...19.....
- iv) the position of the person who appraised you **last** (e.g. head of department, headmaster/mistress, GES official, etc.).....

2. Have you ever had training as an appraisee? Y N

If yes, please state :

- i) the year in which you were **last** trained ...19.....
- ii) the position of the person who trained you.....

3. Please state the position of who you think is the most appropriate person to appraise you AND for what purpose(s).

- i) the position of your preferred appraiser is
- ii) purpose(s) is/are.....

.....

4. Please list the 4 MOST IMPORTANT FACTORS which you YOURSELF think should be taken into account when the Ghana Education Service is considering YOUR claim for promotion. Please arrange these factors in order of preference:

1st.....

2nd.....

3rd.....

4th.....

SECTION II

The appraisal of mathematics teachers in this country usually takes the form of supervision (classroom observations, visits, interviews etc.) by Ghana Education Service officials (e.g. DEOs , REOs etc.) referred to below as "GES officials". The items in this section consist of specific statements about GES officials and their supervisory activities. We ask you to give your opinion about how you perceive such activities. Please state whether in the course of their work, GES officials :

Never (**n**), Seldom (**s**), Often (**o**) or Always (**a**) act in the way depicted in the statement. Please circle one choice only.

NOTE : * Please delete "*other (maths) teachers*" if you have **EVER** been appraised as amathematics teacher.

	Never (n)	Seldom (s)	Often (o)	Always (a)
5. Ghana Education Service officials (GESOs) who evaluate *my/other teachers' maths teaching are well versed in the teaching of mathematics. n		s	o	a
6. GESOs help me to improve my teaching of mathematics.	n	s	o	a
7. GESOs who evaluate *my/other teachers' maths teaching are trained in the evaluation of mathematics teaching.	n	s	o	a
8. GESOs hold preliminary meeting(s) with *me/other maths teachers before observing my/thier maths lesson.	n	s	o	a
9. GESOs tell me how I should teach mathematics.	n	s	o	a
10. GESOs put *me/other maths teachers at *my/their ease during the cbserveation of *my/their maths lesson.	n	s	o	a
11. GESOs hold meeting(s) with *me/other maths teachers after they have observed my/their maths lesson .	n	s	o	a
12. GESOs give *me/other maths teachers enough time to prepare for visits and inspections.	n	s	o	a
13. GESOs inform *me/other maths teachers in advance about what aspect(s) of their work will be appraised during visits and inspections.	n	s	o	a

SECTION III

Appraisal reports are among the factors which are usually taken into account when considering a teacher's claim for promotion. In this section we ask you to pick out rank FOUR of the factors below, which you think Ghana Education Service Officials (GESOs) view as the most important factors when considering a teacher's claim for promotion. The list is not exhaustive, therefore if you think any of GESOs' top four factors are not included in the list, you can add this (or these) to the list and rank it (or them). Please read over all the factors first.

14. Please put "1" next to the factor you believe GESOs think is the most important, "2" next to the one you believe GESOs think is the second important, "3" next to the one you believe GESOs think is the third important, and finally "4" next to the one you believe GESOs think is the fourth important.

-Academic qualifications (e.g. GCE O/A Levels, degree, etc.).
-Age.
-Experience (in teaching and elsewhere).
-Extra curricular activities (e.g. pastoral duties, sports ,etc.)
-Personality (e.g. general behaviour, "appearance", etc.).
-Professional qualifications (Cert "A", Dip. Ed, BEd, etc.).
-Report(s) by head/head of department
-Service to the community.
-Teacher's self report(s).
-Teaching skills.

Please add factors if you have any

.....
.....
.....
.....

SECTION IV

Please state in a few words what you think is the importance of mathematics as a school subject.....

.....

.....

In the rest of this section, you are requested to answer some questions about the subject(s) you teach. Where a question asks for a "yes" or "no" answer, please circle either **Y** (for "yes") or **N** (for "no") and where appropriate, please give reasons for your answer. Where a question does not apply in your case, please write N/A.

Please continue

15. Do you teach mathematics only? **Y** **N**

If you do not teach mathematics only, what other subject(s) do you teach?

.....

.....

16. Please state the level (and form) at which you teach mathematics

- i) level(s) (e.g. JSS, SSS, etc.).....
- ii) form(s).....

17. For how long have you been in the teaching field ? Please circle one range only

- a) 0-5 yrs b) 6-10 yrs c) 11-15 yrs d) 16-20 yrs e) 21-30 yrs f) Over 30 yrs

18. For how long have you been teaching mathematics? Please circle one range only

- a) 0-5 yrs b) 6-10 yrs c) 11-15 yrs d) 16-20 yrs e) 21-30 yrs f) Over 30 yrs

19. If you are promoted to the next grade in the GES, do you hope to continue teaching mathematics? **Y** **N**

Please give reasons for your answer.

.....

.....

SECTION V

Teacher appraisal is not a new subject in this country. It has taken various forms since its introduction into this country over 90 years ago under the system of "payment by results". Please give your opinion on what you think the aims of teacher appraisal in Ghana are today. Please indicate whether you strongly disagree (**sd**), you disagree (**d**), you neither agree nor disagree (**nad**), you agree (**a**) and you strongly agree (**sa**). Please circle one appropriate response only.

Please continue

	Disagree Strongly (sd)	Disagree (d)	Neither agree nor disagree (nad)	Agree (a)	Strongly Agree (sa)
20. Appraisal in our schools today is a way of reaching management decisions about whether or not I need professional help.	sd	d	nad	a	sa
21. Appraisal in our schools today is a way of reaching management decisions about whether or not I should be promoted.	sd	d	nad	a	sa
22. Appraisal in our schools today is a way of finding faults with my work.	sd	d	nad	a	sa
23. Appraisal in our schools today is a way of reaching management decisions about whether or not I should be dismissed.	sd	d	nad	a	sa
24. Appraisal in our schools today is a way of helping me to be more effective.	sd	d	nad	a	sa
25. Appraisal in our schools today is a way of reaching management decisions about whether or not I should be promoted	sd	d	nad	a	sa

Please state any other aim(s) of appraisal in our schools today

SECTION VI

In this section we ask you questions about teacher appraisal (**in principle**) and we hope you will answer all questions as best as you can. The items below consist of specific statements. A five-point scale is provided indicating whether you strongly disagree (**sd**), you disagree (**d**), you neither agree nor disagree (**nad**), you agree (**a**) and you strongly agree (**sa**). Please give your opinion by circling one appropriate response only. Please note that there is no general agreement on the statements. Different people will differ widely in their views on them; this is because there are no right or wrong answers.

	Strongly Disagree (sd)	Disagree (d)	Neither agree nor disagree (nad)	Agree (a)	Agree Strongly (sa)
26. Teacher appraisal should be a way of reaching management decisions about whether or not I need professional help.	sd	d	nad	a	sa
27. Teacher appraisal should be a way of reaching management decisions about whether or not I should be promoted.	sd	d	nad	a	sa
28. Teacher appraisal should be a way of finding faults with my work.	sd	d	nad	a	sa
29. Teacher appraisal should be used as a means of reaching management decisions about whether or not I should be dismissed.	sd	d	nad	a	sa
30. Teacher appraisal should be used as a means of helping me to be more effective.	sd	d	nad	a	sa
31. Teacher appraisal should be used as a way of reaching management decisions about whether or not I should be transferred on disciplinary grounds.	sd	d	nad	a	sa

Please state in a few words, what you think the purpose(s) of teacher appraisal should be

SECTION VII

In this section we ask you questions about your teaching of mathematics and what you can do to improve it. Where appropriate, please circle **Y** (for yes) or **N** (for no).

32. Please state 3 ways in which you can improve your teaching of mathematics.

1st.....
.....
2nd.....
.....
3rd.....
.....

33. Can the way teacher appraisal is done (presently) in this country help you to do the first (1st) thing you have stated in item 32 above?**Y** **N**

a) If no, please state how teacher appraisal can be improved to help you to do the first (1st) thing you have stated in item 32 above.
.....
.....
.....

34. Can the way teacher appraisal is done (presently) in this country help you to do the second (2nd) thing you have stated in item 32 above?**Y** **N**

a) If no, please state how teacher appraisal can be improved to help you to do the first (1st) thing you have stated in item 32 above.
.....
.....
.....

35. Can the way teacher appraisal is done (presently) in this country help you to do the third (3rd) thing you have stated in item 32 above?**Y** **N**

a) If no, please state how teacher appraisal can be improved to help you to do the third (3rd) thing you have stated in item 32 above.
.....
.....
.....

SECTION VIII

Finally, we ask you questions about yourself and we hope you will answer all the questions as truthfully as you can. Please tick the appropriate box(es) in each case.

36. Please state your sex:

a) Female ☐

b) Male ☐

37. Between what range does your age (to the nearest year) lie?

a) Below 20 years ☐

b) 21-30 years ☐

c) 31-40 years ☐

d) 41-50 years ☐

e) Over 50 years ☐

38. Your rank in the GES is:

a) Certificate "A" teacher ☐

b) Assistant Superintendent ☐

c) Superintendent ☐

d) Senior Superintendent ☐

e) Principal superintendent ☐

f) Assistant Director ☐

g) Other, please specify.....

39. Which type of 'certificate' do you have?

a) Teacher's Certificate "A" ☐

b) Specialist Mathematics ☐

c) Diploma in Mathematics ☐

d) BSc/BEd. Mathematics ☐

e) Other, please specify

+ - = % ! @ < > + - = % ! @ < > + - = % ! @ < > + - = %

Thank you very much for your co-operation.

APPENDIX A2

APPRAISER QUESTIONNAIRE

No.....

QUESTION	NOTES
1. You do engage in supervisory activities in schools. Given the fact that there are different grades of teachers in our schools today, how do you assess the work of teachers at such different grades?	
2. At which level of education do you appraise teachers' work (e.g. Primary, JSS, SSS, etc.)?	
3. What is your specialised subject area (e.g. maths, english, history, general, etc)?	
4. Do you collect any information about teachers before you visit their school to appraise their work? 4a. If yes: i) what sort of information do you collect? ii) how do you collect such information?	
5. What proportion of the appraisal that you do is associated with promotion? If less than 100%, what other purpose(s) do you appraise teachers for?	
6. Mathematics is a compulsory subject in the school curriculum. Why do you think every pupil/student is expected to learn mathematics in our schools?	
7. Do you think mathematics teachers are appraised often enough?	

