# Teacher participation in online communities of practice: a mixed-methods study of community, context and practice

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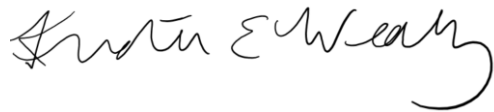
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## Author's Declaration

I, Kristen Weatherby, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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# Abstract

The primary objective of this doctoral research is to understand the relationship between teachers' participation in online communities of practice and the development of their teaching practice. The online community at the centre of this research is the Computing at School (CAS) community, created to support the computing curriculum in the United Kingdom. A mixed-methods methodology was employed that included a survey of CAS member teachers as well as semi-structured interviews with a subset of surveyed teachers. A content analysis of interactions between members on the CAS online community aided in development of maps of teacher context and in understanding whether CAS exhibits characteristics of a COP.

Findings indicate that some teachers report significant changes to their teaching, classroom management, lesson planning or personal understanding of computing concepts as a result of their participation in the CAS community. CAS exhibits characteristics of a COP, according to Wenger's (1998) framework, but not all CAS teachers use CAS in this manner. Other CAS members use CAS simply as a resource bank, from which to download activities for classroom use.  Findings also reveal that a computing teacher's background characteristics, notably his or her professional experience prior to teaching computing, play an important role in their attitudes toward and preparedness for teaching computing as well as influencing the professional development resources to which they have access.

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## Acknowledgments

While pursuing a doctoral degree often seems like a solitary endeavour, I could not have completed this work without the help of many people. First, my thanks go to the leadership at Computing at School, for granting me the permission to study their community and publicising my survey and ultimately my findings to their members. I owe a debt of gratitude to the busy teachers who agreed to respond to my survey and participate in interviews; without you, there would be no study.

I am one of the truly fortunate PhD students to have had the guidance and support of a wonderful supervisor for more years than I care to admit. To Professor Rose Luckin, thank you for your constant encouragement and advice, and for addressing all of my worries over the years.

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Finally, to my guys, Ed and Thomas. Thomas, thank you for understanding why mommy always had to work so that she could become a doctor who couldn't even help you when you got sick. Ed, I'm sure you didn't know what you were getting yourself into, all those years ago. Thank you for all of the sacrifices you made for this and for your continued faith in me, even when I had none.

# Glossary

| | |
|---|---|
| A-level | Advanced level exams taken by 18 year olds in parts of the United Kingdom to prepare for entry to university |
| APM | Academic Programme Manager |
| CA | Controlled assessment |
| CAS | Computing at School organisation |
| CoP | Community of Practice |
| CS | computer science |
| DfE | Department for Education, England |
| EOR | Ecology of Resources |
| FE | Further education |
| GCSE | General Certificate of Secondary Education, qualification in certain subjects taken at the end of secondary education in parts of the United Kingdom. |
| HNC | Higher national certificate |
| HND | Higher national diploma |
| ICT | information and communication technology |
| IT | information technology |
| KS1, KS2, KS3, KS4 | Key Stages 1-4: levels of the English primary and secondary curriculum |
| LPP | Legitimate peripheral participation |
| MAP | More able partner |
| NoE | Computing at School's Network of Excellence programme |
| NQT | Newly qualified teacher |
| NVQ | National vocational qualifications |
| OECD | Organisation for Economic Co-Operation and Development |
| PiL | Partners in Learning |
| PiLN | Partners in Learning network |
| PLN | Personal learning network |
| SOW | Scheme of work |
| STEM | Science, technology, engineering and mathematics |
| TALIS | Teaching and Learning International Survey |

| | |
|---|---|
| UK | United Kingdom |
| ZAA | Zone of Available Assistance |
| ZPA | Zone of Proximal Adjustment |
| ZPD | Zone of Proximal Development |

# Chapter 1 – Introduction

> We know relatively little about how to develop such online (or online and offline) intentional communities… It is yet another leap to have such communities support substantial learning (rather than other pursuits, such as conviviality). *Building online communities in the service of learning is a major accomplishment about which we have much to learn.*
>
> (Barab et al., 2004)

## Overview

This chapter introduces the research carried out in this thesis. It begins by presenting the question that

drives the research and explaining its significance. The research design is summarised and definitions of

key terms are presented. The chapter ends with an outline of the remaining chapters in the thesis.

## Introducing the research

Over a decade ago, Barab and colleagues voiced the challenges associated with the creation of online

communities for the purpose of learning and expressed that there remained much to learn about how

such communities could be successful. More recent research into the development of online

communities, particularly for teacher learning, discusses many of the same challenges, notably:

- barriers to access (Wenger et al., 2009) and participation (Chen & Chen, 2009),
- strength of social ties between members (Tseng & Kuo, 2014),
- motivation of members to participate (Falk & Drayton, 2015) and
- the increasing burden on teachers' time and their own history of being isolated in their practice (Baek & Schwen, 2006).

Why then, does the development of online communities for teacher learning continue? In short, many

believe the benefits outweigh the possible risks. High quality professional development for teachers

needs to be more than just a one-time occurrence and needs to include many ways of engaging

teachers over a sustained period of time. It should instil in teachers a sense of purpose and provide

them with connections to their peers, as well as a link to the larger social and educational context to

which they belong (Cordingly et al., 2015).

Researchers observe many of these qualities in certain online communities for teachers. As a result,

many studies extol the benefits of community learning for teachers (Carr et al., 2008; Klein & Connell,

2008; Schlager et al., 2009, among others). As technology use has become more pervasive in education,

Teacher participation in online communities of practice

these learning communities have moved online, allowing teachers access to peers and to practice

outside of their school or even their local area. The omnipresence of web communities also makes them

convenient for teachers' busy schedules.

The central question that drives the research reported in this thesis is:

**What is the relationship between participation in online communities of practice and the development of a teacher's practice?**

The study employs further research questions to define the elements that are necessary to gain

understanding of the relationship between community membership and any change in teaching

practice:

- How does an online community of practice fit into a teacher's context?
- What are the characteristics of the online community that teachers are actively using to develop their practice?
- What are the characteristics of the changes teachers are making to practice as a result of their participation in online communities?

## Premise and significance of the research

This research espouses a sociocultural view of learning (see Chapter 3) and uses two theoretical

frameworks to help provide answers to the research questions discussed in the previous section: the

community of practice framework and the Ecology of Resources framework. The community of practice

framework was developed by Wenger (1998) and is a continuation of the work he began with Jean Lave

on the social learning that occurs on the periphery of a community. The definition of a community of

practice that is used and referred to throughout this study is as follows:

> *Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis... Over time, they develop a unique perspective on their topic as well as a body of common knowledge, practices and approaches. They also develop personal relationships and established ways of interacting. They may even develop a common sense of identity. They become a community of practice (Wenger et al., 2002, pp. 4-5).*

The Ecology of Resources framework is based on Vygotsky's idea that learners are able to advance

beyond a level of learning of which they are inherently capable with the assistance of a more able

partner (Vygotsky, 1980). The Ecology of Resources framework allows identification and categorisation of resources in a learner's context that might act as a more able partner in offering this assistance. Both theoretical frameworks allow exploration of the online community that is the focus of this study in terms of how and why it fills a learning need for teachers.

## The online community in this study

A preliminary qualitative phase of research was conducted to identify and select the online community that would be at the centre of this research. (This process is described in Chapter 4.) The Computing at School community is an online community for teachers of computing in schools in the United Kingdom. The computing curriculum was introduced into schools in England in 2012, with very little time for teachers and schools to prepare to teach it. Computing at School provides online discussions, teacher-created resources and access to in-person and virtual events to support teachers of this new curriculum across the country.

## Design of the study

The study employs a pragmatist approach to address the research questions and adopts a mixed-methods methodology for the main study data collection and analysis. A sequential mixed research design allows a qualitative strand of the study to follow and build from an initial quantitative strand. The data collection began with a survey of members of the Computing at School community and continued with a semi-structured interview phase in which the sample was drawn from the survey respondents and the interview schedule was developed based on survey data. An additional qualitative phase of data collection included a content analysis of the Computing at School online community, as well as analysis of field notes from attendance at in-person events, in relation to the two aforementioned theoretical frameworks.

## Outline of the thesis

The remaining chapters in the thesis provide background to the study that is rooted in the researcher's past professional experience and the literature of the fields relevant to this research. The data collection, analyses and resulting findings are discussed in detail, and suggestions are made for further research and future development of online communities for teachers. The outline of chapters follows.

- **Chapter 2: Background.** The questions asked in this dissertation emanated from the researcher's own professional experience working with an online community for teachers in the private sector. A description of this community and its flawed implementation is given to provide context for this study.

- **Chapter 3: Review of Literature.** This chapter grounds the research in the literature of sociocultural learning and discusses its importance for this study. It provides the definition of a learner's context that is used in this research and explores how that relates to teacher professional development. The chapter continues by examining what the research says about quality professional development for teachers and how community learning might be beneficial. It looks at the positive and negative characteristics of online communities and online communities of practice and how those characteristics might change when teachers are the learners targeted by online communities. The chapter ends by situating this study as a next step in the sequence of research discussed.

- **Chapter 4: Methodology.** This chapter first addresses the theory behind the selection of the aforementioned mixed-methods methodology employed in this study. It discusses the research design and the methods chosen for each of the phases in the main study. The chapter then details the data collection and analyses that were involved in the selection of the online community to be the focus of this study and concludes with a justification of the choice of community.

- **Chapter 5: Main Study Mixed Methods.** This chapter provides a map of the research questions for this study and the qualitative and quantitative methods that were used to collect data to address each question. It then focuses on the quantitative and qualitative phases of the mixed-methods strand of the main study, providing a timeline of the data collection for each. It also provides details of the sampling, development and implementation of the survey and semi-structured interviews. The mixed-methods study design and the methods that were selected as being appropriate for each of the research sub questions are depicted in Figure 1.1.

**Figure 1.1 Mixed-methods study design.**
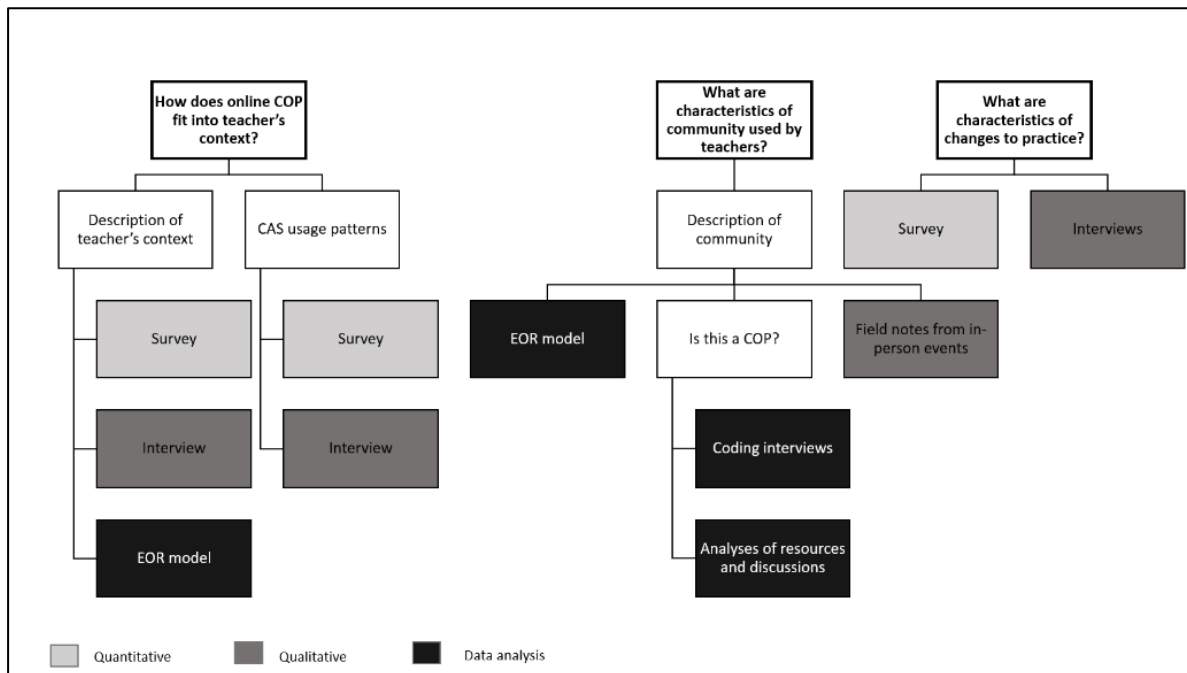


- **Chapter 6: Main Study Review of CAS Community**. In this chapter, the history of the Computing at School initiative, including development of the new computing curriculum and the online community to support it, are presented. A description of the current CAS community, including online and in-person elements, is provided. The community is reviewed through Wenger's community of practice lens, and an explanation of the development of criteria for determining whether CAS might be a community of practice is provided.