QUESTION	NOTES
8. How is the appraisal of mathematics teachers different from that of other teachers at the level(s) which you appraise teachers' work at?	
9. Have you received any training in the appraisal of mathematics teaching? 9a. If yes: i) did you find such training adequate?. ii) what did like/dislike about the the training?	
10. When you visit a school, how do you select maths teachers for observation? 10a. Do teachers usually know in advance that their teaching will be observed? If yes: i) how do they know this? ii) what is the length of the notice?	
11. Does the GES have an official form for classroom observation? 11a. If yes, please state what you like and/or dislike about the use of this form.	
12. Would it be possible to give me 5 things you look for in the classroom when observing a maths teacher's work?	
13. How do teacher know you look for the above things in their teaching of maths?	
14. After classroom observation of a maths lesson, how does the teacher get to know how he/she performed in the lesson?	

QUESTION	NOTES
15. What would you describe as a very good mathematics lesson?	
16. In appraising a mathematics teacher's work, what else do you normally take into account apart from classroom teaching?	
17. Some mathematics teachers study privately to gain extra academic and/or professional qualifications. How do you think their efforts to better their academic/professional qualifications affect their work as maths teachers?	
<p>18. After supervision, how often do mathematics teachers usually receive an appropriate course of training in order to develop professionally?</p> <p>18a. Is this as often as you would like it?</p> <p>If no, how often would you like maths teachers to receive training?</p>	
19. As one might expect, there is always the teacher who has drifted into the teaching profession and has left it too late to drift out again; one who has remained in one place for too long and is always found using his/her 'old' maths notes. How do you handle such a teacher during and/or after supervision?	
<p>20. How long does it take you to have a pretty good idea about a mathematics teacher's work to enable you to pass judgement on his/her performance?</p> <p>21. How long does the whole process of appraisal take (i.e. from preliminary discussion - if any - to judgement/recommendations)?</p>	

21a.

PROMOTION OF TEACHERS

Appraisal reports are among the factors which are usually taken into account when considering a teacher's claim for promotion. In this section we ask you to pick out and rank FOUR of the factors (below) which, in your view, are the most important factors when considering a teacher's claim for promotion. The list is not exhaustive, therefore if you think any of your top four factors are not included in the list, please add this (or these) to the list and rank it (or them). Please read over all the factors first.

Please put "1" next to the factor you believe is the most important, "2" next to the one you believe is the second important, "3" next to the one you believe is the third important, and finally "4" next to the one you believe is the fourth important.

-Academic qualifications (e.g. GCE O/A Levels, degree, etc.).
-Age.
-Experience (in teaching and elsewhere).
-Extra curricular activities (e.g. pastoral duties, sports ,etc.).
-Personality (e.g. general behaviour, "appearance", etc.).
-Professional qualifications (Cert "A", Dip. Ed, BEd, etc.).
-Report(s) by head/head of department
-Service to the community.
-Teacher's self report(s).
-Teaching skills.

Please add factors if you have any

.....
.....
.....
.....

Please complete each of the following by choosing one only of the categories provided . Please tick the appropriate box :

22. Your sex is :

a) female ☐

b) Male ☐

23. Your age lies between the range:

a) 30 years or below ☐

b) 31-40 years ☐

c) 41-50 years ☐

d) 51-60 years ☐

e) Above 60 years ☐

24. Your rank in the GES is:

a) Assistant Superintendent (or below) ☐

b) Superintendent ☐

c) Senior Superintendent ☐

d) Principal Superintendent ☐

e) Assistant Director ☐

f) Other, Please specify ☐

.....

25. You have been in the teaching field for between:

a) 0-5 years ☐

b) 6-10 years ☐

c) 11-15 years ☐

d) 16-20 years ☐

e) 21-30 years ☐

f) Over 30 years ☐

26. You have been appraising mathematics teachers for between:

a) 0-5 years ☐

b) 6-10 years ☐

c) 11-15 years ☐

d) 16-20 years ☐

e) 21-30 years ☐

f) Over 30 years ☐

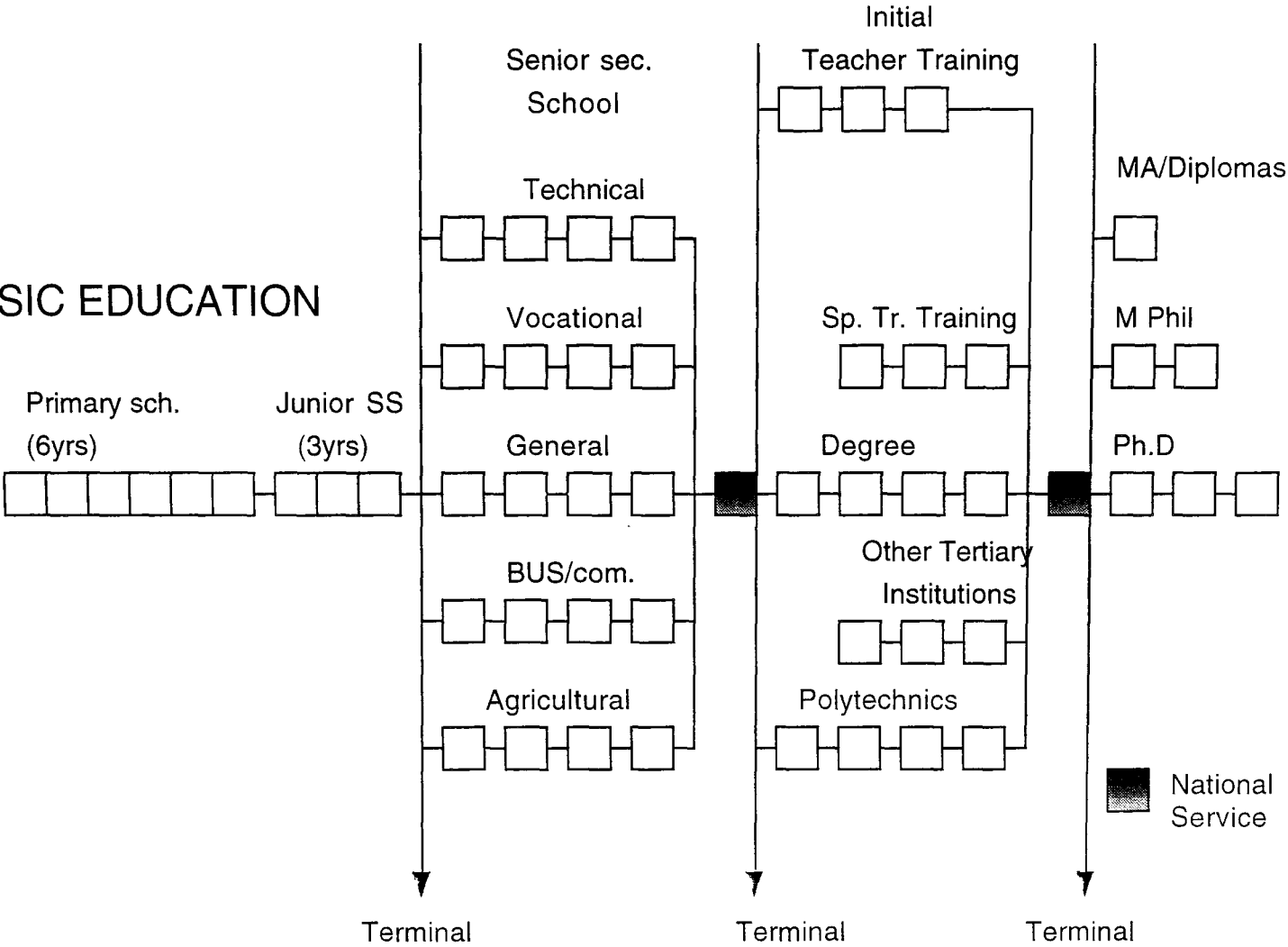
Comments: If you wish to make any comments, please turn over and use the space provided.

COMMENTS

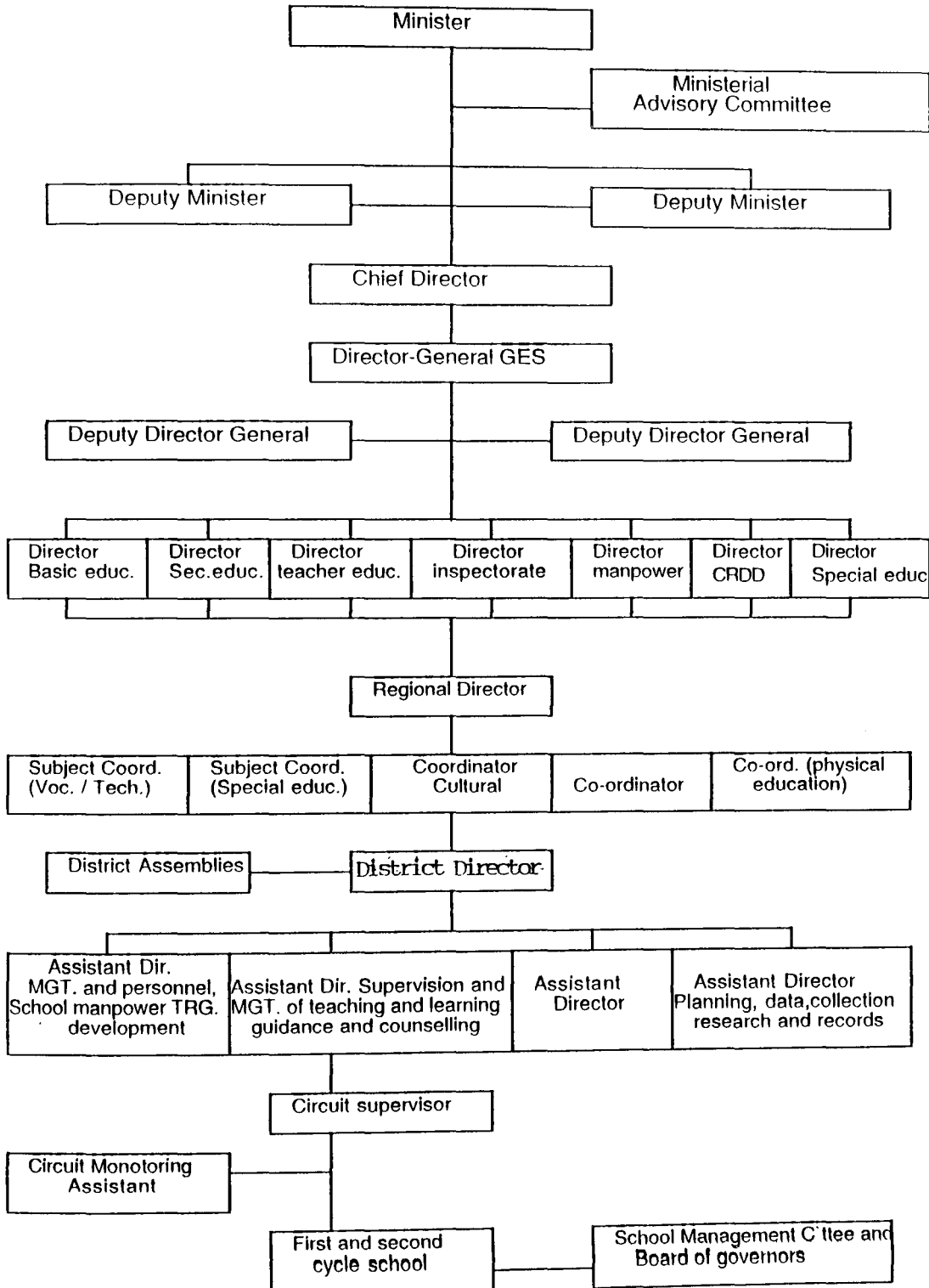
Thank you very much for your help

NEW STRUCTURE OF EDUCATION

BASIC EDUCATION



Institutional Relationship Between the Ministry of Education and Ghana Education Service



GHANA EDUCATION SERVICE

Ref:GES/ER/ADO:69/V.3/70

District Education Office,
P. O. Box 102,
Akropong-Akuapem.

24th May, 1995.

A STUDY OF THE APPRAISAL OF MATHEMATICS TEACHERS
AKUAPEM NORTH DISTRICT

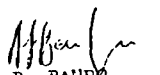
A Research fellow from the Department of Mathematics, Statistics and computing institute of Education, University of London, is in our District to conduct some studies in the teaching of Mathematics in our schools.

He would like to meet all teachers who teach Mathematics in the Junior Secondary Schools in this District at the place and time indicated below.

SCHOOLS	PLACE	DATE	TIME
1. Akropong all Junior Sec. Sch.	Akropong Salem	5/6/95	10.00 a.m.
2. Larteh All J.S.S.	Larteh Presby Church	6/6/95	"
3. Mamfe/Amarokrom all J.S.S.	Mamfe Presby JSS	7/6/95	"
4. Mampong all J.S.S.	Mampong Presby Church	8/6/95	"
5. Tutu	Meth. JSS	9/6/95	"
6. Obosomase	Obosomase Pres. J.S.S.	12/6/95	"
7. Abiriu/Dawu/Awukugua All J.S.S.	Abiriu Presby J.S.S.	13/6/95	"
8. Adukrom	Presby J.S.S.	14/6/95	"
9. Okorase	Okorase Meth. J.S.S.	15/6/95	"
10. Amanfro/Asenema/Okarakwadjo/Kobokobo/Sanfo Salv.	Amanfro L/A J.S.S.	16/6/95	"
11. Adawso/Aboabo	Adawso Presby J.S.S.	19/6/95	"
12. New Mangoase/Old Mangoase	New Mangoase Meth. J.S.S.	20/6/95	"

Headmasters are to ensure that teachers who teach Mathematics in their Schools attend this all important course.

They should bring along pens and exercise books.


A. D. BAHFO

ASST. DIRECTOR(SUPERVISION & INSPECTION)
for: DIST. DIRECTOR OF EDUCATION
(AKUAPEM NORTH)

ALL HEADMASTERS (J)
SCHOOLS CONCERNED
AKUAPEM NORTH DISTRICT.

cc:- All Circuit Supervisors,
Akuapem North District.

Mr. Jonathan Fletcher,
Department of Mathematics,

/ba/

A P P E N D I X B6**Department of Mathematics, Statistics and Computing**

Chairperson Professor Celia Hoyle
 Department Office 0171-612 6653/4
 Department Fax 0171-612 6686

Departmental Administrator Alison Shapton
 Direct Line 0171-612 6651



**INSTITUTE OF
EDUCATION**
UNIVERSITY OF LONDON

20 BEDFORD WAY
LONDON WC1H 0AL
Telephone 0171-580 1122

Director Professor Peter Mortimore OBE

Wednesday, March 29, 1995

To whom it may concern

Jonathan Fletcher is a research student at the Institute of Education, University of London. He is conducting doctoral research into the appraisal of mathematics teachers, and the potential of appraisal to improve the quality of mathematics teaching and of education in general. We are confident that his findings will be of great interest and benefit to the Ghanaian education system, and would appreciate any assistance which you are able to give Mr Fletcher as he conducts his fieldwork.

Thank you on his and the University of London's behalf.

Yours sincerely

Alison Wolf
Reader in Education and Research Supervisor

To: Heads of Institutions
 — Basic & JSS,

Kindly offer Mr Jonathan
 Fletcher all the assistance
 he may need in connection
 with his research work.

Director of Education
 ACCRA METROPOLIS 17/7/95


ISS. 12/V.2/26

14th January, 93

INSPECTION REPORT ON
MATHEMATICS AND SCIENCE (SS1 AND SS2)

— Enclosed is a report on the above.

2. Please study it and take the necessary action.


(A.A. GOCKAH (MISS)
DIRECTOR
INSPECTORATE DIVISION

THE HEADMASTER,
O'REILLY SECONDARY SCHOOL,
P. O. BOX
ACCRA.

Recy

Desp.


18/1

Seen P.D.

- 1.0 NAME OF SCHOOL: O'Reilly Secondary School
- 2.0 DATE OF VISIT: 19th November, 1992
- 3.0 NAME OF HEADMASTER (ACTING): Mr. F. O. Yeboa
- 4.0 PURPOSE OF INSPECTION: To find out whether the necessary facilities exist for the teaching and learning of Mathematics, Physics, Chemistry and Biology and to find out whether something had been achieved in the past two years.
- 5.0 NAME OF INSPECTOR ~~OR~~ Yaw Osei Sarpong.

MATHEMATICS

6.0 TEACHING STAFF:

NAME	QUALIFI- CATION	RANK	EXPERIENCE
Obeng K. K.	BSc. MSc.	Supt.	2 Years
E. L. K. Gomasie	BSc.	Senior Supt.	17 Years

7.0 STUDENT ENROLMENT:

There were three streams for SS1 and an equal number of streams in SS2. Each stream had a maximum of thirty-five (35) students.

8.0 ORGANIZATION:

- 8.1 Mr. E. L. K. Gomasie BSc. with seventeen years' teaching experience was the head of department.
- 8.2 The number of periods allocated to the subject in the various classes was adequate.
- 8.3 Continuous assessment sheets had been provided. However, it appears masters were not keen in writing out schemes of work and teaching notes.
- 8.4 So far one hundred and eighty (180) Mathematics Book I and one hundred and fifty (150) Mathematics Book II had been supplied to the schools. Since the SS2 had not completed the Book I it means the SS1 and SS2 are sharing the Book I. Quality and quantity of work done by students were fair.

9.0 REFERENCE BOOKS:

Five copies of the prescribed textbooks were kept in the library. There were practically no back-up reference books in the library.

10.0 OBSERVATIONS:

- 10.1 The masters were qualified and experienced to adequately prepare the students for the SSS examination.
- 10.2 Masters were not keen on writing out lesson notes and schemes of work.
- 10.3 The Ministry of Education has not kept pace with the supply of the prescribed textbooks.

- 10.4 An adequate number of periods had been allocated to the subject.
- 10.5 Number of students in a stream is handy. Some students are very weak in the subject.
- 10.6 Some students refuse to hand in their work for marking.

11.0 RECOMMENDATIONS:

- 11.1 Masters should be keen on the writing of schemes of work and notes.
- 11.2 Extra remedial classes, if possible, should be given to the weaker students.
- 11.3 Students should present their work for marking at the correct time.
- 11.4 Textbooks should be sent to the school at the correct time so that a particular textbook should be finished before tackling the next one.

SCIENCE

6.0 TEACHING STAFF:

NAME	QUALIFICATION	R A N K	EXPERIENCE
Mr. Aggrey	BSc.	Supt.	7 Years
Mr. J.K. Ennin	BSc.	Supt.	11 Years
Mr. Ayitey	BSc.	Supt.	2 Years
Mr. G. Owiredu	BSc.	Supt.	3 Years
Miss Allotey K.	BSc.	Supt.	5 Years
Miss Blankson Arthur	BSc.	Supt.	Just joined.

7.0 STUDENT ENROLMENT:

There were thirty-five students in the Science Programme (Physics, Chemistry, Biology) in SS1 and SS2 respectively.

8.0 ORGANIZATION:

- 8.1 Miss K. Allotey was the Head of Department of Science. Regular meetings were held by members of the department. A report is always written by the Head of Department.
- 8.2 The maximum number of periods had been allocated to the Core Science and the Elective Science.
- 8.3 Of late masters/mistresses have stopped the writing of schemes of work and lesson notes. Continuous assessment is done and the masters/mistresses had started transferring this on to the assessment sheets provided for this purpose.
- 8.4 Frequency and volume of work done by students were fair. However, students should present their work for marking.

9.0 LABORATORIES:

There were enough well furnished laboratories for the SSS Programmes in Biology, Physics and Chemistry.

10.0 EQUIPMENT AND TOOLS:

Equipment and tools were available but the quantity was not adequate in some cases. For example, there were only three microscopes, fifteen hand lenses and five sets of Dissecting instruments.

There was a need for Millon's reagent, Fehling solution, Sudan III and Petri Dishes.

11.0 TEXTBOOKS/REFERENCE BOOKS:

11.1 Textbooks for the Core Science as well as for the Elective. Science were available and in sufficient quantities. However, teachers and students alike prefer the textbooks authored by the Ghana Association of Science Teachers to those provided by the Ghana Education Service. According to them the GAST books are better illustrated than those prescribed by the Ministry of Education.

11.2 "As far as Science is concerned there is no library in the school", so says the head of the Science Department.

12.0 OBSERVATION:

- 12.1 Masters/Mistresses were qualified to handle the SSS students
- 12.2 Classes were not large and the laboratories could accommodate them.
- 12.3 Students fail to do their assignments; those who do them feel reluctant to present them for marking.
- 12.4 Tutors of late have stopped writing schemes of work and lesson notes.
- 12.5 Some equipment were in short supply.
- 12.6 Teachers preferred the GAST science books to those offered by the Ministry of Education.
- 12.7 There were no relevant Science Reference Books in the library.

13.0 RECOMMENDATIONS:

- 13.1 Students should present their assignments for marking at the correct time.
- 13.2 Tutors should write their schemes of work and lesson notes.
- 13.3 The quantity of microscopes, hand lenses and sets of dissecting instruments should be increased considerably.
- 13.4 Some of the science books written by GAST should be bought and placed in the library for use as reference by the students.

GHANA EDUCATION SERVICE
PROMOTION EXAMINATION TO ASST. SUPT., 1994
MATHEMATICS - PAPER 1
ATTEMPT ALL QUESTIONS

1. Find the value of x if $3x + 8 = 29$

2. If a point $A=(2,3)$ and $B=(5,6)$, Find \overrightarrow{AB}

a. $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$ b. $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ c. $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ d. $\begin{pmatrix} -3 \\ 3 \end{pmatrix}$ e. $\begin{pmatrix} 3 \\ 3 \end{pmatrix}$

3. Draw a number plane and indicate the names of the quadrants.

4. Find the image of $A(2,-3)$ if it is translated by a vector $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$

a. $(-4,-6)$, b. $(4,-6)$, c. $(-4,6)$, d. $(0,-6)$, e. $(0,0)$).