- **Chapter 7: Data Analysis and Results.** This chapter describes in detail the data analysis processes that were implemented for the survey and semi-structured interviews and their intended objectives. It presents the initial findings from the survey that were used to inform the development of interview questions. The chapter describes the process of coding the interviews and the development of the codebook, including the codes that were used to determine whether elements of a community of practice were present. Finally, the chapter begins to develop a map of a CAS teacher's Ecology of Resources.

- **Chapter 8: Discussion of Findings.** This chapter presents the main findings as to whether the CAS community can be considered a community of practice. It describes factors that might influence a teacher's access to resources that could aid in their own development and separates the sampled teachers into profiles based on their common prior work experience. The chapter completes the map of CAS teachers' Ecology of Resources in terms of the resources that might be more able partners in teachers' learning. It concludes by discussing how a teacher's participation in the CAS community might be related to his or her teaching practice.

- **Chapter 9: Conclusions.** The final chapter of this dissertation revisits the study's research questions and explains how the findings presented in previous chapters provide possible answers, while at the same time raising new questions for future research. It also provides guidelines for future developers of online communities for teachers that are based on the findings in this study and the research literature reviewed.

- **Appendix A: Data Collection.** This Appendix provides supporting documentation relevant to the data collection phases of this study, including survey and interview questionnaires and communications with teachers.

- **Appendix B: Data Analysis.** This Appendix provides materials relevant to the data analysis phases of this study, including the codebook that was used and a sample of the coding for one interview.

# Chapter 2 – Background

## Overview

This chapter is written from the perspective of the researcher, based on her experience working as a programme manager for Microsoft's Partners in Learning (PiL) initiative in the United States and United Kingdom from 2003 to 2011. The purpose of this chapter is to provide background information to help explain the researcher's objective in conducting this doctoral research. The experiences working with teachers, schools and government to adopt and use Microsoft's own online teacher community (formerly the Innovative Teachers Network, then the Partners in Learning Network; now the Microsoft Educator Network) shaped the questions being posed in this study.

The researcher has written this chapter based on her own recollections, experiences and review of personal and corporate documentation from Microsoft's Partners in Learning programme. The chapter has been reviewed by two former colleagues for accuracy:

- David Walddon, former global Innovative Teachers programme and Partners in Learning Network lead (from 2006 to 2011)
- Stuart Ball, former Innovative Teachers programme lead in the United Kingdom (from 2008 to 2016)

It should be noted that the information in this chapter reflects Partners in Learning, its programmes and its teacher community during the time that this researcher was working at Microsoft. There have been many developments to the programme and the technology underpinning the online community since 2011 that may address some of the issues raised in this chapter. This text does not reflect those changes.

## Microsoft Partners in Learning

Microsoft Corporation's Worldwide Public Sector organisation developed the Partners in Learning programme in 2003 as a major corporate social responsibility effort, dedicating close to $500 million and nearly 100 staff to the programme globally over ten years. Microsoft's website describes the programme as follows:

> *We help educators and school leaders connect, collaborate, create, and share so that students can realize their greatest potential. We have the tools and the technology to*

> *help educators do what they do best: teaching kids and growing young minds.*
> *Microsoft Partners in Learning is a 10-year, almost 500 million dollar global initiative*
> *aimed at improving teaching and learning. Since 2003, we've led the way in*
> *partnering with educators, helping nearly 8 million educators and reaching more*
> *than 190 million students in 114 countries in our first 7 years alone.*[1]

One of the original components of the Partners in Learning programme was the Innovative Teachers Programme (ITP). In fact, ITP preceded PiL as a programme in which teachers could share new ways of integrating information and communication technologies (ICT) into teaching and learning. Teachers participating in this programme could meet in person for professional development offerings, such as training or forums provided free of charge by Microsoft. Innovative teachers attending Microsoft's global forums (originally called Innovative Teachers Forums) would meet in person and share their share their own technology-rich classroom lesson plans with other teachers. Ultimately Microsoft turned the forum into a series of local, regional and global competitions during which teachers' lesson plans were judged by a panel of experts and prizes were awarded to teachers in several categories.

Around the same time that PiL was beginning, elsewhere in Microsoft's Public Sector organisation an online community based on Microsoft's SharePoint product was developed for government customers. The objective of this community, called the Solutions Sharing Network (SSN), was that government customers (such as cities or departments within a national or regional government) who had purchased and implemented Microsoft software solutions could use this community to share their experiences with other existing or potential government customers. The PiL leadership team at Microsoft headquarters reviewed the SSN online community and thought that a teacher-specific version of the SSN would better enable teachers to share their practice, as well as connect with other teachers to have discussions or form communities around specific topics.

## Developing a global network for teachers

Microsoft used the SSN platform to create the Innovative Teachers Network. This community has undergone many iterations since its original inception and, as previously mentioned, when this researcher left Microsoft it was called the Partners in Learning Network (PiLN). This chapter will refer to

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[1] From http://www.microsoft.com/education/ww/partners-in-learning/Pages/overview.aspx accessed 14 May 2013.

a snapshot of the PiLN taken in 2010 for an article this researcher co-authored with Rosemary Luckin

(Luckin & Weatherby, 2012).

Microsoft's website describes the PiLN as follows:

> *With the Partners in Learning Network, teachers share advice, discover best practices, post examples of student learning projects, learn new ways to utilize technology in the classroom, and gain unparalleled access to education experts. They connect with peers around the world and create new communities dedicated to innovative teaching, learning, and professional development.[2]*

The objective of the PiLN has remained the same since its inception: to connect teachers around the world with resources, professional development (PD) and a community of like-minded teachers to support the innovative use of technology in teaching and learning. Use of the PiLN was free of charge for educators and, as of 2010, there were localised versions of the community in 75 countries around the world, comprising more than 2.9 million members. In 2010, each local site might have had its own branding and content based on agreements that existed between Microsoft and local partners or the needs of the teacher community in that country. The text in this chapter refers to the PiLN in general whenever possible. When needed, specific examples provided are taken from the PiLN in the United Kingdom, with which the researcher also has substantial experience.

## Describing the Partners in Learning Network

In 2010, there were a variety of resources available for teachers on the PiLN, including communities, people, ready-to-use classroom lesson plans, professional development materials and software. To access most country PiLN sites, users needed to register for a free Windows Live ID on a Microsoft Corporate website (separate from the PiLN) and use that username and password to log in to the PiLN. Once teachers were logged in to the site, they saw a home page, the content of which varied by country. On the UK PiLN site, for example, the home page linked learners to the newest and most popular content for teachers. This included links to free software downloads, top-rated teacher-created

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[2] From http://www.microsoft.com/education/ww/partners-in-learning/Pages/network.aspx accessed 14 May 2013.

resources on the site, information about upcoming professional development events for teachers and links to the latest blog posts for teachers, written by Microsoft employees in the United Kingdom.

To further navigate through the site, the teacher selected from the tabs at the top of the page to go to any of four other sections: My Notebook, Connect, Community and Resources. In the My Notebook section, teachers could complete a personal profile which included personal information about their own educational background, the subject area they taught, their interests and information about the school in which they worked. These data were then associated with the individual teacher's profile and aided in the search process on the website. The My Notebook page also presented teachers with a snapshot of their actions on the site, including a list of the communities to which they belonged, the resources they had uploaded, and the public and private documents they had posted to the site.

The Connect section was the site's search engine from which a user could search for another member of the Network based on the categories of personal information that were available in the My Notebook section. Once a teacher found other PiLN users of interest to them, he or she could contact the other teachers directly or "connect" to them, which would add them to the teacher's list of contacts on the site. As with other search engines that are reliant on data tagging, the quality of the search engine used to "connect" teachers was reliant solely on the completeness and accuracy with which teachers completed their own user profiles. In other words, a teacher could remain anonymous to others on the PiLN by simply refusing to complete their own user profile in the My Notebook section.

The Community section of the UK PiLN was, at the time, one of the most used sections of the site. In this section, users could create private or public communities dedicated to a specific content area or interest (teaching science or using a certain piece of software, for example) or supporting a professional development offering. Teachers could also use the communities as workspaces within which they could collaborate with colleagues on a project or piece of work. The user interface of the communities was similar to SharePoint document-sharing spaces, with places to post documents, have discussions, make announcements and view who belonged to that community. Communities could be either public or

private.[3] Private communities might be invitation only (if they were dedicated to a certain piece of work or a course, for example), or open to any site user whose membership was approved by the community owner. If a teacher had a particular interest or learning need, he or she could search the site for a community on this topic or simply scan the list of all communities on the site and join the community (if it was public), or send a request to the community leader to join (if it was private).

The Resources section of the PiLN contained various professional development resources for teachers to download. This included but was not limited to training materials, free software from Microsoft or partners, and lesson plans posted by other teachers. When teachers posted new resources for sharing on the site, they were required to tag the resources according to the type of content, the subject and the target age range of students. As with the user profiles, the more complete the tagging on each resource, the easier it was for other users within the community to find it. However, there were other issues with tagging, which will be discussed later in this chapter.

## Problems with the Partners in Learning Network

The idea of creating an online community for teachers centred on teaching with technology was very popular amongst the Microsoft Partners in Learning staff and their partners, at least at first. The PiLN seemed like an ideal place to cultivate a community of technology-savvy teachers who were already users of Microsoft technology in the classroom, and to whom Microsoft could promote new software, resources or ideas. However, issues quickly arose with the implementation of the community in many different countries. The major issues relevant to this study are summarised in the sections below. All issues discussed are also reflected in the literature on online communities presented in Chapter 3.

### Developing a technology platform for an online community

The most significant issue came with the choice of a technology platform itself. Microsoft SharePoint was not designed to be an internet-based product. It was intended to be used as an intranet site within a business organisation. However, Microsoft required that its employees use Microsoft software products whenever possible. Therefore, the technology platform for the PiLN was built using Microsoft

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[3] Even public communities on the PiLN were not open to the public, so to speak, as the website itself was private and required registration and a username and password.

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SharePoint, and the aforementioned Solutions Sharing Network for government customers was used as a base upon which the PiLN was developed. In other words, the technology solution was not selected to fit the needs of the community; the community was made to fit the constraints of the technology.

## The user interface as barrier to teachers' access to resources
The technology platform for the PiLN was available in one version of a language (United States English, and not British English, for example) and a generic education lexicon was employed for all country websites outside of the United States. In practical terms, this meant that any resources posted by teachers could not be tagged in a manner that was meaningful to the education systems of their countries. For example, a Key Stage 2 geography teacher could not tag her lesson with the subject "geography" or the age level of "Key Stage 2", as those terms were unavailable in the drop-down menus on the community. Similarly, teachers could not search for learning resources specific to the subject or age they taught. Search options were limited to a generic age range of the students (5-7 years old) and broad subject categories (history).

## Teachers were not actively joining and participating in the PiLN
Many technology-savvy teachers, such as the so-called early adopters who were the initial target for the PiLN community, already had their own favourite online websites which they visited for lesson plans, ideas and connections with like-minded colleagues. Teachers were reluctant to join one more site, especially one in which they could not efficiently search for and find the resources they wanted, and for which they needed to create yet another username and password.

## Inspiration for this Research
After years of working with the Microsoft staff trying to implement the PiLN, with partners to grow the membership and with teachers who were understandably reluctant to use it, this researcher began to question whether the PiLN provided any value to teachers, teaching and learning. Providing a platform to connect a global community of educators with a common goal and enabling them to share practice is a noble objective, one that could lead to the formation of one or multiple communities of practice for learning amongst teachers. In reality, however, the community was not meeting this objective. Moreover, it became apparent that the PiLN was only one of scores of online communities that were

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developed or being developed for teachers. Schools, local authorities, quangos, NGOs, subject associations and other software companies were all creating online communities for teachers to join. Also, during the implementation of the PiLN, the use of social media platforms such as Facebook and Twitter began to increase in popularity with teachers.

Teachers who sought online resources or communities were now faced with more choices than they could be cognisant of. Membership to some of these communities, such as their schools' learning platforms, might be obligatory. Other communities might have been discovered through the recommendation of a colleague or by simply searching on Google. In many cases the onus is on the individual teacher to be able to determine whether the content and interactions on the community are of sufficient quality and appropriateness to aid in the teacher's own development. Teachers' levels of participation in these communities vary according to a variety of factors. From a purely administrative point of view, logging in to all of these communities probably requires teachers to memorise multiple usernames or passwords. Furthermore, not all of the communities are likely to be accessible from within their schools' firewalls.

After observing first-hand an online community that was not successful (in terms of recruiting and retaining members, encouraging active participation and providing value for teaching and learning), this researcher wanted to learn what characteristics are present in successful online communities for teachers. How do teachers locate online communities that are useful to them, and how do they assess whether the resources on the communities are of high quality? What common factors do successful online communities possess that encourage member teachers to actively participate and connect with other members of the community? Finally, how could this information be shared with the developers of online communities to help them create more successful resources for teachers?