5. What is $2^4 - 4^2$

6. A. On a graph sheet, draw two perpendicular axes OX and OY.

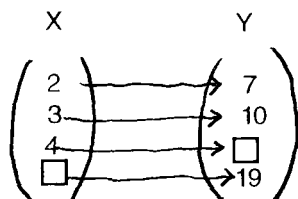
B. Using a scale of 2cm to 2 units, mark both axes from -6 to 6.

C. Plot the points $P=(2,4)$, $Q=(-1,2)$ and $R=(1,2)$. Join the points to form a triangle.

D. Draw the image $P'Q'R'$ of PQR under a reflection in the Y-axis where $P \rightarrow P'$, $Q \rightarrow Q'$ and $R \rightarrow R'$

E. Write down the coordinates of P' , Q' and R'

7. Copy and complete the mapping diagram below.



8. What is the rule for the mapping in question 7 above?

9. What is an integer?

10. Find the image of $K(0, -3)$ reflected in $y=0$.

SECTION 'B'

ANSWER ANY TWO OF THE FOLLOWING QUESTIONS.

- You are asked to teach the topic-sets in a primary school for a double period. State what you would do to make the lesson activity oriented and at the same time child centred.
- Why is it necessary to lay a good foundation in Mathematics for our pupils in the basic schools?
- Describe the different game that you would use to teach "addition" and "subtraction" of integers in a primary school.
- Select a maths topic and write a lesson note for a class in either a primary school or a J.S.S.

GHANA EDUCATION SERVICE
PROMOTION EXAMINATION TO SUPT., 1994
MATHEMATICS - PAPER 1

Answer all questions

1. Expand and simplify: $3(x - 2) + 9$.
2. Find the value of x if $5x - 13 = 22$.
3. If set $A = \{1, 3, 5, 9\}$ and set $B = \{2, 3, 8\}$ Find $A \cap B$.
4. What is the value of 2^5 ?
5. Solve this integer $77 - 98$.
6. How many quadrants has a circle?
7. Write one mathematical statement which is open.
8. Write one mathematical statement which is true.
9. Write one mathematical statement which is false.
10. A box contains 5 beer bottles, 6 coke bottles and 4 fanta bottles.
What is the probability that a bottle selected at random from the box is a coke bottle?
11. The following are marks obtained by 25 pupils in a maths test:
1, 5, 1, 4, 3, 2, 3, 2, 1, 5, 4, 2, 1, 3, 5, 5, 4, 2, 2, 2, 1, 5, 2, 4, 3.
 - A. Draw a frequency distribution table for this data.
 - B. Draw a bar chart to illustrate the information above.
 - C. Determine (i) modal mark
(ii) median mark

SECTION 'B' Answer any two questions from this section:

1. Show how you would use the following objects to teach Union and Intersection of sets: bottle tops, sticks (counters) marbles.
2. Why is it important to lay a good foundation in Mathematics for our pupils in the basic schools?
3. Select a maths topic and write a lesson note for a class in either a primary school or a J.S.S.
4. A. What do you understand by pre-number activities?
 B. Describe the important activities in sequence in which you would engage your pupils to develop number concept. Indicate clearly the important concepts to be formed at each stage.

Ghana Education Service
PROMOTION EXAMINATION TO ASST. SUPERINTENDENT GRADE 1994
EDUCATION PART I

1. It seems that infants are most likely to develop attachment to
 - a. The person who is with them all day
 - b. Their parents
 - c. The person who shows 'sensitive responsiveness' when dealing with them
 - d. The person who teaches them
 - e. The people they see
2. The process of becoming successfully adjusted to the environment is
 - a. Adaptation
 - b. Assimilation
 - c. Association
 - d. Behaviour
 - e. Learning
3. One of the physical characteristics which is peculiar to male adolescents is the
 - a. Development of hips
 - b. Development of the breasts
 - c. Development of the eyes
 - d. Development of the waist
 - e. Development of the voice
4. Piaget believed that children learn through
 - a. Association
 - b. Guidance
 - c. Discovery Method
 - d. Memorization
 - e. Listening
5. Which of the following is not a way of arousing direct interest in children in the class?
 - a. Begin the lesson with an expected statement or question
 - b. Give the pupils a problem to solve
 - c. Perform an experiment
 - d. Bring new objects into the classroom and let the children examine them
 - e. The teacher should appear very neat
6. According to the New Educational Reforms which of the following is the community NOT expected to do?
 - a. Provide furniture to school
 - b. Provide land for school farm
 - c. Organise Open Days
 - d. Provide accommodation for teachers
 - e. Provide workshops for Junior Secondary Schools
7. Which of these contributes to pupils' attentiveness?
 - a. Mixed grouping
 - b. Lecture Method
 - c. Role Play
 - d. Rigid use of the time table
 - e. Frequent punishment
8. promotes the learning of the backward child
 - a. Interest Grouping
 - b. Ability grouping
 - c. Mixed ability grouping
 - d. Age grouping
 - e. Sex grouping
9. Externally imposed discipline results into resentment. True / False
10. To make the classroom favourable for teaching and learning the teacher must ensure :
 - a. Rigid sitting arrangement
 - b. Suitable pairing of children
 - c. Non-rigid sitting arrangement
 - d. Sitting in ability groups
 - e. Sitting according to height
11. is vital in planning classroom learning activities.
 - a. The time table
 - b. The Syllabus
 - c. The Textbook
 - d. The Course Book
 - e. The Chalk-board
12. Which of the following factors does not directly influence the child's behaviour?
 - a. The Mass Media
 - b. The peer group
 - c. The Home
 - d. The School
 - e. The adolescent
13. A Scheme of Work is the teacher's plan of work to cover the syllabus taking into account the favour except
 - a. The teacher's own interest
 - b. Time allocation
 - c. Pupils' level of ability
 - d. Pupils' previous experience
 - e. Available resources.
14. What is the best way of handling students' answers in the classroom?
 - a. Reject students answers that are wrong outright
 - b. Students should be made to feel afraid to make mistakes.
 - c. All answers should be accepted.
 - d. Repeat questions several times
 - e. Answering in unison as a class should not be allowed too often or for too long.

15. Individual assignments in the class may be the Ideal thing but
 - a. Time Consuming
 - b. It creates much interest in learning
 - c. Involves most of the students in the classroom
 - d. It helps students to answer questions
 - e. It engages children throughout the learning process
16. All these are important to the note when selecting the right textbook except
 - a. Quality of paper used
 - b. Durability of the binding
 - c. Size of prints
 - d. Number of illustrative materials
 - e. The price
17. is one of the tools for Teaching/Learning.
 - a. Motivation
 - b. Rewards
 - c. Classroom questions
 - d. Praise
 - e. Group work
18. The School head performs the following important functions with the exception of
 - a. Interpreting Educational policies
 - b. Seeing to pupils' welfare
 - c. Executing curriculum programmes
 - d. Acting as the Chairman for I.T.A.
 - e. Maintaining effective school community relations.
19. Readiness for learning depends on
 - a. Heridity and Eivironment
 - b. Physical and Mental maturation
 - c. Capacity and Concentration
 - d. Maturation and Environment
 - e. Heredity and Maturation
20. The stage when the child begins to learn the qualities of materials as he uses them and develops concepts of shape, size and quantity is the
 - a. Sensory-Motor stage
 - b. Intuitive stage
 - c. Concrete Operational Stage
 - d. Formal Operational stage
 - e. Informal Operational Stage

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GHANA EDUCATION SERVICEPROMOTION EXAMINATION TO THE GRADE OF ASST. SUPERINTENDENT 1994EDUCATION PAPER IIAnswer THREE (3) Questions Only.

Discuss the means by which the school and the community can be forged together.

Discuss Four ways of maintaining discipline in the Classroom.

You have ~~been~~ observed that a child always come to school late. As a classteacher what steps would you take to help him/her ?

What is the educational value of a school-based library ?

The Criterion Reference Test has revealed that majority of our Primary School children cannot read. Suggest possible means by which this ~~exi~~ problem can be solved.

EDUCATION PAPER I

1. Attachments between human infants and parents seem to appear fully when the infant is about
 - a. 10 minutes old
 - b. 4 weeks old
 - c. 7 months old
 - d. 12 months old
 - e. Just at birth
2. A definition of perception would be
 - a. A process which enables us to hear
 - b. The interpretation of information which we receive through our senses
 - c. The interpretation of visual information only.
 - d. The process of communication
 - e. The process which enables us to see
3. The stage of development where the human body proportion approaches those of the adult is
 - a. Infancy
 - b. Childhood
 - c. Adolescence
 - d. Youth
 - e. Manhood
4. A test designed to reveal differences in personality is
 - a. Diagnostic test
 - b. Psychophysics test
 - c. Personality test
 - d. Ro-Schao test
 - e. Memory test
5. In our study of the behaviour of a juvenile delinquent, which of these is not applicable to him?
 - a. Submissiveness
 - b. Aggressiveness
 - c. Bullying
 - d. Stealing
 - e. Truancy
6. In all societies is the social matrix ~~xxx~~ within which personality is rooted and nourished.
 - a. The Church
 - b. The Peer Group
 - c. The Nuclear Family
 - d. The School
 - e. The Ethnic Group
7. Which of these is NOT correct? Objective tests -
 - a. Can be used to assess application and appreciation as well as knowledge
 - b. Are more difficult to construct
 - c. Can be used to test practical skills in science.
 - d. Can be used to test a wide content coverage
 - e. Can pose a whole series of precise problem.
8. Inborn behaviours are often referred to as
 - a. Habits
 - b. Reflexes
 - c. Characteristics
 - d. Sensory
 - e. Infantile
9. This is not part of the package of the New Educational Reform Programme.
 - a. Period of Pre-university course duration reduced from 17 to 12 years.
 - b. Continuous Assessment
 - c. Construction of Pavilion
 - d. Construction of Headteacher's Bungalow
 - e. Formation of P.T.A.
10. Which of these is NOT a characteristic of the Continuous Assessment?
 - a. Systematic
 - b. Comprehensive
 - c. Formative
 - d. Cumulative
 - e. Summative.
11. The immediate resource person for the school based In-Service Training is the
 - a. Circuit Supervisor
 - b. Headteacher
 - c. District Training Officer
 - d. Circuit Monitoring Assistant
 - e. Trained Resource Persons from G.E.S
12. The first and possibly the most important factor to consider when planning a curriculum is the
 - a. Number of Schools
 - b. Number of P.T.A.s
 - c. Age of the Children
 - d. Development of the Community
 - e. National aims or goals of education
13. The stage at which the child needs more guidance and counselling in his development is during
 - a. Pre-natal
 - b. Infancy
 - c. Childhood
 - d. Adolescence
 - e. Adulthood
14. This is not one of the Office Records of the School.

15. A core point in the Expanded Scheme of Work means the
 - a. Methodology b. Art of Questioning c. Salient points
 - d. Use of Teaching/Learning materials e. Use of teaching skills
16. Which of these is NOT true with a carefully planned and properly given assignment ?
 - a. It makes students lazy
 - b. It develops a positive attitude towards extra work
 - c. It provides direction and guidance for independent study
 - d. It serves as a follow-up activity to what has already been learned in the classroom.
17. Pupils are more likely to take good care of Teaching/Learning materials displayed in the classroom if the
 - a. Teaching/Learning materials are beautiful
 - b. Teaching/Learning materials are high above their reach
 - c. Teacher gives explicit instruction on caring for them
 - d. Pupils help in their production
 - e. Pupils understand the Teaching/Learning materials
18. Clubs and Societies in schools are of a great importance because
 - a. They enable members travel to places of interest
 - b. They help in the socialization process of the child
 - c. They help members pay their school fees
 - d. They promote school drop out.
 - e. They furnish school authorities with necessary information
19. Which of the following is NOT a Visual Aid ?
 - a. Chalkboard b. Textbook c. Projector d. Models e. Classroom
21. A curriculum may be defined as a
 - a. Combination of the objectives of instruction, the strategies of instruction, the various learning experiences offered to the learner and the evaluation of the planning and execution of the school programme.
 - b. Combination of the objectives of instruction, the methods of teaching, the learning experiences given to the pupils and evaluation of the pupils' progress.
 - c. Combination of the objectives of instruction strategies of teaching learning processes, the various learning experiences available to the learner and evaluation of the school programme.
 - d. Combination of the objectives of instruction, the teaching methods, learning experiences of the child and general evaluation of the planning and execution of the content.
 - e. Combination of the objectives of instruction, the strategies of instruction, the learning process, pupils' experience and evaluation and execution of the school programme.

GHANA EDUCATION SERVICEPROMOTION EXAMINATION TO THE GRADE OF SUPERINTENDENT - 1994EDUCATION PAPER IIAnswer 3 Questions Only

At a P.T.A. Meeting, a parent submitted that the results of the S.S.S. graduates indicate complete failure of the programme. What will be your reaction to convince parents that the programme has not failed ~~is~~ because of the S.S.S. results.

As a Headteacher, how would you ensure effective teaching and learning in your school ?

Comment on the characteristics of the Continuous Assessment.

"Educational Psychology is the sole key to successful teaching". Discuss.

There are frequent incidences of parents harrassing teachers in your community. As a Superintendent in the G.E.S., write an address on behalf of the District Director to educate the public on the issue at an Open Day Celebration.

PROMOTION EXAMINATION TO ASSISTANT SUPERINTENDENT GRADE 1994

ENGLISH LANGUAGE

TIME : 25 MINS

SECTION 'A' : OBJECTIVES - ANSWER ALL QUESTIONS

1. He attended the interview with a view to all the questions posed.
a. have answered b. be answering c. answering
d. answer e. have answering
2. Since the killing of the man was not deliberate, the accused was convicted of
a. patricide b. suicide c. regicide d. matricide e. manslaughter
3. The passengers from the ocean liner.
a. Convinced b. Disembarked c. Converged d. Congregated
e. Descended
4. Notwithstanding all efforts by the Government, the economic position continued to
a. decay b. depreciate c. degrade d. murder e. deteriorate
5. The critics of the new book was most interesting.
a. examination b. assertion c. revise d. review e. observation
6. He was for lack of evidence.
a. Acquitted and discharged b. Forgiven and released
c. Resolved and absorbed d. Liberated and jailed
e. Convicted and reviled
7. An e version of that voluminous book has been published for young teachers.
a. exciting b. interesting c. orderly d. abridged e. easy
8. The producer of the new T.V. programme said it was specially for the youth.
a. amended b. devoted c. designed d. arranged e. promoted
9. Please with the instructions in the brochure.
a. comply b. agree c. respect d. obey e. adhere
10. I can do without him, he's not
a. disposable b. indofatigable c. avoidable
d. indispensable e. regrettable
11. Jacob rode away
a. chuckling with glee b. with glee chuckling c. chuckling glee with
d. with chuckling glee
12. We shall take a flight
a. at Lagos Monday to three O'clock in the afternoon
b. to Lagos on Monday at three O'clock in the afternoon
c. at three O'clock in the afternoon on Monday to Lagos
d. to Lagos at three O'clock on Monday in the afternoon
13. He was the field for indiscipline.
a. let of b. sent off c. sent out d. let off
14. that he worked hard he failed the test.
a. Despite of b. For the fact c. Despite d. Despite the fact
15. The Director a party yesterday.
a. host b. played host at c. played host d. was the host to
16. She complained her brother's behaviour.
a. by b. on c. about d. with
17. This is all I wish to tell you.
a. that b. what c. which d. when
18. When the friend heard the joke, she into laughter.

19. He does not really love her, he wants to marry her.
a. against this b. nevertheless c. instead d. otherwise
20. By the time she arrived home her husband for their hometown.
~~a. had left~~ b. have gone c. has left d. had leave
21. Kofi Ofori jumping the College fence.
a. catch b. caught c. cut d. catching
22. Oduro is well.
a. far from been b. being far from c. far from being
d. far being from
23. The ~~very~~ essay was I became tired of reading it.
a. very long that b. too long that
c. so long that d. too long as
24. His appearance when he came yesterday.
a. puts me of b. puts me off c. put me off d. put me of
25. The government hasn't supplied enough textbooks to all schools.
a. Has he? b. Hasn't it? c. Has it? d. Isn't it?
26. I am poor to spend money on fancy clothing.
a. much too b. very much c. too much d. much so
27. Why are the traders getting in so much sugar? They have already.
a. quite a lot b. rather more c. quite some d. rather a bit
28. Our manager is hardworking that he stays at the factory until late.
a. too b. so c. rather d. very
29. I didn't expect my father's health to be bad as it was.
a. quite b. too very c. much d. rather too
30. You'd never be tempted,, if they offered a bribe?
a. should you b. could you c. would you d. ought you

ENGLISH PAPER I

TIME : 25 MINS.

SECTION A : OBJECTIVES (Answer all Questions)

From the words or group of words lettered A - D
Choose the word or group of words that best
completes each of the following sentences.

1. Do you know the rhyme about
a. The King's of Spain daughter b. The King's daughter of Spain
c. The King of Spain's daughter d. the daughter of the Kings of Spain
2. Atta said he did not want to live for as as eighty years.
a. long b. many c. more d. much
3. My uncle with his wife the village.
a. are leaving b. is leavin, c. have been leaving d. were leaving
4. Her attacker left her helpless.
a. to lie b. lay c. lies d. lying
5. The inside is neat but dirty.
a. the surrounding is b. a surrounding is
c. Surroundings are d. the surroundings are
6. Kofi is the chairman of the disciplinary committee
appointed by the Headmaster.
a. three men's b. three men's c. three mans' d. three man
7. Abena's mother instructed her to add salt to the soup.
a. a few more b. a little more c. some few d. many more
8. The model was the best of them all.
a. fair-skinned, beautiful Ghanaian
b. Ghanaian beautiful fair-skinned
c. beautiful, fair skinned Ghanaian
d. fair-skinned, Ghanaian beautiful
9. If a raincoat, we should not have been drenched.
a. we had b. we have been having
c. we had had d. we were having
10. The teacher said we should open back page 10.
a. for b. at c. on d. by
11. We her that information.
a. ought to have not given b. ought not to have given
c. ought to have given not d. ought to not have given
12. Better take some food along the stores are closed.
a. so that b. should in case d. on conditions
13. The farmer was not sure be paid his levy to.
a. who b. whose c. when d. which e. to whom to
14. The friend spied on our local chief to find out
party he was supporting.
a. what a b. whether c. any of the d. which
15. Kofi, Kwame and Kwadwo discussed among the challenges
of the times.
a. each other b. yourselves c. themselves d. all of them.
16. As the little boy stared at his image in the mirror he admired
a. himself b. oneself c. itself d. him

17. "Colleagues, I warn you who runs away is at risk",
the guard said.
a. anyone b. any you c. all of you d. whoever
18. "Ajo was not present at the ceremony and neither was of you",
Kofi Adu said
a. none b. everyone c. both d. any
19. "..... say that all men are never equal".
a. One b. They c. Someone d. No one
20. Danso was the cameraman took the pictures.
a. which b. whom c. whose d. who
21. Five of them are among the groups of armed men broke into
Mr. Adjei's house.
a. that b. whoever c. those d. whom
22. Emma wanted to be sure of the office to his son paid his fees,
a. which b. whoever c. whose d. who
23. Mrs. Ankoma has lost an uncle of
a. her b. hers c. She's d. her's
24. The committee is the mouthpiece of association.
a. we're b. our c. these d. ours
25. The colleagues maintained stance to boycott the games,
a. once b. their c. theirs d. ours
26. When I was in Accra I met the Head of State for the first time.
a. last two years b. two years ago c. the last two years
d. the past two years
27. I shall be going to Enugu
a. next week Thursday b. Thursday next week
c. The next two weeks Thursday d. two weeks next Thursday
28. Mr. and Mrs. Boakye knew
a. themselves b. one another c. each other d. oneself
29. I can't miss Adwoa's services. She is
a. serviceable b. unusual c. hardworking d. dutiful
30. I am a teacher
a. Aren't I ? b. Am I not ? c. Don't I ? d. Ain't I ?

PREScribed COURSE FOR PROMOTION TO ASSISTANT SUPT.
AND SUPERINTENDENT - 1994 EXAMINATION

INSTRUCTIONS: ASST. SUPT. TO ATTEMPT SECTIONS A - E.
SUPERINTENDENTS TO ATTEMPT SECTIONS A TO F.

ENGLISH PAPER 1 Time 45 mins.

SECTION A: Fill in the blank spaces with the correct form of the verb 'be'. Write the ss. in full.

1. Kweku and Kwesi close friends.
2. School fees one problem of the parents.
3. One problem of the parents school fees.
4. The Ghief, as well as the Queen-mother, present
5. I, your teacher, older
6. The hunter, together with his dog, lost in the woods.
7. Asante Kotoko have gone into camp and playing tomorrow.
8. Either Kofi or Ama telling a lie.
9. Our leader and spokesman going to speak.
10. All the pupils but Stephen going to pass the exams.

SECTION B: Use the following words in sentences.