These are the kinds of questions that this dissertation endeavours to answer.

# Chapter 3 – Review of Literature

## Overview

This chapter provides a review of the research literature that is relevant to this study. It introduces the

theories that are central to the development of the research questions and to the later analyses of the

data. The main themes that are covered in this chapter and that inform the work of the entire thesis

are:

- Learning as a social endeavour
- The learner's context
- Situating learning in communities of practice
- Supporting teachers as learners
- Online learning communities for teachers

The study espouses a sociocultural view of learning, in which individuals learn through their interactions

with others. The culture and norms of society interact with the environment, the features of the setting

and the beliefs, prior knowledge and intentions of the individual. In other words, learning does not

occur in the confines of a learner's head. This view of learning is then contrasted with the culture of the

teaching profession to understand whether and how teachers might benefit from the social learning

that occurs in a community of practice. The introduction of technologies to the realm of learning

communities is discussed in terms of its strengths and weaknesses when applied to the community of

practice model. Figure 3.1 depicts the progression of topics from the underlying theories of learning to

the more specific research into communities of practice, teacher professional development and online

communities, as they are discussed in this chapter.

**Figure 3.1 Topics discussed in literature review.**
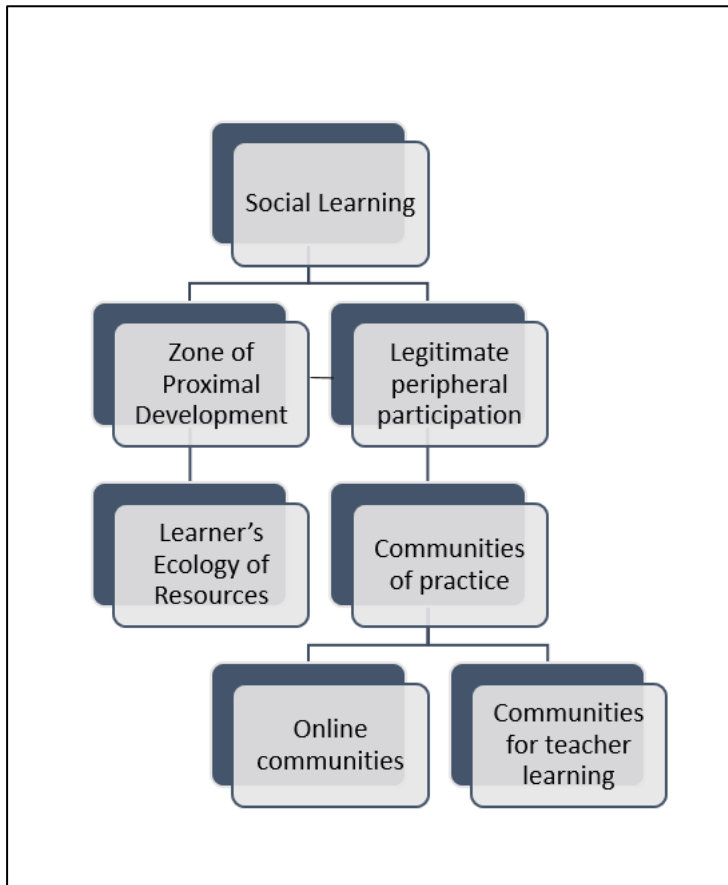


The literature explored for each of these topic areas leads in a direction that allows this thesis to follow.

After examining what the literature indicates as recommendations for the success of online

communities of practice in general and for educators, the conclusion delineates how this thesis provides

a logical next step in the path outlined in this chapter.

## Learning as a social endeavour

The view of learning as a social endeavour originated with psychologists in Russia in the 1930s, namely

Lev Vygotsky and his colleagues, whose studies of the learning process in children developed theories of

learning that were contrary to the work of psychology at that time. While the beliefs of psychologists

until this point tended to divorce individuals from the social, it was Vygotsky's position that the

individual and society could not be separated, especially in terms of an individual's development (Cole,

1985). Throughout Vygotsky's work studying children's development, he observed social learning

occurring naturally in the learning processes of children (Vygotsky, 1980). It is from this research and

Vygotsky's opinions about the state of education and psychology at that time, that he developed the

concept of the Zone of Proximal Development (ZPD) (Cole, 1985). The ZPD states that every individual

has two development levels. The first level relies on individuals' own intellectual capacity, and is the

level of development that they can reach by relying on their own mental abilities. The second level of

development is the potential which the individual can attain when they have help from what Vygotsky

refers to as a More Able Partner (or More Able Other). The distance between these two development

phases is referred to as the Zone of Proximal Development. Vygotsky believed that certain

developmental processes in children are only available to them if they are able to seek out support from

other people (peers, adults, others in their environment) in their learning (Vygotsky, 1980). Therefore,

all learning must seek to create a Zone of Proximal Development.

Vygostky's sociocultural theories of learning have enjoyed a resurgence in recent years, especially in the

study of any kind of computer-supported collaborative learning, such as that examined in this study

(Scanlon, 2011). Some scholars have limited the application of the ZPD, while others have expanded it

(Guile & Young, 1998). Cole, in particular, discussed use of the ZPD in education to examine how more

able partners structured support for learners of all ages, rather than limiting it to just children (Cole,

1985). His thoughts on how the more able partner allowed novices to participate in activities that would

normally be out of reach for them made connections to Lave's early work discussing the relationships

between apprentice and expert West African tribal craftsmen in the same manner.[4] Thus, the idea of

learning as a social endeavour and a ZPD for learners at all levels emerged, defined by the interactions

between the learner and others who have more experience (Cole, 1985; Lave & Wenger, 1991).

Researchers came to believe that when studying learning, the social circumstances surrounding the

learner are just as important as the individual himself (Putnam & Borko, 2000). Furthermore, according

to Cole (1985), it is impossible to separate an individual's learning from his or her society. Humans are

social beings and, as such, our learning occurs through living and through our interaction with others,

rather than inside our own minds (Wenger, 1998). Individuals may process learning on their own, but

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[4] The work to which Cole is referring is *Lave, J. (1978). Tailored learning: Education and cognitive skills among tribal craftsmen in West Africa. Manuscript, University of California, Irvine*, which was not read for this dissertation.

even this is in reaction to the society around them, including behaviours, norms and culture (Lave, 1991). The individual only turns inward *after* social interaction, to process and organise his or her own thoughts informed by the social experience (Vygotsky, 1980).

As these sociocultural theories of learning developed, researchers began to understand the possibilities associated with them. It is thought, for example, that social learning is also connected to becoming an expert in a particular field. The interaction with a more able other is necessary in order to build expertise which cannot be gained from working alone, even if resources such as books or videos are employed (Bransford & Schwartz, 2009).

### Expanding further on Vygotsky's theories of social learning: activity theory

In addition to building on the possibilities related to Vygotsky's theories, researchers have interpreted his work differently since his early death, and even during his lifetime. Many of the Russian terms that Vygotsky used are as difficult to translate to English as they are challenging to Western philosophy (Davydov & Radzikhovskii, 1985; Wertz, 1985). Some of Vygostky's peers in his study of sociocultural learning at that time began to branch out to examine the role of activity and activity systems in relation to the social systems within which they exist (Cole, 1985; Wertz, 1985).

The primary goal of activity theory is to study how people develop their own consciousness. It has evolved over three phases, or "generations," the first beginning with Vytosky's own work (Engeström, 2009).  Vygotsky himself placed great weight in the idea of consciousness in his work and defined it as "organisation of behaviour that is imposed on humans through participation in socio-cultural practices" (Wertz, 1985, p. 187). This idea of consciousness was also central to Vygotsky's thoughts about how children learn with the assistance of a more able partner. A child can learn beyond that of which he or she is capable alone because the more able partner is "a vicarious form of consciousness until such time as the learner is able to master his own action through his own consciousness and control" (Bruner, 1985, p. 24).

This first phase of what is now known as activity theory was considered somewhat limited as it focused solely on the individual (Engeström, 2009). The second generation of activity theory moves on from the

ZPD to look at the systems of activity, tools and artefacts that exist within the learner's social environment. Human motivation to work toward a larger goal initiates activity (Cole, 1985). Smaller goals are set, leading up to the larger objective, and are achieved by action. Tools and signs are used in these actions and act as mediators, shaping the overall experience (Nardi, 1996). Tools are external to the learner and serve to change an object. Signs are psychological tools that aid the learner in controlling various internal processes (such as counting or writing) (Engeström, 2014). These tools and signs are thus mediating artefacts that are based in the culture in which the activity takes place and form part of the connection between humans and their culture (Engeström, 2009). The activity then becomes the unit of analysis (Cole, 1985; Wertz, 1985), and artefacts and tools are studied in an effort to understand both their role and the activity itself (Nardi, 1996).

Until this point, one of the characteristics of activity theory was that it continued to focus on children and how they interacted with their own peers. The so-called third generation of activity theory began when researchers outside the Soviet Union (in Scandinavia, in particular) expanded on these theories and on the domain, by studying adults in the workplace as well, for example (Engeström, 2009). This next generation of activity theory, referred to as expansive learning, studies the interaction between two activity systems, and the challenges associated with inter-organisational learning (Engeström, 2001).

Traditional views of learning such as the ones described by the learning theories examined in this dissertation, define learning as something concrete to be learned, for which there can be a person in the role of "teacher" aiding a learner. Once this concept is learned, there is an observable change in the learner himself. Expansive learning originated in the study of workplace learning, where this traditional view of learning does not always apply (Engeström, 2009). Problems in the workplace do not always have a known solution that can be learned from a more able other. As complex organisations try to work together, they must discover solutions to issues that might involve rethinking previously-accepted behaviours and processes. Expansive learning studies the contradictions that occur as a result of the interface between activity systems. These contradictions can cause friction but not necessarily

problems, and are the source of changes to the activity itself (Engeström, 2001). Situating this study within the realm of sociocultural psychology

Researchers tend to use activity theory to study human behaviour from multiple perspectives, in terms of the actions and goals or consciousness and operations involved, for example (Wertsch, 1979). This is one of the key differences between activity theory and Vygotsky's theories of sociocultural learning, according to Zinchenco (1995). Activity theory focuses on the objects and tools that are involved in activity, whereas sociocultural theories of learning centre on the development and negotiation of an individual's consciousness.

Activity theory is also frequently used in research studying human-computer interaction (Scanlon & Issroff, 2005). Indeed, many of the studies of online communities reviewed in this dissertation make use of activity theory. This thesis, however, focuses on the social aspect of learning in terms of how a learner engages with a more able partner in order to advance his or her own capabilities. It also examines what Bruner (1985) refers to as "props," or resources that make it possible for the learner to advance beyond their inherent abilities. Vygotsky's ZPD explores activities in relation to how control over those activities shifts from the more able partner to the learner over the course of the learning process (Cole, 1985).

Examining the third generation of activity theory, specifically the theory of expansive learning illuminates another key difference with the theories used in this dissertation. In each of these theories (Vygotsky's ZPD, Luckin's EOR and Wenger's COP, which will be discussed in subsequent sections of this chapter), learning is one-directional. Both Vygotsky and Luckin look at individual learners, while Wenger asserts that learning occurs through interactions with other members of a community. When cultural-historical activity theory (CHAT) is used in education, it also tends to focus on individual learners or classrooms of learners (Engeström et al, 2002). Engeström's theory of expansive learning enables an understanding of how education organisations and their shared practices transform (Engeström et al, 2002). In addition, although the theory of expansive learning also involves communities of learners

interacting with one another, the learning is not limited to movement along a pre-defined scale (from novice to master, for example).

Finally, the ZPD also allows examination of the learner's context and what elements of context provide the best conditions for their learning (Bruner, 1985). Indeed, Cole (1995) believed that both Vygotsky's theories and activity theory share a common origin in the environment in which people live. It is this environment that the activity of previous generations has shaped, and that cannot be separated from learning, consciousness or activity (Cole, 1995).

## Situating Learning

The idea of learning as social also means that any activity associated with learning does not exist in isolation. The physical and social environments in which it occurs are influential insofar as the situation itself becomes part of the learning that transpires (Putnam & Borko, 2000). In other words, all learning and conceptual knowledge are situated (Brown et al., 1989) and this notion of situation must always be considered when trying to understand learning (Suchman, 1987).

What, then, is a situation? As Lave states, "It is not possible to walk into a situation"(Lave, 1991, p. 66). In other words, a situation is not the same as a physical environment; it also involves the shared meaning that comes from interaction with others around us. One of the critiques of schooling is that the knowledge that students are supposed to obtain through their schooling is not connected to the situation in which it is supposed to be employed (Brown et al., 1989). Brown et al (1989) provide an example of how learners acquire language in society through participating in conversation, making meaning of new vocabulary by listening to the context of what surrounds the new word. In school, students are required to memorise dictionary definitions of new vocabulary, thus losing the nuance and understanding of how to apply the new word in multiple contexts.

Therefore, it is the application of knowledge that embeds the acquisition of conceptual knowledge. Brown et al (1989) view conceptual knowledge as merely that which needs to be actively used in order to develop understanding of the concept itself, its use and its meaning in the world.

Thus, situating cognition refers to designing learning that takes into account an individual and his or her context and environment as well as the content that is to be learned. This point becomes important not only in terms of the discussion of a learner's context that follows, but also when looking at the central themes of this study - teacher learning within a community of practice. The development of a teacher's workplace knowledge should be situated within a community of practice. To paraphrase Avis & Fisher (2006), if one wants to be a teacher, one must learn - from the larger community of teachers - to do what teachers do.

## Context

Situations themselves always exist within a particular context (Cole, 1998), but there are differing views amongst researchers as to what defines a learner's context. One school of thought is that context is a container in which learning occurs and, as such, includes the environment and any interactions, culture or norms from the surrounding society (Miller, 2009; Cole, 1998). For those from this school of thought, much is made of the idea of transfer of learning from one context to another. Some believe that learning transfer can be affected by context. Learners can acquire knowledge in one context and yet when the environment or situation changes, that learning does not transfer (Bransford et al., 1999). While many advocate for teaching learners the skills to aid them in more successful transfer of learning between contexts (Evans & Guile, 2012), a more extreme view, espoused by researchers such as Suchman (1987) and Brown et al (1989) and discussed here by Laurillard, is that "learning must be situated in the domain of its objective" (Laurillard, 2013, p. 15). Putting this in the perspective of schooling and teacher learning would mean that all teacher learning (or professional development) should occur in the environment in which the learning will be applied, likely the teacher's own classroom.

Others argue that the notion of "transfer of learning" is too limited to describe the actual social process of learning as it relates to society and context. Evans and Guile (2012) describe a process of recontextualisation that occurs when content is prepared to be taught to learners in a formal learning environment. The content to be learned is changed when it moves from its original domain (in industry, trade or research) and is organised into a format that is used in teaching (Evans & Guile, 2012). Lave

believes, "A narrow focus on transfer from one problem to another is not equivalent to, nor

representative of, the experience of bringing knowledge to bear in diverse situations in the lived-in

world" (Lave, 1988, p. 62). In other words, transfer of learning is about more than just being able to

transfer knowledge from one situation to another. It is also a process of socialisation, in which culture,

shared values and norms are also transferred from society to the individual.

Thus, an alternative view of context exists that follows a kind of "woven cloth" metaphor, whereby

context follows the learner and is not thought of as a container with a strict limit. Ideas, knowledge and

new opportunities for learning transcend a variety of situations in which a learner finds him or herself

(Miller, 2009). This definition of context means that context is specific to the learner; each learner's

context travels with him or her (Lave, 1991). What is more, a learner's context is further defined by the

intentions and interactions of the learner (Luckin, 2010).

## A learner's Ecology of Resources

If a learner's context travels with him or her, what does that context include, and how does it influence

learning? Luckin's Ecology of Resources (EOR) framework (Luckin, 2010; Luckin, 2009; Luckin, 2008) is

based on Vygotsky's idea of a Zone of Proximal Development in the thinking that the learner's

development benefits from the support of a more able other. The EOR framework is also centred

around the idea that a learner's context is dynamic and related to the conditions, actions and social

circumstances in which the learner is involved at that time (Luckin, 2010). As such the EOR introduces

the concept of the Zone of Collaboration, which encompasses the learner's potential to collaborate with

others as well as the resources available for use in this collaboration.

Inside the Zone of Collaboration, the following elements also exist:

- The Zone of Available Assistance (ZAA): The collection of all resources available to a learner to help advance his or her learning, regardless of whether the learner knows that such resources exist.
- Filters: Elements that might prevent or encourage a learner's interaction with available resources, as well as the relationships between these resources.
- The Zone of Proximal Adjustment (ZPA): Those resources that are most suitable to a learner's needs at a certain point in time. (The ZPA is a sub-set of the ZAA.)

A depiction of a learner's Zone of Collaboration is shown in Figure 3.2.

**Figure 3.2 A learner's Zone of Collaboration.**
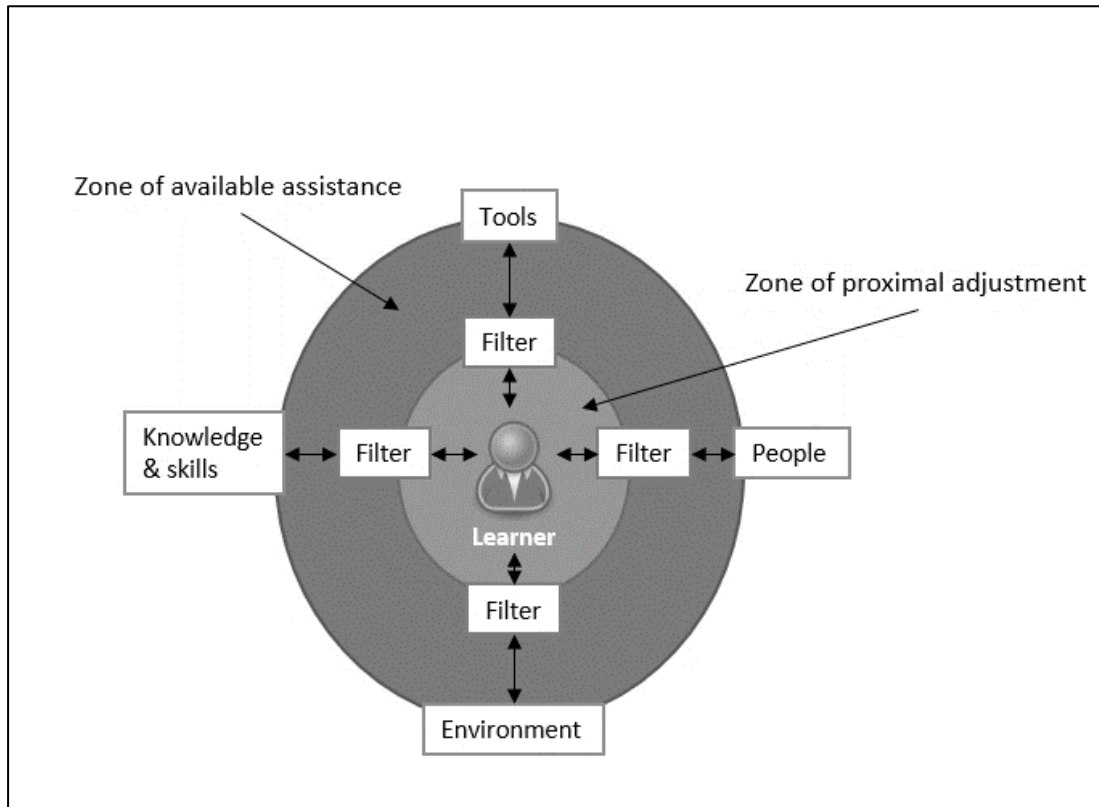


*Source: Adapted from Luckin, 2010*

The EOR framework was developed in the early part of this century and as such its application in research studies is not anywhere near as abundant as the community of practice framework, for example. The EOR framework has been used in a range of studies to help researchers understand learners' contexts so they might have more success in developing aids for their learning (Avramides et al., 2013; Hall, 2012; Söderström et al., 2014.) When using the EOR framework to look at a microworld or virtual learning environment (VLE) that is used for learning, the software itself becomes the ZAA, and the functionality of the program and its available resources, if well-designed, can provide support to the learner and enable her to identify resources that become part of her ZPA (Luckin, 2008).

The involvement of the learner in designing his or her own learning resources is inherent in Luckin's EOR work and many of the studies that make use of it. This in itself exhibits similarities to Engeström's theory of expansive learning, in which learners also create a new object for their activity (Engeström & Sannino, 2010). One of the key principles of activity theory is the history of both the activity and the

system (Engeström, 2009). The activity system itself takes time to develop and the experiences over time become a part of the system's history. The activity system can only be understood when its history is also taken into account (Engeström, 2001). Similarly, the individual learner also has a history and personal experiences, as well as a role and a voice within the activity system. These characteristics of the individual can influence both his or her current or future activity (Luckin, 2010) as well as the activity system itself (Engeström, 2001).

The research conducted as part of this thesis endeavours to identify where online communities of practice fit into a teacher's Zone of Available Assistance, and how these online communities then become resources that are part of a teacher's Zone of Proximal Adjustment. The EOR framework enables the development of a model of each learner's contexts. These models provide a useful picture of the interaction between the learner and the filters and resources within their context. The mapping of a learner's interactions with these filters and resources helps educators and designers to understand how and why resources are useful enough to learners for them to become a part of that learner's ZPA. However, given the current maturity level of the theoretical framework, the usage in this research might deviate both from what is set out in Luckin's original work and what other researchers have done to date. The use of the EOR framework is described in detail in Chapter 6.

## Summary of theories of learning in relation to this research

This section will examine how the specific aspects of the theories of learning used in this study -- Vygotsky's original ideas (and others' subsequent interpretations) about learning as a social endeavour, how and whether situation influences learning, and the definition of a learner's context – relate to the study of teachers' professional learning, which will be examined in more detail in later sections of this chapter.

To apply these theories of learning to the research conducted for this dissertation, it must first be assumed that the theories of learning developed by Vygotsky in his exploration of how children acquire knowledge with the aid of a more able partner, can also be applied to adult learners. This means that adults also have an capacity for learning that can be surpassed with the aid of another person with

more experience (Lave & Wenger, 1991). Many researchers, including those studying teacher professional development and teacher learning, already employ the idea of a more able partner in their research, especially as one who can provide support for the learner. The more able partner and learner relationship does not have to be between an adult and a child, as originally envisioned by Vygotsky. The learner can be an adult who is part of a formal education programme (Hall, 2012) or learning on the job (Brown & Duguid, 1991). The more able partner could be a peer (Lave & Wenger, 1991) or, increasingly, a technology application (Darling-Hammond & Bransford, 2007). These theories of learning are increasingly being used to develop more effective methods of teacher education (Putnam & Borko, 2000), and a discussion of how sociocultural theories of research are being applied to teacher professional development occurs later in this chapter.

The idea that learning is situated would mean that all teacher learning needs to take place in a classroom. But researchers such as Putnam and Borko (2000) disagree. They argue that situating learning away from the school, both physically and temporally (during the summer, for example), provides teachers with a respite from the constraints of schooling and encourages them to innovate. It is here that many researchers who believe in context as something akin to environment would also assert that transfer of learning comes into play. In other words, teachers attend professional development away from the school environment and are not always successful in transferring the learning back to their own school and classroom setting. However, this research sees context as belonging to the learner, so that a learner's context includes her beliefs, values, culture, knowledge and skills as well as the social norms of the group to which she belongs and the physical aspects of her environment. In this view of context, it is not that teachers are unable to access the knowledge that they have just been exposed to in the professional development; it is that they are unable to apply it in the new setting (Putnam & Borko, 2000). In the language of Brown et al (1989), these teachers possess a tool but do not know how to use it.

Therefore, the discussion of the research questions for this thesis will be based on the understanding that teachers, too, can learn beyond the level at which they are individually capable with the aid of a

more able other. Their professional learning does not need to be situated in the classroom; indeed, that could even be detrimental to their progress. However, a teacher's own context needs to be considered in their learning. Teachers, too, have access to a variety of resources in their daily lives that might aid in their learning and act as a more able other to support their development. How and whether they choose to interact with these resources is influenced by the characteristics of their context, including their setting, culture, values, beliefs and their existing knowledge and skills. Many of these elements might already be a part of the community of learning that could exist in their schools or as part of their wider professional community. The notion of teachers belonging to communities of learners – or even communities of practice – is examined in the sections that follow.

## Learning in a community

These sociocultural theories of learning, situation and context enable us to interpret and understand the learning that occurs in a community of practice. Vygotsky's ZPD exists within society and, as such, the society influences how its learners develop their practices, behaviours and identities (Guile & Young, 1998). Knowledge is produced socially and bridges people, tools, environments and artefacts (Gunawardena et al., 2009). In addition, a group's capacity for producing knowledge surpasses that of an individual (Hutchins, 1995; Putnam & Borko, 2000). This kind of learning is referred to as distributed cognition. In schools, there is little opportunity for distributed cognition, as each student is responsible for his or her own learning (Darling-Hammond & Bransford, 2007). Likewise, in schools, cognition is situated in the culture of schooling, rather than in the culture of the subject being studied (biology, mathematics or music, for example (Brown et al., 1989). The community of practice model mirrors the learning that occurs naturally in society in which learning is situated; learning is social, and it occurs through participation in a community of practice (Luckin, 2010).