1. advice 2. ourselves 3. one (as a pronoun) 4. time
5. close.

SECTION C: Change the following sentences into the Passive:

1. The prisoner cleared the land.
2. The prisoner is clearing the plot.
3. The teacher sent them to hospital.
4. The teacher has sent them to hospital.
5. Our teacher marks the work.
6. We are studying English.
7. James Watt invented the energy of water.
8. Kofi has killed two big rats.
9. Ama had already bathed the children
10. We would talk to the boys.

SECTION D: Complete the sentences.

1. Having finished the work,
2. If he comes
3. If he came
4. If he had invited me
5. Two plus two
6. If any thing happens you and will suffer.
7. Unless
8. anything but good
9. five minutes slow.
10. pound foolish.

SECTION E: Explain the following phrasal verbs in a word.
Example: find out = discover

1. give in 2. give up 3. keep up 4. look down upon
5. look into (a matter) 6. put up with 7. keep on
8. hold on 9. make out 10. get over (illness)

SECTION F: Make abstract nouns from the following words:

1. proud 2. deep 3. tynanical 4. splendid 5. eternal
6. wonderful 7. wise 8. safe 9. frandulent
10. accurate.

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GHANA EDUCATION SERVICE
PRESCRIBED ASSISTANT SUPERINTENDENT/SUPERINTENDENT
EXAMINATION 1994
GENERAL PAPER

Objectives:

1. The International Conference on Population is being held in which African country. (a. Egypt, b. Ethiopia, c. Nigeria, d. Kenya.)
2. Who is the government chief whip (a. J. H. Owusu Acheampong, b. Dr. Kenneth Dzirasah, c. Dr. Kwabena Adjei, d. Owusu Agyekum.)
3. Who is the minority leader in Parliament. (a. Dr. Owusu Agyekum, b. Alhaji B. A. Fuseini, c. S. Nuamah Donkor, d. J. H. Owusu Acheampong.)
4. What Law established the Intestate-successive Law (a. L. 42, b. L. III, c. L. 207, d. L. 281.)
5. Who is the Director of PAMSCAD (a. K. P. Brown, b. Peter Kpodugbe, c. Peter Kpotorphy, d. Ato Ahwoi.)
6. Who is the Director for Teachers' Education (a. Anthony Boafor, b. Elizabeth Addabor, c. Alex Tetteh Enyo, d. E. Osei-Wusu.)
7. Who is the Ag. Director General of the G.E.S. (a. Attah Quayson, b. S. E. Amisah, c. A. N. Tatter, d. R. A. Gbadamosi.)
8. Who is the Assistant Director (Management and Supervision of the District Office) (a. S. W. Y. Jim-Krow, b. A. D. Bampo, c. S. K. Budu, d. M. A. Addo.)
9. What Law amended the National Service Scheme (a. L.I. 201, b. L.I. 422, c. L.I. 279, d. L.I. 242.)
10. Who is the Brong Ahafo Regional Minister. (a. Godfried Abulu, b. Mike Gizo, c. J.E. Ekuban, d. I. Agyei-Mensah.)
11. Who replaced Ibrahim Babangida as Head of state in Nigeria. (a. Ernest Shonekan, b. M.O.K. Abiola, c. Sani Abacha, d. Babaude Ibrahim.)
12. He is not a member of the council of state (a. Mary Grant, b. Nana Obiri Yeboah, c. Kwame Arhin, d. Kwadwo Afari Djan.)
13. Who is the chairman of the council of state (a. Mumuni Bawumia, b. Dr. Mary Grant, c. Dr. Oti Boateng, d. Justice E.N.P. Sowah)
14. What is the largest state within the Commonwealth (a. India, b. Canada, c. Vanuatu, d. Nigeria.)
15. Iraq and fought for eight years (a. Kuwait, b. Bahrain, c. Syria, d. Iran.)
16. Who is the editor of the Daily Graphic (a. Sam clegg, b. Elvis Ayeh, c. Albert Sam, d. S. Ayebrafo.)
17. Who is not a Presidential staffer (a. Francis Adjei Danso, b. Nana Akweku Sarpong, c. Sam Garba, d. Dr. Don Arthur.)

18. Who is the minister for Transport and Communication (a. Dr. Kwabena Adjei, b. E. T. Mensah, c. Edward Salia, d. D. S. Boateng.)
19. Who is the 2nd Deputy Speaker in Parliament (a. Kenneth Dairasah, b. S. B. Arthur, c. D. Kwabena Agyei, d. Justice e. F. Annang.)
20. This District was not placed under the state of emergency (a. Yendi, b. Nanumba, c. Gushiegu-Koraga, d. West Gonja.)
21. Moses Bukani Mabengba, the M.P. for was suspended from parliament (a. Saboba, b. Gushiegu, c. Bimbila, d. Nanumba.)
22. Who is the Head of state of Malawi (a. Baliki Mulnzi, b. Kamzu Banda, c. Mpha Omer K., d. Menes Zenawi.)
23. The Headquarters of the Food and Agricultural Organisation is in (a. Gerebe, b. Washington, c. Rome, d. Paris.)
24. Who is the secretary general of the ECOWAS (a. Edouard Saoma, Benjamin, c. Salim Ahmed Salim, d. Abbas, Bundu.)
25. Who is the Director of the World Bank (a. Levis Preston, b. Michael Camdessus, c. Badacar Ndiaye, d. Robert Macnamara.)
26. Where is the Headquarters of the African Development Bank (a. Accra, b. Cairo, c. Addis Ababa, d. Abidjan.)
27. What is the capital town of Burundi (a. Bujumbura, b. Kigali, c. Bangui, d. Aiun.)
28. Who died in a plane shot (a. Paul Kagami, b. Cyprien Ntayaranzi, c. Sylvie Kinigi, d. Pasteur Bizimungu.)
29. Who was the chairman of the committee of Experts (a. P.V. Obeng, S. K. Basante, c. Pe, Rowland Ayagitam II, d. D. F. Annan.)
30. Where is the Headquarters of the O.A.T.U.U. (a. Accra, b. Lagos, c. Nairobi, d. Algiers.)
31. How many nations form the African Petroleum Producers Association (a. 10, b. 9, c. 51, d. 11.)
32. This is one of the ECOWAS Protocols. Free movement of people for (a. 100 days, b. 88 days, c. 120 days, d. 90 days.)
33. Which city hosted the 1994 commonwealth games (a. Canberra, b. Atlanta, c. Victoria, d. Detroit.)
34. What decree established the Ghana Education service (a. D. 247, b. 274, c. 111, d. 109.)
35. Who is the Vice-chancellor of the University of Development studies in the north (a. Amono-Neizer, b. R. Benning, c. George Benneh, d. K. A. Nukunyah.)
36. This nation is not a permanent member of the U.N. Security council (a. Germany, b. U.S., c. Britain, d. France.)
37. Who is the General Secretary of G.N.A.T. (a. Peter Osei-Mensah, b. T. A. Bediako, c. Georgina Baiden, d. Paul Osei Mensah.)
38. Which of these countries practice communism (a. Poland, b. Verezuela, c. Cuba, d. Bangladesh.)

- 3 -

39. The U.S. and her allies plan to invade this country (a. Haiti, b. Guatemala, c. Panama, d. Falkland.)
40. What is the appellation of Nana Oduro Nunapan (a. Daasebere, b. Oseadeeyo, c. Osagyefo, d. Odeneho.)
41. This is not a cabinet Ministry (a. Sports, b. Parliamentary Affairs, c. Interior, d. Finance.)
42. President Sylvester Ntibantuganga of Burundi is a Tutsi. True or False.
43. Ghana won no medal in the recent commonwealth games True or False.
44. Which country won the 3rd Place (bronze) in the 1994 World Cup. (a. Sweden, b. Romania, c. Bulgaria, d. Italy.)
45. He is not a founding member of the N.A.M. (a. Indonesian, b. Yugoslavia, c. Ghana, d. U.S.)

Write down the Abbreviations:

46. I.F.A.D.
47. R.P.F.
48. U.N.A.M.I.R.
49. PAMSCAD
50. ECOMOG

GHANA EDUCATION SERVICE
PREScribed ASSISTANT SUPERINTENDENT
EXAMINATION 1994 - GENERAL PAPER

ATTEMPT ANY THREE.

1. Trace the steps leading to constitutional Rule in Ghana.
2. Teachers were said to be the main contributory factor towards the poor performances of the first S.S.S.C.E.
Do you agree?
3. The Rwandan crisis.
4. The Non-Formal Education.
5. The Northern Conflict.

GHANA EDUCATION SERVICE
PRESCRIBED SUPERINTENDENT EXAMINATION 1994
GENERAL PAPER
- - - - -

ATTEMPT ANY THREE

1. What are the Features in the New Educational Reform Programme
2. Write short notes on one of the following:
 - a. The Northern conflict
 - b. The National Service Scheme.
3. The Rwandan Crisis.
4. Trace the factors leading to the poor performance of the first S.S.S.C.E.

- [illegible]

(b) Teachers working in District Offices and elsewhere should similarly be reported upon, state the type of work being done and level of efficiency, their strong points and weak points, etc. etc.

1. The first part of the document is a list of names and their corresponding dates. The names are: John Doe, Jane Smith, and Bob Johnson. The dates are: 1/1/2020, 2/1/2020, and 3/1/2020.

2. The second part of the document is a table with two columns: Name and Date. The data is as follows:

Name	Date
John Doe	1/1/2020
Jane Smith	2/1/2020
Bob Johnson	3/1/2020

3. The third part of the document is a paragraph of text. It states that the data is accurate and complete.

4. The fourth part of the document is a signature line. It is signed by John Doe.

5. The fifth part of the document is a date line. It is dated 1/1/2020.

14. GENERAL REMARKS:

15. FINAL RECOMMENDATION: (State whether teacher is recommended for promotion or not).

.....

.....

.....

.....

INSPECTING OFFICERS

NAMT

SIGNATURE

RANK

1.

2.

APPROVED BY:

DISTRICT EDUCATION OFFICER

DATE _____

N D I X B 1 0
APPLICATION FOR PROMOTION TO A POST IN THE
GHANA EDUCATION SERVICE

(6 copies of this Application form
must be completed with passport-size
photograph affixed to each one)

Affix
Passport size
Photograph

Post Applying for:
.....

PART 1

Surname(Mr/Mrs/Miss/Dr.)
(CAPITALS)

2. Other Names
3. Previous Names (If name has been changed)
4. Date of Birth Place of Birth
Region:.....
5. Nationality and how acquired
6. Religious Denomination
7. Marital Status Number of Children
8. Official GES Address in full
.....