The idea of participation being central to learning is key to bridging the theories of social learning that started with Vygotsky. Vygotsky would agree that learning is not a process that is isolated in the mind of an individual. Over time, academics have built on this concept and the idea that activity is needed in order to fully understand how to apply the tools or conceptual knowledge that has been introduced to the learners (Brown et al., 1989). Lave and Wenger (1991) posit that learning occurs through active

participation with others that changes both the role of the learner and the skill that is being acquired. They use an example of the learning that occurs within an apprenticeship situation, in which an apprentice is guided by a "master" in the trade and is able to participate in the activity of the community as part of the learning process. This echoes Vygotsky's view of the more able partner's involvement in structuring learning for the learner, often by performing, aiding or directing the activities for the learner (Cole, 1985). Through this process of legitimate peripheral participation (LPP), the apprentice is able to participate in activities in which they couldn't normally. The learner is able to gain legitimacy in the community, and eventually their role transitions from novice to full participant in the community. Fuller and Unwin's 2003 study of three apprenticeship programmes in the UK observed that all three programmes were actually designed to ensure the eventual full participation of apprentices in the community[5].

Lave and Wenger use the idea of LPP to introduce the concept of a community of practice, saying "Legitimate peripheral participation provides a way to speak about the relations between newcomers and old-timers, and about activities, identities, artifacts, and communities of knowledge and practice. It concerns the process by which newcomers become part of a community of practice" (Lave & Wenger, 1991, p. 29). In other words, Lave and Wenger use legitimate peripheral participation to characterise learning. In their view, learning is not as simple as the relationship and interactions that occur between the novice and master in the apprenticeship example. Learning is broader; it is about changing the learner's identity as part of the learner's participation in a community of practice (Wenger, 1998).

### Communities of practice
The definition of a community of practice ranges from simple (a community that shares practice, Hoadley, 2000) to much more complex. The initial definition of the term community of practice comes

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[5] Activity theorists argue that in complex activity systems, the concept of communities of practice becomes impossible, as discreet work groups do not exist. Rather learners are required to work across organisation and that which they need to learn may be unknown. For these types of unknown skills, there can be no master and novice relationship (Engeström, 2001).

Teacher participation in online communities of practice

from Wenger, and is influenced by his work with Jean Lave on legitimate peripheral participation (Lave & Wenger, 1991).

> *Over time, this collective learning results in practices that reflect both the pursuit of our enterprises and the attendant social relations. These practices are thus the property of a kind of community created over time by the sustained pursuit of a shared enterprise. It makes sense, therefore, to call these kinds of communities communities of practice.* (Wenger, 1998, p. 45)

In Wenger's original work on communities of practice, he states that the two central tenets to a community of practice are the negotiation of meaning and the development of practice. Vital to both of these is the participation of both newcomers and old-timers in a community. It is from the interaction and resulting tensions between new and experienced community members that a community's practice emerges (Guile, 2009). Practice is central to the community; it is what brings the community together. The process of reification transforms practice into a learning object – a physical product of the learning process (Wenger, 1998). Part of the process of transitioning from novice to expert in a community of practice involves both continuing to develop the practice of the so-called old-timers in the community, but also developing new practice that will replace some of what exists already. In the same way, novices developing into experts might also replace previous experts, whose practice might become obsolete or who might no longer need the community themselves (Lave, 1991). Some believe that it is this process of transitioning from novice to expert that defines a community of practice (Hoadley, 2000).

### The evolution of the community of practice

As Wenger's work on communities of practice developed, it moved away from academia and theories of learning and began to take root in the world of business and knowledge management. The definition of communities of practice changes as well, becoming broader and more inclusive of different types of communities. An increased interest in communities of practice as development tools grows in response to the poor quality professional development that exists for many professions. One reason for this might be that situated learning occurs within a community of practice, whereas traditional professional development removes the learner from the situation in which he or she needs to apply what they have learned. In addition, COPs allow for learners to progress at their own pace rather than requiring all

members to learn the same thing at the same time, as often occurs in typical professional development or training (Johnson, 2001). Finally, learning communities start to find homes online in order to span organisational boundaries or distances. Wenger recognises this in his later work on digital habitats for COPs by defining communities of practice simply as "communities where the learning component is central" (Wenger et al., 2009, p. 3). Around the same time, Clarke notes Wenger's definition on his own (now defunct) website as "Communities of practice are groups of people who share a concern or passion for something they do and learn how to do it better as they interact regularly" (Clarke, 2009).

With each iteration, the definition broadens and allows more communities to be included under the communities of practice umbrella. At the same time, many other new forms of community for learning are being developed and named. One point of consensus amongst researchers is that there is little consistency as to how these communities are being named and subsequently referred to (Barab et al., 2004; Blankenship & Ruona, 2007; Hoadley, 2000). As Andriessen notes in his classification of different knowledge communities:

> *Since everyone prefers to have his or her own concepts, many new terms are invented, such as community of interest, community of commitment, interest group, network, network of practice, knowledge network, knowledge community, internal community, expanded community, formal network and epistemic community… The final effect seems to be that different names are applied to the same phenomenon and the same name appears to refer to different phenomena (Andriessen, 2005, p. 192).*

Wenger's own definition of the term has evolved throughout his research into communities of practice, as he moved from an academic, situation-based position to one more grounded in the world of business (Andriessen, 2005). As stated in Chapter 1, the definition of a community of practice that is used in this thesis is from Wenger et al., 2002:

> *Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis... Over time, they develop a unique perspective on their topic as well as a body of common knowledge, practices and approaches. They also develop personal relationships and established ways of interacting. They may even develop a common sense of identity. They become a community of practice (Wenger et al., 2002, pp. 4-5).*

## What sets apart a community of practice?

Even though many researchers have moved away from the stricter definitions of a community of

practice, there still exist certain characteristics of COPs that set them apart from other learning

communities. For example, just because one is a member of a certain profession or belongs to a certain

social category, this does not mean that one is part of the community of practice (Hoadley, 2000). Riel

and Polin (2004) differentiate between COPs and practice-based communities that arise around

members of a certain profession. In addition, physical proximity does not equate membership in a

community of practice. Nor does simply knowing a group of people (Wenger, 1998). Communities of

practice are not just a group of people coming together at a particular time or in response to a certain

need. To be successful, community members also have a shared history and culture (Barab & Duffy,

2000). One of the most significant differences between COPs and other communities is that members of

a COP have a shared enterprise; they are working together toward a common objective (Andriessen,

2005). As such, no one member needs to know everything in a COP. Members can rely on each other

and work together to build their own knowledge and that of the community (Wenger, 1998). Again,

when comparing this kind of learning to the learning that occurs in school, we see fewer boundaries

associated with learning in communities of practice (Lave, 1991).

Andriessen (2005) created a classification of different types of communities based on the levels of

institutionalisation of the community (including formalisation and their link with an organisation) and

the degree to which members share a social connection. He found communities of practice to be

characterised by high connectivity amongst members, but low to moderate institutionalisation.

There is a culture within the community of practice as well – including accepted social norms and ways

of behaving. These ways of behaving create a person's value as a member of the community, more so

even than does the knowledge he or she contributes (Contu & Willmott, 2003).

A step away from the traditional community of practice model is the distributed community of practice,

which Wenger et al define as "any community of practice that cannot rely on face-to-face meetings and

interactions as its primary vehicle for connecting members" (Wenger et al., 2001, p. 115). Wenger also

speaks of learners belonging to constellations, which he describes as a collection of practices inside of which both communities and boundaries form. People in these constellations are linked by their engagement to the practice (Wenger, 1998).

### Negative aspects of the community of practice model

The community of practice model of learning is not without fault. COPs can fall prey to the hoarding of knowledge by certain members, the formation of cliques, limitations on innovation and exclusivity regarding who is allowed membership (Blankenship & Ruona, 2007). Power struggles can develop internally, which can influence whether or not novices are able to make the transition to master (Contu & Willmott, 2003). Wenger agrees that there are several downsides with the COP model of learning. Often outsiders are not welcome if members are too possessive of their domain and practice, or they might not understand the language of the community if it is too specific. There can be issues within the community, such as the cliques mentioned previously, but also including inflated status given to one or a select few members, or a lack of self-criticism that prevents the community from developing or hinders learning (Wenger et al., 2002).

One negative of the COP model that relates specifically to this research is that Lave, Wenger, Brown and Duguid all dismiss formal education as a way of learning (Fuller et al., 2005). Lave goes so far as to say that legitimate peripheral participation does not occur in a school setting as it does with artisans, apprentices, etc. Students are not allowed to exist on the periphery and must act as full-fledged members of the school community, so to speak (Lave, 1991). This relates to one of the questions set forth in the introduction to this study and leads us to ask, is it possible for a community of practice to exist for teachers?

### Social learning and teacher learning

Teaching has long been considered an isolating profession, with individual teachers practicing alone and interacting nearly exclusively with their classrooms of students (see, among others, Barab et al., 2001; Dexter & Anderson, 1999; Hargreaves, 1994). Researchers have long observed that "...the actual practice of teachers sharing what happens in their classrooms with other teachers is not common" (Barab et al., 2001, p.74). Creators of professional development (PD) for teachers recognised the

detrimental effects of this isolation to teachers' development (Scott, 2009) and began to look at teachers as learners themselves. As learners, might teachers also benefit from social ways of learning with peers, as part of communities?

The answer to this question appears to be a resounding "yes". Over time, various forms of teacher learning communities have been developed and instituted as teacher professional development or support networks. Many in academia are starting to see value in the use of communities of practice in staff development (Carr et al., 2008; Klein & Connell, 2008; Schlager et al., 2009, among others). As technology has continued to make its way into schools, many of these communities have built digital habitats or formed exclusively online. The distinction between designing communities for teachers versus designing communities of practice for other professions originates with this culture of isolation to which teachers are accustomed, which might make them less likely to look to a community for professional development in the first place (Schlager & Fusco, 2004). Anyone designing communities for teacher learning needs to take these cultural differences into account.

This section discusses what the research tells us about successful teacher professional development and explores how communities might fill a need in that arena. Before delving into those issues however, the idea of a teacher's practice is explored. Wenger describes practice as "doing"; when a teacher is "doing" teaching, what does that actually mean? This study aims to look at the relationship between teachers' participation in online communities and their teaching practice. It is therefore important to understand what the research tells us about teachers' practice today and what motivates them to change their practice.

Finally, this section of the chapter brings the communities of practice concept online to explore the characteristics, advantages and disadvantages of online communities and what the literature tells us about online communities of practice.

### What constitutes a teacher's practice?

When a teacher leaves their initial teacher training institute, ideally she possesses the basic knowledge and skills in both content and pedagogy, developed through a study of theory and subject-area content,

as well as a teaching practice, needed to teach her first set of classes. However, a teacher's education

does not end with the initial teacher training and her practice continues to evolve with experience.

According to Darling-Hammond and Bransford, "teachers continually construct new knowledge and

skills in practice throughout their careers rather than acquiring a finite set of knowledge and skills in

their totality before entering the classroom" (Darling-Hammond & Bransford, 2007, p.3). Research

largely agrees that teaching practice includes activities such as facilitation, lecturing, demonstration,

relationship management, application of learning theory, knowledge of subject content, classroom

management and effective use of the many tools that are in a teacher's toolbox (technology being one

such tool) (Shulman, 1987). Also associated with teachers' classroom work is the planning of curriculum

and individual lessons and activities, providing feedback to students and evaluating their work, working

with parents, colleagues and the larger community and growing in their own development and careers.

Teachers do collaborate with each other on practice, but much of their practice remains private. Little

(2002) distinguishes between "public" practice, which is that practice a teacher might discuss with his or

her colleagues and might include lesson planning or conversations about students. "Private" practice,

on the other hand, might include those tasks that a teacher still accomplishes alone, such as marking

student work.

## Conditions that influence teachers changing their practice

This thesis explores the changes that an individual teacher chooses to make to his or her teaching

practice and starts to explore conditions that might prompt a teacher to change. Unlike many

professionals, teachers are not motivated by salary increases or more prestige (Guskey, 1986). Instead,

teachers are driven largely by the impact of their actions on their students (Guskey, 1986; Shulman

1987; Hargreaves et al., 2001). Teachers are always changing practice, whether as a reaction to

something that has occurred in their class to help reach a particular student, or as a result of the success

or failure of an activity.

The personal knowledge of the teacher plays an important role in whether he or she will change. "When

a teacher tries new activities, he or she assesses them on the basis of whether they 'work,' that is,

whether they fit within the teacher's set of beliefs about teaching and learning, engage the student, and

allow the teacher the degree of classroom control he or she feels necessary" (Richardson, 1994, p.6). Teachers rely on what they have learned through practice to determine what will work in their classroom. They are more likely to make decisions to change based on inherent knowledge about their own situation and experience. This practical knowledge, according to Richardson, is just one factor a teacher considers in determining whether to make a change (Richardson, 1990).

Culture, both the school culture and the teacher's own culture and attitudes toward learning, plays a role in whether the teacher will make changes in his or her practice. If the school culture in which the teacher finds him or herself is not one that allows the teacher to take chances, try new things, and make mistakes, the teacher is less likely to change his or her practice (Richardson, 1990). This is noted in other research on specific professional development as well. Teachers who did not come from school cultures that were supportive of the ideas being imparted in the professional development, had to take what they were learning and alter it to fit their own situation before being able to make changes in their practice (Scheckler, 2009).

The personal values and culture of the teacher are also important in determining whether a teacher will make a change. Laurillard and Masterman note teachers' perspectives on their own practice is significant in that "...they need to think of themselves also as learners and to think of teaching as, in part, a learning profession" (Laurillard & Masterman, 2009, p. 232).

Finally, the aspect of control comes into play. A teacher needs to feel that he or she is in control of his or her own practice (Richardson, 1990; Hargreaves, 1994; Hargreaves et al., 2001). Teachers are less likely to adopt a practice just because research — or some other outside force — tells them it should be so. They need to feel that they can use their practical knowledge, their formal knowledge and their own value and beliefs to make this practice their own and do what they know "works" in their own situation (Guskey, 1986; Richardson, 1990). Teachers want to feel autonomous and that they are an individual (Hargreaves, 1994; Dexter & Anderson, 1999).

## Developing a teacher's practice

A teacher's knowledge and skills develop through practice (Darling Hammond & Bransford, 2007) and experience, but often new skills or content knowledge are needed that cannot be obtained through the act of teaching. In these instances, teachers often participate in some sort of professional development offering, which might include training, seminars, mentoring or coaching relationships or classroom observation. Teacher professional development is defined by the OECD as "activities that aim to develop an individual's skills, knowledge, and expertise and other characteristics as a teacher" (OECD, 2014, p.86).

In a meta-analysis (or "umbrella review") of 46 reviews of evidence published since 2000 on what constitutes effective teacher professional development, Cordingley et al (2015) found that the following characteristics are present in the PD offerings that are deemed the most effective:

- Focuses on improving student outcomes
- Duration is extended to at least two school terms or more
- Contains multiple activities over time following the initial input
- Contains various opportunities for follow-up support or activities
- Content is relevant to individual teachers and their needs
- Builds a sense of purpose amongst attendees
- Environment is professional and relates to larger social and educational context
- Provides opportunities for peer-to-peer support

Surprisingly, whether attendees voluntarily attended these PD offerings or were required to attend did not seem to have as much of an influence on the effectiveness of the PD. Other scholars agree, and relate the qualities of good PD to the theories of learning discussed earlier. Relating the PD to the larger social and educational context involves helping teachers understand how to apply their learning, which is an important consideration of professional development or other support (Putnam & Borko, 2000). Chalmers and Keown (2006) believe that for PD to be effective, it has to develop teachers personally, professionally and socially. PD for teachers must take into consideration teachers' environment, culture, previous education and skills and individual experience (Barab et al., 2001). People bring their own prior knowledge to their learning, which can help or hinder the acquisition of new information. For example, the new content might not fit with what the learner already knows (Bransford et al., 1999; Suchman,

1987). Laurillard (2013) agrees that new knowledge must relate to a teacher's own personal experience. Teacher PD must help teachers relate the understanding of another teacher's experience back to their own personal situation. It must develop in teachers a "cognitive flexibility" that can enable them to look at problems from several points of view as well as bringing knowledge from the PD situation and apply it in the classroom (Darling-Hammond & Bransford, 2007). Finally, effective PD for teachers must provide them the space and tools with which to reflect on their own practice and observe and consider that of their peers (Carr & Chambers, 2006). However, as Barab et al note, "Critically reflecting on other teacher's teaching is not common practice in this very isolated profession in which teachers shut their classroom doors when the bell rings (Barab et al., 2001, p. 92)."

## The realities of teacher professional development

There has long been a divide between the theories of what constitutes quality teacher professional development and what occurs in practice. Some believe that both the system of PD and the underlying culture of the teaching profession are at fault. In some countries (such as the United States and United Kingdom) there does not exist a coordinated system of PD for teachers with a progression of offerings according to their stages of development. Teachers, again used to working in isolation, often find it difficult to trust colleagues or offer feedback on another teacher's practice. Since teaching practice is often linked to teacher identity, it is often hard for teachers to accept criticism of their own practice as well (Schlager & Fusco, 2004). Teacher culture and the current evaluation methods in place in many school systems do not allow for failure, which renders many teachers reluctant to ask questions or show any uncertainty with their practice (Snow-Gerono, 2004). Access to PD can be a challenge, and much PD does not enable teachers to observe good teaching practice (Hargreaves et al., 2001).

Guskey believes that "Most teachers engage in staff development because they want to become better teachers." (Guskey, 1986, p. 6) However, even when teachers are motivated to attend professional development (PD) offerings to help develop their practice, they often have difficulty instituting the new skills or practice when they return to the classroom. Much teacher PD remains isolated, one-off training with no follow-up support (Scott, 2009), which does not align with the reality that learning requires a process of continuous feedback (Laurillard, 2013). It must be noted that the fault here lies with the

design of the PD, rather than with transfer of learning from the PD to the classroom (Scott, 2009). It is not correct to assume that people must learn new ideas in the setting in which they intend to use these ideas, that transfer of learning is impossible (Putnam & Borko, 2000). All learning for teachers does not have to occur in the classroom; rather, as mentioned previously, learning in situations away from the classroom can allow teachers the freedom to explore new ideas that are not bound by the constraints of the school culture or environment (Putnam & Borko, 2000). What is paramount is that PD for teachers provides them with the tools to apply the new knowledge regardless of the setting in which they learn it (Bransford & Schwartz, 2009).

## Learning communities for teachers

Learning communities for teachers embody many of the tenets of quality professional development for teachers: continued support, peer-to-peer learning, ongoing development opportunities and acknowledgement of the larger culture and context of teaching. Some researchers believe that community learning offers an ideal professional development solution for teachers, if only because "knowledge is situated in the day-to-day lived experiences of teachers and best understood through critical reflection with others who share the same experience" (Vescio et al., 2008, p. 81). Communities for learning also allow teachers to learn from their peers, which is beneficial (Darling-Hammond et al., 2009). Member teachers are able to work with other practitioners who have similar backgrounds and get immediate feedback on any developments to their own practice (Avis & Fisher, 2006).

As with COPs in general, many different types of learning community have been created for teachers. One of the more popular terms for an education-focused learning community is the professional learning community (PLC). The PLC emerged as a reaction to the idea that schools were learning "factories" that treated all learners as parts on an assembly line to which various pieces of knowledge could be added (Dufour & Eaker, 1998). PLCs share many of the same traits as communities of practice, including members sharing a vision or goal and collaborating on practice. However, PLCs have a distinct focus on improving student outcomes in individual schools. They are traditionally physical, school-based communities that do not cross organisational boundaries. In other words, one school equals one PLC. Some researchers believe that online communities can function as PLCs or that PLCs can be moved

online (Blitz, 2013). This study does not focus on PLCs in schools, or even PLCs that have been moved online. The research here looks at online communities that cross organisational boundaries and focus on providing support for teachers with the ultimate objective of improving the learning experience for students.

## Online communities – and online communities of practice

As with in-person communities, there are many different terms for online communities: virtual communities, networked learning, computer-supported collaborative learning (CSCL) are but a few. Again, similar to in-person communities, the terminology is defined differently by different researchers. For example, Barab et all define an online community differently than a community of practice with a digital habitat. According to them, an online community is merely "a persistent, sustained [socio-technical] network of individuals who share and develop an overlapping knowledge base, set of beliefs, values, history and experiences focused on a common practice and/or mutual enterprise." (Barab et al., 2004, p. 23) More relevant to this research is the distinction that Johnson makes between virtual communities and online communities of practice. In his view, virtual communities are designed by someone and make use of technology as a gathering point for people online. Communities of practice, on the other hand, emerge naturally (just as Lave and Wenger determined) from within a virtual community (Johnson, 2001). Thus, a virtual community that has been purposefully set up by an organisation, for example, might have multiple communities of practice that emerge organically within its online member base.

This thesis has the objective of identifying and studying a community of practice that exists online. It examines an online community to see if it exhibits characteristics of a community of practice. The question at the root of the research questions in this study, after observing many online communities for teachers fail and after reading the literature on communities of practice for teachers, is: Is an online community of practice for teachers even possible? And if so, what are the conditions necessary to make it work?

Do online communities of practice exist?

Some researchers believe that online teacher communities of practice simply are not possible. "Online interaction between practitioners may not demonstrate the shared tasks, repertoire and mutual engagement characteristic of a community of practice.  It may be more appropriate to conceptualize it as a form of networking rather than a virtual community." (Thorpe, 2009, p. 127). Furthermore, not only do online communities prevent the physical proximity that is necessary to enable the interactions that are necessary in a community of practice, the ties between members of an online community are also too weak for them to share practice (Jones & Esnault, 2004). Nichani & Hung (2002) do not go so far as to say that online communities are not possible, but they believe that an online community can only be successful if it emerges from an in-person community that is already in existence. The technology needs to be added to existing social structures for the model to work.

The social model of learning developed by Vygotsky and continued by Lave, Wenger and Suchman, provides the theoretical justification for the kind of distributed learning that is facilitated by technology through an online community (Kirkup, 2002). Wenger himself says that "Communities of practice offer a useful perspective on technology because they are not defined by place or by personal characteristics, but by people's potential to learn together" (Wenger, 2009, p. 11). Other researchers have examined the three structural elements of a COP described by Wenger et al (2002) - domain, community and practice – and have found that they are equally applicable to both online and face-to-face communities of practice (Gunawardena et al., 2009). Pea (1993) believes that the addition of technology to a community of practice is beneficial in extending the resources available to members. However, computers can't make sense of intentions as humans can, which might influence the success of a mentoring relationship between a novice and expert. As Suchman posits, novice and expert do not have to be limited solely to in-person contact. So-called "Web 2.0 technologies" can connect them if both people in the relationship are agreed on a plan for the action. This leaves room for the kind of legitimate peripheral participation that is discussed by Lave to occur in an online space (Suchman, 1987).

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Technology acts as a bridge connecting the knowledge of an individual with their efforts to build that knowledge as part of a community (Gunawardena et al., 2009).

Thus, online (or virtual) communities of practice are shown in the literature to exist, but they are naturally different than in-person communities of practice. Dubé et al (2006) examined 17 virtual communities of practice and developed a typology of 21 characteristics that define the structure of virtual COPs. They assert that virtual communities of practice are different than face-to-face COPs for the following reasons:

- Members experience the community differently because of the online environment
- Interactions between members are different
- The act of building trust between members can be more difficult
- A member's sense of belonging is not the same
- The act of sharing occurs differently

Barab et al believe that "online communities face all the challenges of co-present communities with the extra challenges added by the technologies and by the physical distancing these technologies both permit and cause" (Barab et al., 2004, p. 54). One example of an "extra challenge" is that community norms are different in online communities as people are not interacting with each other face-to-face (Johnson, 2001). The continued contribution of knowledge is essential to the survival of any community of practice, and "...if no one is motivated to share knowledge in the first place, all the knowledge capture and storage efforts will be in vain" (Hew & Hara, 2007, p. 574).

## Positives for online communities

When thinking about learning communities, the default point of view is that in-person interactions are superior to virtual ones, and that online communities need to be designed in such a manner that the virtual interactions mimic what might be possible in person. However, Thorpe (2009) asserts that online communities allow for new practices to develop which, in turn, accommodate new learning that would not be possible in traditional, in-person communities. In fact, there are many ways in which technology can benefit the work of a community of practice. These include providing a way to link members of the community, creating a forum in which discussions can take place, allowing for a repository of shared resources and generating awareness of resources or activities within the community (Hoadley, 2000).

Web 2.0 technologies enable communication and connection with other people with whom you have a similar interest (also called social networking) regardless of time or location (Gunawardena et al., 2009). Technology can also aid in the overall connectedness of a community by allowing members to participate at different levels of intensity (active, moderate or lurking) (Tseng & Kuo, 2014). The asynchronous nature of online communities can encourage participation as people have a chance to think about their responses to discussions and can attend online training at times that are convenient to them (Chapman et al., 2005). In addition, some feel the lack of visual and verbal cues makes it more likely for people (especially teachers) to participate (Hew & Hara, 2007).

Online communities are thought to be of particular benefit to teacher learning as well. Online communities of practice can satisfy a need for professional development by improving teachers' content and pedagogical skills. As a result, assert Tseng & Kuo (2014), teacher participation in online communities of practice could even improve their students' achievements. The asynchronicity of online communities promotes teacher reflection on practice more than traditional, in-person PD does (Carr & Chambers, 2006). Online communities – as with in-person communities – remove the sense of isolation so common in teaching by allowing teachers to learn with their peers (Chapman et al., 2005). Anyone can join an online community. This could be beneficial to teachers in terms of providing new ideas and alternative points of view, but teachers should be aware that the community does not necessarily provide a community of their peers (Thorpe, 2002).