PART II

1. Date of First Appoinment into the Ghana Education Service
.....
2. Present Grade Regd No.
3. Date Appointed to Present grade
4. Have you had a break in Service? If so, give details and
state date of your return to the Service.
.....
5. Have you ever been dismissed or otherwise removed from one
of the Public Services in Ghana?
6. Have you ever been convicted of a Criminal Offence?
If "Yes" give details
.....

.../?

Schools And Colleges Attended with dates:

PART IV

PART V

Record of Employment since living school to Date:-

[illegible]

Particulars of In-Service Training Attended:-

TITLE OF COURSE	FROM	TO
	MONTH & YEAR	MONTH & YEAR
.....
.....
.....
.....
.....
.....

PART VII

Any Further Information you wish to give

.....

.....

I CERTIFY that the Information given on this Form is correct.

SIGNATURE OF CANDIDATE:

DATE:

PART VIII(a) Remarks by:

Head of Institution (Second Cycle/Tertiary), or District
Director (Basic Education Schools, Offices) or Regional/
Divisional Director (Regional & National Headquarters)

.....

.....

.....

Name:.....

Signature:.....

Date:.....

Official Stamp.

(b) To be completed by REGIONAL/DIVISIONAL DIRECTOR:

I do/do not consider the Candidate eligible in terms of the requirements laid down for the post.

I do/do not recommend his/her Application.

My reasons are given below:-

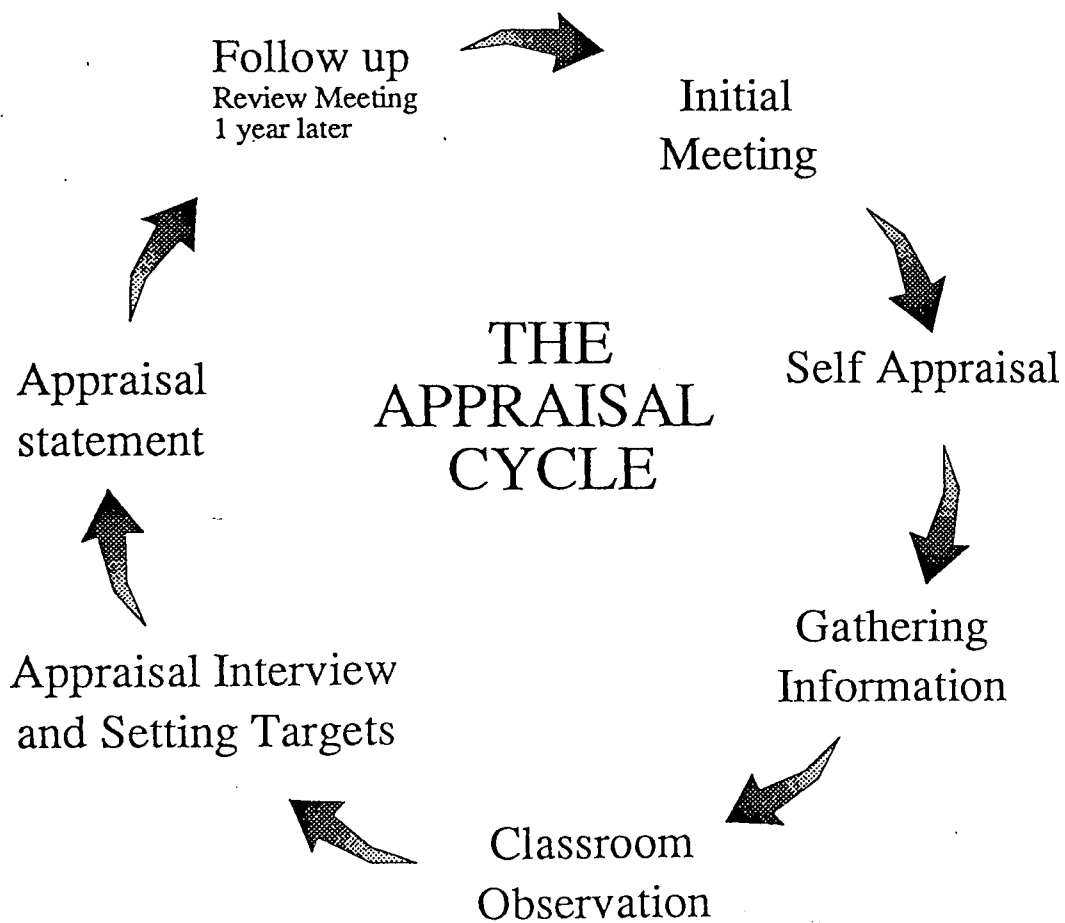
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Name:
Signature:
Date:

Official Stamp:

/IAA/

THE TEACHER APPRAISAL CYCLE (Two Years)



SELF APPRAISAL / INTERVIEW PREPARATION FORM

1. Write down what you think are the main tasks and responsibilities of your current post.
2. During the past academic year, what parts of your job have given you greatest satisfaction?
How could these be used to best advantage?
3. What parts of your job have given you least satisfaction?
Is there something that could be done to overcome this?
4. Were there any problems or difficulties which prevented you achieving something you intended or hoped to do?
Are they still a cause for concern? If so, could they be eliminated?
5. To help you improve your performance in your job what changes in the school organisation would be beneficial?
6. What additional things might be done by your
Headteacher?
Your Head of Department?
You?
Anyone else?
7. What do you think should be our main target(s)/ goal(s) for next year?
8. How would you like to see your career developing?

SUGGESTED AREAS FOR CLASSROOM OBSERVATION

Classroom observation forms an integral part of staff development. What follows gives you an idea of the areas which could be chosen by the teacher or observer as part of the observation process.

Planning and Preparation

- adequacy of lesson notes
- suitability of lesson content to age and ability of pupils
- structure of the session, e.g. phases, pace, activities
- teacher's knowledge of the subject

Classroom Organisation

- arrangement and distribution of materials
- use of space, equipment and teaching aids
- organisation and planning for group and individual activities
- marking and display of children's work

Teaching Techniques

- balance of teaching and learning activities
- use of instructions, descriptions and explanations
- questioning techniques, e.g. open/closed, distribution
- communication, e.g. use of voice, vocabulary
- range, nature and purposefulness of the tasks asked of the children
- monitoring of individuals, groups etc.
- acceptance and use of children's ideas and answers

Class Control

- atmosphere of classroom, e.g. responsiveness and co-operation of the children, use of courtesies
- use of procedures, e.g. entering/leaving the classroom, distribution of materials
- use of praise, encouragement and positive reinforcement
- anticipation and avoidance of misbehaviour
- techniques for dealing with misbehaviour
- presentation of self, e.g. mood, humour, confidence
- responses to differences in personality and emotional make-up

CLASSROOM OBSERVATION RECORD

CONFIDENTIAL



Name of Class Teacher _____

Name of Observer _____

Date of Observation _____

Name of Class _____ Time of Lesson _____

Total No of Pupils _____ Girls _____ Boys _____

All teachers being observed should see the format of this report at the time that the lesson observations are negotiated and should, at this time, complete the following box:

Appraisee's comments on the context of the lesson to be observed

Agreed general/specific focus for observation:

1 _____

2 _____

3 _____

You may wish to itemize particular points for observation within the focus.

Time	Evidence of pupil activity related to focus	Evidence of teacher activity related to focus	Comments or questions to be asked

contd overleaf

Time	Evidence of pupil activity related to focus	Evidence of teacher activity related to focus	Comments or questions to be asked

Negotiated Summary

Signed (Observer) _____ Date _____

Signed (Teacher) _____ Date _____

Setting Targets *Proforma*

Target	Action Plan	Support / Resources needed	Success Criteria	Date for Accomplishment

TEACHER APPRAISAL STATEMENT

CONFIDENTIAL

SCHOOL



Appraisee _____

Appraiser _____

Period covered _____

Agreed Areas appraised _____

Evidence drawn from _____

Strengths noted _____

Areas for development _____

Constraints noted

Targets agreed

1 _____

2 _____

3 _____

4 _____

OPENING ADDRESS BY HON. MR. HARRY SAWYERR
MINISTER FOR EDUCATION ON THE OCCASION
OF GHANA ACADEMY OF ARTS AND SCIENCES THREE-DAY
SEMINAR ON THE STATE OF SCIENCE EDUCATION IN GHANA
APRIL 10 - 12, 1995

MR. CHAIRMAN,

DISTINGUISHED SCIENTISTS,

INVITED GUESTS,

LADIES & GENTLEMEN,

I consider it an honour to be asked to address the opening Session of this important symposium on the "State of Science Education in Ghana" being organized by the Ghana Academy of Arts and Sciences with the active cooperation of the Ghana Association of Science Teachers.

The Latin word "Scientia" from which the English "Science" was derived simply means knowledge. Since the dawn of civilization human beings have sought knowledge about

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themselves and their immediate and far distant environment - the universe - through superstition, magic, folklore and even common sense. Many shades of these practices - Abracadabra, Hocus Pocus etc. still linger on even in the most scientifically advanced countries.

Although not easy to define, science is now taken to mean organized knowledge; - an organized system of precise methods or procedures of observation, measurement, description, recording, analyses, deduction, reporting, proof and so on - collectively known as the scientific method. Scientific knowledge can be verified by anyone willing and able to make the effort!

Civilization as we know it today would not be possible without the study, understanding and application of science to our lives - in industry, agriculture, medicine, the environment etc. There is no limit to the extent to which scientific knowledge

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can be so harnessed and employed as to become an integral part of our lives in Ghana, as has occurred in the advanced countries, and now emerging in the Newly Industrialized Countries (NIC) of Asia. It is not at all satisfactory just to be observers, and users of scientific innovations and discoveries from other parts of the world without making any contributions, even to address our own problems of over population, environmental degradation, disease, malnutrition, increasing misery and squalor, to mention only a few.

Any self-respecting people must be able to develop the barest minimum processes and devices to enable them improve their quality of life.

This concern has been the main driving force that led to the organization of this symposium. It is imperative that all levels of Ghanaian Society must be exposed to some education in science.

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Mr. Chairman, the new Educational Reform Programme has placed much emphasis on science and technology education at all levels of the educational system. About 45 to 55% of all subjects taught at the Primary and Junior Secondary School levels respectively are science and technology related.

At the JSS level, the curriculum has been designed to provide opportunities for pupils to acquire basic pre-technical, pre-vocational and scientific knowledge and skills that will enable them to discover their aptitudes and potentialities, appreciate the use of hands as well as mind, and understand their environment and contribute towards its survival.

The SSS programme has been designed to reinforce and build on knowledge, skills and attitudes acquired at the JSS level and to further diversify the curriculum to cater for different talents and abilities to produce well developed individuals capable of fitting into a scientific and technological world.