## Possible barriers for participation in online communities

Wenger himself discusses the reasons why distance makes participation more difficult in any distributed community of practice and expounds on why technology, in his view, is not an adequate substitute for face-to-face interactions (Wenger et al., 2002). Wenger and colleagues see the following as negative characteristics of online communities of practice:

- The community feels remote to members, who may struggle to remember that it even exists.
- Members are not visible in the community unless they actively participate.
- More organisational boundaries are crossed so that people do not feel as though they belong together. This could also create cultural difficulties.

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- Language becomes more important as meaning can be misconstrued in online communications.
- Not everyone has access to technology when needed.

As technology offers community members new ways to participate in a community, some members may need to develop new skills simply to communicate with or learn from other community members (Riel & Polin, 2004). If members are more confident using online communities and their associated technologies, they are more likely to share as part of the community (Chen & Chen, 2009). A lack of sharing and participation can make it difficult for dialogue to develop in online discussions. The presence or absence of a real dialogue between members can be due to the strengths or weaknesses of the technology platform (Chapman et al., 2005), but members' confidence in their own abilities as written communicators may prevent them from participating in the activity of the community as well (Chen & Chen, 2009).

## Teacher participation in online communities

Once teachers are added to those for whom the online communities are intended, another set of issues with online communities appears. A study of an online community of teachers in Australia by Carr & Chambers (2006) uncovered many of the same issues as Wenger et al, and added the following problems influencing teacher participation:

- Reluctance to share or lack of confidence
- Organisation does not value reflection
- Personal preference for in person or verbal communication
- Limited experience using online communities
- Lack of time provided by school management to explore online communities
- Personal propensity for active contribution to discussions

In addition, teachers may be reluctant to participate in discussions because they are afraid of being criticised. They also might fear the seemingly permanent nature of their written word on a web discussion, which remains on the community for others to see (Carr & Chambers, 2006). The culture of teachers, which in many countries has not been one of actively engaging with colleagues, could inhibit their participation in online communities and could influence the success or lifespan of an online community for teachers. Normally teachers only share with colleagues at work or within their immediate subject area (Sheehy, 2008).

In addition, online communities of practice are a different model of professional development altogether. Participation in these communities is often voluntary (or should be, according to Wenger and others), and there might not be any formal acknowledgment given to members for the time and effort they spend there. For teachers, this means that their motivation to participate in an online community is likely to come from either a professional need or their own personal interest (Falk & Drayton, 2015), or a belief that they will personally benefit from the participation. They might feel obligated to share or might seek better understanding of a topic or to boost their own reputation amongst members of the site (Sheehy, 2008).

## A question of trust

Much of the literature on online communities discusses a specific issue that plagues online communities more than their in-person counterparts. That issue is trust. Whether a member of a community can trust their fellow community members can influence the strength of the ties they form with other members, how much they are willing to share or participate in the community and their views of whether the community can support their learning. Trust is the most important part of the coalescing process for members of any community, and it is the central issue in encouraging members to share (Wenger et al., 2002). "Trust is the glue that binds the members of a community to act in a sharing and adapting manner" (Nichani & Hung, 2002, p. 51). Furthermore, the stronger the ties between community members, the stronger the feelings of belonging to the group, which is also linked to how much members are aware of each other's skills and expertise (Tseng & Kuo, 2014).

The issue of identity is closely linked to the issue of trust, and this is where online communities and in-person ones differ. Online identities can be constructed and can be completely different from that of the actual user (Thorpe, 2009). Thus, every online community member needs to determine for themselves what the relationship is between the identity of their fellow community member online and the real person (Kirkup, 2002). In addition, trust is built through multiple interactions between members that occur over time, and the virtual exchanges between online community members are often brief (Nichani & Hung, 2002). For this reason, some research suggests that at the beginning of an online event or course, it is vital to make sure participants develop a sort of online rapport with their

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colleagues in order to build a level of trust that will hopefully encourage interaction (Chapman et al.,

2005). This is also where the suggestion of having a combination of online and face-to-face interactions

occurs in some research. Sheehy suggests that "When paired with a community of practice, the online

environment can work more appropriately as a compliment to knowledge exchange rather than as a

primary mode" (Sheehy, 2008, p. 57).

## Advice from the literature for online communities of practice

Research agrees that online communities of practice can exist, although whether they form organically

as part of a larger, formalised virtual community or can simply stand alone is not clear. There also seems

to be consensus that communities of practice, whether online or otherwise, can provide quality

professional development for teachers. However, online communities of practice for any learners – and

perhaps especially for teachers – are not without their challenges. One of the reasons that online

communities for teachers are not successful is the absence of understanding on the part of the

community designers of the participants' offline cultures. These communities do not consider the

pressures facing teachers in terms of time, evaluation, maintaining academic standards, as well as their

history not only of isolation but of a lack of reflection on their own teaching (Baek & Schwen, 2006).

Many researchers, including Wenger, offer suggestions for ways to make them more successful.

First, it is important to consider the objective of the online community and how success will be

measured. Individuals or organisations who set up virtual communities often want to see "success"

(however it is defined) achieved in a short period of time. But how is success measured? (Avis & Fisher,

2006). The typical measures of success are counting members, members' interactions, uploaded or

downloaded resources, page views, and so forth. More meaningful measures of success are needed,

which relate back to the objectives for the original community, as well as the value of the community to

the members themselves. This, of course, is more difficult to determine than simple quantitative

measures (Falk & Drayton, 2015).

The issue of trust between members, as discussed previously, is crucial to the success of an online

community. For this reason, it is suggested that face-to-face meetings between members are added to

the online interactions that community members experience. Researchers even go so far as to say that the percentage of time that members are required to interact with others online versus face-to-face, impacts the long-term success of the online community. Online communities with no face-to-face component are less likely to be successful than those that combine online and in-person interactions (Dubé et al., 2006). Thus, organising in-person events or meetings for online community members is necessary to help build trust and strengthen ties between participants.

Finally, the technology platform itself is key. The technology used should not hinder members' interactions in the community. It should allow the community to develop its own identity and foster members' mutual engagement around their practice. The technology needs to be intuitive and efficient, allowing members to find each other, become acquainted, share practice and learn together (Wenger et al., 2009).

To allow for this kind of flexibility of the technology platform, Wenger et al (2009) believe that all online communities need a "technology steward". As the community grows and changes, the technology for the online space needs to adapt. The technology steward is defined as a person who has "enough experience of the workings of a community to understand its technology needs, and enough experience with or interest in technology to take leadership in addressing those needs." (Wenger et al., 2009, p. 25) There needs to be more oversight of an online community of practice than there would be for an in-person COP in order for knowledge sharing to occur. "Knowledge sharing between practitioners in communities of practice cannot simply be transferred online. A context has to be reconstructed and participation invited through the use of activities, structured formats and textual genres operating at various levels." (Thorpe, 2009, p. 130)

## Conclusion

The literature examined in this chapter indicates that teachers too, can benefits from professional development practices that espouse sociocultural theories of learning and take into account a teacher's own context. One such model for teacher learning might be a community of practice, which could encourage peer learning and reflection on a teacher's own practice while combating the isolation that

many in the teaching profession experience. Moving communities of practice online might enable teachers to connect with people and ideas that exist beyond the boundaries of their school or immediate setting, but designers of online communities of practice need to be aware of many of the issues inherent in online communities in general (development of trust, adaptability of the technology platform, and so forth) and specific to online communities for teachers in particular.

This study examines one large online community for teachers of computing in the United Kingdom, not so much in an effort to identify whether it is an online community of practice and, if so, what difference this might make to the core of a teacher's work: her teaching practice. The research seeks to understand the characteristics of the community itself that are beneficial to a teacher's professional development, and how the teacher comes to know about the online community in the first place. In other words, with all of the other resources that form part of a teacher's Zone of Available Assistance and all of the possible filters that are at play, how does this online community become a More Able Partner for the teacher learner, enabling her to advance beyond that which she is inherently capable. The following chapter discusses the methodology that was adopted to answer the research questions in this dissertation.

# Chapter 4 – Methodology

## Overview

As seen in the literature review, this study espouses a sociocultural view of learning, believing that learners acquire knowledge as part of their participation in and interaction with communities of learners. A learner's context is of paramount importance in terms of the learning resources with which he or she is able to come in contact. Due to this view of learning, it could be assumed that the design of this study might employ qualitative methodologies for the gathering, analysis and interpretation of the data needed to answer the research questions. However, due to the nature of the research questions being asked, a pragmatist approach was adopted since the research paradigm needed was neither strictly positivist nor strictly interpretivist. This chapter details the theoretical basis behind this the mixed-methods methodology used in this study and the choice to employ it. The discussions that follow describe the study design for both phases of the research, the combination of quantitative and qualitative methods and their sequence and priorities within various points of the study. Finally, this chapter enumerates the actions taken to collect and analyse data during the initial phase of the research. The data collection for the main study of the research is described in Chapters 5 and 6.

## A personal journey towards a mixed-methods methodology

This study was originally planned to be purely qualitative in nature. It was envisaged as in-depth case studies comparing and contrasting three online communities for teachers, one at a school level, one at a national level and one at an international level. The data collection and analysis methods were anticipated to be much the same as those actually employed in the qualitative strands of this dissertation, including semi-structured interviews and content analysis of the site.

When presenting this plan to the Institute of Education upgrade panel, however, advice was given to narrow the sample to one online community. It was suggested that one well-selected community would provide ample data for responding to the proposed research questions.

After receiving the upgrade feedback, the researcher gained professional experience in quantitative research, managing a survey of over 100,000 teachers in 34 countries for the Organisation of Economic Co-Operation and Development (OECD). The three years of work leading the design and testing of the survey instruments, the collection of data from teachers around the world as well as the analysis and publication of results proved invaluable not only in building quantitative research skills but also in demonstrating to the researcher the value of survey data in responding to certain research questions. Once the CAS community was selected for the focus of this research, the large size of the online community at that time necessitated a greater sample of teachers to be drawn in order to have a better chance of the data being representative of the community population as a whole. It was deemed necessary to re-design the study using a mixed-methods methodology, so that a quantitative strand of data collection could be added. This also enabled more detailed responses to the particular research questions posed by this study.

## Theoretical basis for methodology

The "paradigm wars" or paradigm dialogue between quantitative and qualitative researchers as to which epistemological stance and accompanying methodological approach to research is more valid, has been going on for decades and is not the focus of this study. However, as a mixed-methods study, it is necessary to review the belief systems that underpin both methodologies, how they came to be, and how they made room for mixed-methods research as a possible "third paradigm" for research. In other words, mixed-methods research is not simply a combination of qualitative and quantitative methodologies. Rather, it is its own method, with a different theoretical basis, that can be seen as an alternative to quantitative and qualitative research (Denscombe, 2008). For years, academic research valued the quantitative, positivist approach to scientifically-based studies, in a search to find objective answers to research questions. Traditionally, the positivist approach to research "rejects metaphysical speculation in favour of systematic observation using the human senses" (Lewis-Beck et al., 2003, p. 836). Positivism relies on scientific knowledge that is based in pure observation and free from bias from human beliefs or other speculative influences (Howe, 1988). Education research in particular seemed to position quantitative and qualitative research in opposition due to this conflict between positivism and

naturalism (Roth & Ercikan, 2009). Furthermore, it was believed that generalising from research data, especially important in education research where representative samples are used to generalise about the larger population, could only be accomplished with quantitative data (Eisenhart, 2009; Ercikan & Roth, 2006).

However, even in quantitative research there is a certain amount of subjectivity present, as researchers rely on their own belief systems to develop the instruments to collect data, interpret the data or even to decide what to study in the first place (Ercikan & Roth, 2006); Johnson & Onwuegbuzie, 2004). This subjectivity even in so-called scientific research allowed room for the assumed subjectivity of qualitative research to gain respect in academia. When exploring cultural-historical phenomena, such as that studied by psychologists such as Vygotsky and Leont'ev, the objective is to use the data collected from a particular instance or event to construct a reality that could possibly exist in society at large. This kind of research requires data that are both "particular and universal, concrete and abstract, or specific and general" (Ercikan & Roth, 2006; p.15). Thus qualitative research started to gain popularity in the education community in particular from 1980 – 2000 (Denzin, 2008). The interpretivist paradigm allowed for researchers to develop theories about reality based on their perceptions of the research subjects. Today still, it involves understanding the point of view of participants and building learning from that (Howe, 1988).