5

In implementing the curriculum under the educational reform programme, science and technology related subjects have been given the pride of place in the following ways:

- a) Basic science, mathematics, agricultural science, pre-technical, pre-vocational and technical drawing are studied by all pupils at the basic education level.
- b) Core science, core mathematics, core agriculture and environmental studies are studied by all students at the SSS level.
- c) Science programmes emphasize the activity oriented method as well as enquiry and discovery approaches to learning and teaching in an attempt to relate theories in science to real life situations.
- d) In the initial teacher training programmes for training teachers for basic schools, science and mathematics are core subjects studied compulsorily by all teacher

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trainees.

- e) The development of the professional competencies of science, mathematics and agricultural science teachers at both basic education and SSS levels are respectively supported by the Ghana Association of Science Teachers (GAST), Mathematics association of Ghana (MAG), and the Agricultural Science Teachers Association of Ghana (ASTAG). The Ministry of Education and the Ghana Education Service support the work of these professional teachers' associations with the periodic release of funds for their activities such as in-service training programmes and Science Fairs projects at at the Primary, JSS and SSS levels.
- f) The prevalent notion in our society tat studying science, mathematics and technology related subjects and taking up occupations in these fields is the

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preserve of males is also being combated to reverse that notion. The Science, Technology and Mathematics Education (STME) programme under which clinics and other activities are organized for girls in basic schools and senior secondary schools, and female students in teacher training colleges to encourage and motivate them study science, mathematics and technology related subjects and take up careers in them, has been instituted.

Since the inception of the educational reforms, tremendous gains have been made in the area of science education in the country. Under the old system of education, 27% of the students admitted to six th form in 1990 studied science subjects. This percentage of Sixth Form Students fell to 22% in 1991. Under the educational reform programme, an average of 41% of the students admitted to senior secondary schools in 1991, 1992,

8

1993 and 1994 studied or are studying science and technology related subjects under the agriculture, technical and science (General) programmes.

An interesting phenomenon is that, in admitting SSS graduates into the university at the beginning of the 1994/95 academic year, the University of Ghana for the first time in its history admitted more students

This symposium will seek to:

- (i) obtain accurate and up-to-date information about the current state of science education at all levels and for all its branches from the so called basic or pure, to the applied and technological as well as gender issues; and
- (ii) evaluate the adequacy and suitability of current methods, facilities and institutions in meeting our basic requirements for the dissemination and application of

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science, particularly for sustainable development and improving the quality of life.

I look forward to receiving proposals for action arising from this symposium as soon as possible and assure you that my Ministry will give them the highest priority attention.

I wish you the best of luck in your deliberations.

Thank you

APPENDIX C1

USING ALL THE RANGE OF VALUES FOR MATHEMATICS TEACHING EXPERIENCE

The relationship between *mathematics teaching experience* and the other variables used in the hypotheses at the junior secondary level.

KEY: df ...degrees of freedom
 *(**) Significant
 R....correlation

JUNIOR SECONDARY LEVEL

<u>VARIABLE</u>	<u>Pearson's R</u>	<u>χ^2 (df)</u>	<u>Significant Level</u>
1. Appraisal experience	.32*	28.0922(4)	p<.001***
2. Last Appraiser	.35*	29.0468(4)	p<.001***
3. Training	.37*	39.5788(4)	p<.001***
4. Rank	.71*	149.3473(20)	p<.001***
5. Gender	.07	2.1025(4)	ns
6. Professional Status	.13	6.1799(4)	ns
7. <i>Perceived support</i>	.01	0.6852	ns

SENIOR SECONDARY LEVEL

The relationship between *mathematics teaching experience* and the other variables used in the hypotheses at the senior secondary level.

<u>VARIABLE</u>	<u>Pearson's R</u>	<u>χ^2 (df)</u>	<u>Significant Level</u>
1. Appraisal experience	.43*	61.1329(5)	p<.001***
2. Last Appraiser	.39*	47.7476(5)	p<.001***
3. Training	.42*	55.6403(5)	p<.001***
4. Rank	.60*	201.1138(25)	p<.001***
5. Gender	.15*	6.6918(5)	ns
6. Professional Status	.46*	67.7435(5)	p<.001***
7. <i>Perceived support</i>	.30*	38.6852	p<.001***

APPENDIX C2

USING ALL THE RANGE OF VALUES FOR RANK

The relationship between *rank* and the other variables used in the hypotheses at the junior secondary level.

KEY: df ...degrees of freedom

*(**) Significant

R....correlation

JUNIOR SECONDARY LEVEL

<u>VARIABLE</u>	<u>Pearson's R</u>	<u>χ^2 (df)</u>	<u>Significant Level</u>
1. Appraisal experience	.37*	40.5598(5)	p<.001***
2. Last Appraiser	.39*	42.4803(5)	p<.001***
3. Training	.49*	59.5967(5)	p<.001***
4. Maths teaching exp.	.71*	149.3473(20)	p<.001***
5. Gender	.10	2.8784(5)	ns
6. Professional Status	.05	4.7608(5)	ns
7. <i>Perceived support</i>	.15*	27.0280 (15)	p<.05*

SENIOR SECONDARY LEVEL

The relationship between *rank* and the other variables used in the hypotheses at the senior secondary level.

<u>VARIABLE</u>	<u>Pearson's R</u>	<u>χ^2 (df)</u>	<u>Significant Level</u>
1. Appraisal experience	.36*	39.7578(5)	p<.001***
2. Last Appraiser	.33*	30.6999(5)	p<.001***
3. Training	.38*	53.5274(5)	p<.001***
4. Maths teaching exp.	.60*	201.1138(25)	p<.001***
5. Gender	.19*	18.0370(5)	p<.005*
6. Professional Status	.54*	81.1276(5)	p<.001***
7. <i>Perceived support</i>	.32*	51.5883(15)	p<.001***



Deal made further increases in teachers salaries and stipulated that 12 per cent of the then certificate "A" teachers would be promoted to senior teachers (now Assistant Superintendents) and put on a scale of £G500 - £G700. In addition, another grade of Principal teachers (now superintendents) who would have a salary of £G900 was to be created. Promotion to both grades was via prescribed examinations conducted by the Ministry of Education. This was really a new deal because previously the maximum annual income which an elementary teacher could earn in the teaching service was less than £G500 and the highest grade was "Cert A" teacher. The salary increases were real because between 1954 and the beginning of the 1960s, there was remarkable price stability in Ghana. As Birmingham et al (1966) observed, "this was the period of large external balances and unrestricted imports. Increases in demand were met by importation of more goods and this damped down any inflationary tendencies" (p.29). It must be pointed out however, that the period of price stability did not last long for, the retail price index which stood at 119 in 1961 (1954 = 100) rose to 130 in 1962 and 136 in 1963 (ibid). Even so, as compared to present salary levels (which have been dwarfed in real terms by the virtually unstoppable inflationary pressures in the economy), the increases teachers got in 1961 constituted a real deal. This is in spite of the observation that Ghanaian teachers are presently among the highly paid workers in the civil service (GNAT, 1995).

In any case, 1961 marked the beginning of a new era in the teaching profession in Ghana not only because of the new deal but also because of the "gains" made by the then teachers' union in terms of the latter's control over their development and career. Before 1961, secondary teachers were classified as civil servants and there were only two grades available to professional teachers in the elementary schools of Ghana, namely, Certificate "B" Teacher and Certificate "A" Teacher. Teachers in the former category were Middle School Leaving Certificate holders who had completed an approved two-year teacher education course; and those in the latter category were Certificate "B" teachers who had gained promotion through either long service or the completion of a two-year post Certificate "B" teacher education course. There were, of course, thousands of ex-Middle School leavers pressed into teaching as a result of the pupil explosion which followed the famous Accelerated Development Plan for Education in 1951. The phenomenal changes in education focused attention on teachers. The overgrowing demand for teachers gave the then teachers union, the Gold Coast Union Teachers (GCTU) a strong bargaining power for demanding better salaries and improved conditions of service for teachers. The new grades were thus the result of the demands made by the GCTU.

The GCTU had been formed five years earlier as a merger of two unions - the

Ghana. The most common *source* was the Ghana Education Service official. At the junior secondary level, of the 148 teachers who had been appraisal 133 (93%) were last appraised by an official from the Ghana Education Service. The corresponding figure at the senior secondary level was about 70 percent. The other *sources* were the appraisees' heads of department or their heads.

9.3.2 Instruments

Classroom observation

Classroom observation is one of the main instruments used for data collection in teacher appraisal systems. Many researchers (e.g. Mortimore and Mortimore, 1991) have underlined its importance in the teacher appraisal process and many others (e.g. Barber et al, op. cit.) have found teachers to be very positive about classroom observation. However the value of one or two hours of classroom observation has been questioned by a number of authors (e.g. Scriven, 1990; Burgess, 1989). The issues for concern highlighted by these authors include the limit of data collection, sampling in terms of time, people and events and the relationship between the observer and the observed. The implication is that for classroom observation to be valid as an appraisal instrument, it must be made a more frequent event. If classroom observation is absorbed along with the rest of the appraisal system, it would become routine and less of a special event. In that case some of the limitations listed above might be overcome.

The study found that classroom observation was the main instrument used for the collection of data for teachers' work for both formative and summative appraisals, particularly at the junior secondary level. The only other instruments used was the promotion interview, which is discussed below. It was found that classroom observation when it was used to collect data about teachers' work for either purpose was used once or twice, not more. As argued above, the scanty samples of teachers' work used in summative evaluations weakened the validity of classroom observations in the present study.

Promotion Interview

The promotion interview was used to collect data about teachers seeking promotion to the ranks above senior superintendent in the GES. Teachers seeking promotion to the above ranks were also interviewed once. *The study concluded that the nature of the questions mathematics teachers were asked at such interviews invalidated the interviews.* This is because the interviews did not ask teachers enough questions about their classroom practice. Far too many of the questions were on issues which bore no relevance to mathematics teaching.

In case of reply the
number and date of this
letter should be quoted

AKUAPEM NORTH DISTRICT

..... EDUCATION SERVICE

102

P.O. Box.....

AKROPONG-AKUAPEM.

My Ref No.....GES/ER/ADO:69/V.5/72



Your Ref No.....

REPUBLIC OF GHANA

31st May,..... 19..95..

TEACHER APPRAISAL AND THE TEACHING OF MATHEMATICS IN GHANA

I refer to your letter dated 24th May, 1995 on the above topic and have to inform you that you have been granted permission to conduct the research in the schools in this District.

Headmasters of Junior Secondary Schools in the District have already been informed.

I assure you of the co-operation of this Directorate.

.....
A. D. BAMPO
ASST. DIRECTOR(SUPERVISION & INSPECTION)
for: DIST. DIRECTOR OF EDUCATION
(AKUAPEM NORTH)

JONATHAN FLETCHER
DEPARTMENT OF MATHEMATICS,
STATISTICS AND COMPUTING
INSTITUTE OF EDUCATION,
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