In spite of their paradigmatic differences, the designs of qualitative and quantitative studies are much the same. Both involve identifying a central research question to answer, collecting and analysing data, testing hypotheses and writing up interpretations and conclusions. The design of a quantitative study might be more specific in detailing the types of variables the researchers plan to measure and the analyses they intend to complete. In terms of the research questions themselves, the questions in a quantitative study are often thought to be less judgemental and more statistical than those in a qualitative, with the intention of obtaining scientific and unbiased results. As mentioned previously, the quantitative researcher may have already made judgements in order to determine the variables to be measured and the questions to ask in the first place (Howe, 1988).

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A third paradigm

As the arguments about the comparative merits of quantitative and qualitative research and their

accompanying paradigms continued, a third viewpoint emerged in the social sciences. Researchers

began to realise that social science research could not be exactly like – or nothing like – physical science.

In addition, in some fields traditionally thought of as social science (such as education), researchers

were increasingly being asked to eschew traditional ethnographic or interpretivist approaches to

research in favour of more quantitative methods. "Educational researchers are facing increasing

demands for 'hard data' generated by pseudo-positivist methods that purport to establish cause and

effect between educational practice and improved test scores," (Somekh, 2005, p. 8). Many researchers

began to criticise scientific-based research in education, saying that traditional quantitative methods

alone could not provide as complete a description of a phenomenon as a mix of quantitative and

qualitative methods could (Denzin, 2008).

It is from this that mixed-methods research emerged. Also called multi-methods, multi-strategy and

mixed methodology (Bryman, 2006), mixed-methods research is defined as "collecting, analyzing, and

interpreting quantitative and qualitative data in a single study" (Leech & Onwuegbuzie, 2009, p. 265).

Because it has its own set of ideas and practices that set it apart from quantitative and qualitative

methodologies, mixed-methods research is increasingly thought of as an alternative to the two

historically predominant methodologies rather than a combination of the two (Denscombe, 2008).

Even in the last ten years there has been discussion as to which theory best describes the underlying

principles of mixed-methods research. Indeed, there are several theories that could form the basis of

this methodology; when a researcher employs qualitative research he or she is drawing on both a

realist, objective and value-neutral perspective as well as a constructivist and subjective perspective

that is grounded in values (Greene & Caracelli, 2003). It is generally agreed that pragmatism provides

the best fit from both an epistemological point of view and a logical one (Johnson et al., 2007).

Pragmatism emerged in the United States at the end of the 19$^{th}$ century, during a time when society and

philosophy were rife with contradictions. Society was future focused yet new immigrants to the United

States were concerned with proving their own self-worth to their peers; philosophy at the time included

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battles between the competing viewpoints of science and religion, among others (Elkajer, 2009).

Scholars such as John Dewey, an early proponent of pragmatism, believed that for philosophy to be useful for the wider population, people needed to understand its practical use. At a time of such change in the United states, the improvement of society required its citizens to find innovative, intelligent and creative solutions to the problems of the day. Whereas a pragmatist seeks results with little regard for how those results are achieved, pragmatism, according to Dewey, meant that the underlying ideas, hypotheses and theories actually influence the results that can be realised (Elkajer, 2009).

In research, this means thinking about the best possible way to solve a problem, rather than simply embracing one paradigm or another. Pragmatism is itself a mixed approach to research that believes reality is both objective and socially constructed. As such, pragmatism draws on both the positivist belief system underlying quantitative research as well as the interpretivist epistemology espoused by qualitative studies (Cohen et al., 2011). According to pragmatism, "the situation determines which concepts and theories are useful for an analysis of a given problem" (Elkajer, 2009, p.77).

Researchers were at first unwilling to accept this combination of quantitative and qualitative methodologies and their accompanying underlying theories, saying the two were incompatible, as positivist and interpretivist theories simply could not work together. However, the discussion has evolved from one of incompatibility to explorations of how any tension between methods can contribute to development of new theories, new ideas and new ways of understanding (Creswell, 2009; Howe, 1988). It is now generally agreed that multiple paradigms and methods can be used in the same study (Denzin, 2008).

## Central tenets of mixed-methods research

In addition to a theoretical basis in pragmatism, mixed-methods research is thought to have the following defining characteristics:

1. Quantitative and qualitative methodologies are used in the same study.

2. The research design details the sequence and priority given to the methods in terms of data collection and analysis. In other words, where does each method appear in the research process, when are they mixed, and which method is given more importance?

3. The research specifies how quantitative and qualitative methods relate to each other in the study and the function of each. In other words, are they used for triangulation, exploration or explanation? (Bryman, 2006; Creswell, 2009; Denscombe, 2008).

The "what works" approach to mixed-methods research (and pragmatism at its base) does not mean that the study design is haphazard or random. The placement of each method within the study is intentional in order to answer specific research questions, provide a more complete picture of the phenomenon or build on initial findings (Bryman, 2006; Denscombe, 2008).

## Benefits and drawbacks of mixed-methods research

Integrating two different approaches to research can be powerful in terms of using triangulation to find errors that might exist in the use of a single approach. Mixed-methods research also allows the viewing of a problem in different ways and the strengthening of the inferences that can be made from the data (Cohen et al., 2011). In a meta-analysis of 232 social science research articles that combined quantitative and qualitative methodologies, the most common justifications that researchers had for using mixed-methods research were:

1. Triangulating data
2. Enhancing or clarifying results
3. Using results from one method to develop another
4. Using results from one method to contradict or recast another
5. Increasing the range of inquiry possible in the study (Bryman, 2006)

However, Bryman also found that researchers' intended uses of mixed-methods research and their actual uses do not always match. There are other challenges associated with mixed-methods research. Namely, researchers may themselves be conflicted about the methods they are using, having more confidence in the results they have gained from one method over another. The findings from one method might be available for publication sooner or might be more interesting than the findings from the other and thus the other method remains largely ignored. There could be practical difficulties to integrating data from both methods, and thus data are not integrated in the study at all. This lack of integration may not be problematic, but it could also mean that the full potential of the data is not being explored (Bryman, 2007). Finally, the outcomes of mixed-methods research are not always predictable because decisions the researcher makes at the beginning of the study may lead the study in

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an unintended direction (Bryman, 2006). These are just some of the many issues that mixed-methods

researchers need to consider and that were considered in this study.

## Choosing a methodology to fit the research questions

Ercikan and Roth (2006) propose an integrated framework for education research that includes a scale

that includes both quantitative and qualitative methods, arguing that ""research questions, not method,

ought to drive education research" (p.21). They posit that research questions can answer high- or low-

inference questions, and understanding the types of questions being asked drives the methods to be

used. The research questions being explored in this study do not have simple answers. A variety of

question types are used to explore how an online community of practice becomes part of a teacher's

context. The central research question, as stated previously, is:

**What is the relationship between participation in online communities of practice and the**

**development of a teacher's practice?**

The study employs multiple further research questions to define the elements that are necessary to gain

understanding of the relationship between community membership and any change in teaching

practice:

- How does an online community of practice fit into a teacher's context?
- What are the characteristics of the online community that teachers are actively using to develop their practice?
- What are the characteristics of the changes teachers are making to practice as a result of their participation in online communities?

Due to the nature and quantity of the research questions, a pragmatist paradigm was followed to

answer them. As mentioned previously, a pragmatist approach to research is driven by the research

questions rather than by the philosophical beliefs of the researcher. Pragmatism requires selecting the

best methodology to answer the research questions. It is often employed in studies with more than one

research question to answer. As a methodology, mixed methods allows application of both quantitative

and qualitative strategies to answer different research questions. Questions that start with "what" are

often best answered by numerical or quantitative data. Questions that start with "how" or "why" often

require a qualitative approach to data collection and analysis (Cohen et al., 2011).

The research questions for this study include a combination of "what" and "how" questions. To answer the central research question, the research needs to discover what features of an online community of practice are most useful and thereby most employed by teachers. Answering the question requires an understanding of teachers' usage patterns and their frequency of use of the community. To understand why a teacher selects this community as opposed to any of the other online communities and resources available to help her teaching, it is first necessary to have a picture of the other resources available to the teacher. Thus, a picture of a teacher's context needs to be drawn and a more in-depth look into a teacher's background characteristics is necessary. The research needs to explore the kinds of resources teachers are using from the community, and the self-reported differences in their teaching or development as a result of one or more of those resources, in order to discover the characteristics of changes teachers are making to their teaching practice as a result of the community. Finally, an exploration of the idea of a community of practice and an analysis of whether the online community exhibits characteristics of a community of practice is needed.

## Communities of practice and mixed-methods research

As evidenced in the literature review, this study is also firmly based in sociocultural theories of learning, specifically examining whether and how teachers can learn through participation in a community of their peers, or communities of practice. In communities of practice, learning is a social endeavour in which learners acquire knowledge through their participation in a community of others who have a similar goal and share practices. Communities of practice "come into existence through the need to collaborate with those who face similar problems or issues for which new knowledge is required" (Denscombe, 2008. p277).

Some researchers view similarities between the communities of practice approach to learning and the paradigm underlying mixed-methods research. Creswell (2009) discusses communities of scholars who share beliefs, are working towards answering common questions and employ similar practices in that they agree the methods needed to answer these questions. Denscombe (2008) goes further, suggesting that communities of practice could be the underlying theory for mixed-methods research. In his view, communities of practice are consistent with the pragmatist paradigm underlying mixed methods, and

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can aid in understanding some of the methodological choices made by mixed-methods researchers. The

concept of multi-membership, in which scholars can be active participants in multiple communities of

practice and can share knowledge and practices between them, is evident throughout communities of

practice research (Carr et al., 2008; Niesz, 2010; Wenger, 1998; Wenger et al., 2002, among others) and

applies naturally to the mixed-methods community in which practices from both quantitative and

qualitative communities might be shared.

Denscombe clarifies that the communities of practice model as a paradigm for mixed-methods research

is just a suggestion however, and hasn't been proven. And his suggestion is not without issue. Due to

the value placed on learning from practice, there are concerns that the communities of practice model

shifts the entire field of academic research from the academic to the practitioner. In education research

in particular, the idea that knowledge is obtained through practice does not account for the point of

view of the "detached observer". This last point is relevant for this study, as data analysis will explore

those online community users who are not adding to the body of knowledge in a community but still

might be learning.

## Research design

This study necessitated two phases of research. The first, a preliminary phase, required data to be

collected and analysed in order to select the online community that would be used for the focus of the

main study. The main study itself then used a mixed-methods research design to answer the research

questions discussed previously. A multi-phase sampling plan was designed to select the appropriate

sample of teachers to correspond to the differing purposes of each strand of the study (Cohen, 2013).

The design of the preliminary research phase and main study, and justifications for design decisions, are

discussed in the sections that follow.

### Design of the preliminary research phase

The objective of the preliminary phase of research was to identify the online community that would be

the focus of the study, and from which a sample of participant teachers would be drawn in to answer

the aforementioned research questions. This portion of the study necessitated a qualitative

methodology, because the researcher needed to have in-depth conversations with teachers about their

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use of an online community to ascertain whether the community would be appropriate for the study.

(The development and use of criteria to ascertain "appropriateness" are discussed later in this chapter).

Although some consideration was given to asking teachers to provide a narrative of their use of an

online community, ultimately the semi-structured interview was selected as the research method.

Narrative inquiry was initially considered as a research method, as teachers' stories of their experiences

with an online community were important. Indeed, the interview schedule for the preliminary phase did

employ some open-ended questions, which are characteristic of narrative inquiry (Holloway & Jefferson,

2000). Ultimately, however, it was decided that the interviews would need to be more structured than

narrative inquiry allowed (Savin-Baden & Van Niekerk, 2007). Due to the diverse locations of the

teachers interviewed, in-person interviews, which are generally recommended in narrative inquiry,

would be impossible (Clandinin & Connelly, 2000). Semi-structured interviews allowed the researcher to

focus the conversation and ask questions, prompting the subject to continue the narrative in the

direction in which evidence is required.

*Drawing a sample for the preliminary research phase*
With all of this in mind, the sample of teachers for the preliminary phase needed to be drawn. The

sampling methodology needed to guarantee that the teachers interviewed would be active users of

online communities. A decision was taken early on to limit the study to teachers and communities in

England due to the location of the researcher. To answer the question of which online community

would be most appropriate for this research, the sample for the preliminary phase of research required

teachers from England who were currently active participants in online communities of teachers.

However, the majority of teachers around the world still do not use technology frequently in their

teaching. According to the OECD's Teaching and Learning International Survey (TALIS) in 2013, on

average only 38% of lower-secondary teachers from the 34 countries surveyed report using technology

frequently or in all or nearly all lessons. In England, this number is 37%. Teachers surveyed by TALIS

have also reported since 2008 that one of their biggest areas of need for professional development is

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around using information and communication and technology (ICT) in their teaching (OECD, 2014; OECD, 2009).

Therefore, drawing a random sample of teachers, or even choosing teachers whose experiences with technology were unknown to the researcher, would not work for this research. A non-probability sample was required, in which some participants are actively included and some excluded from the study (Cohen, 2013). Specifically, a purposive sample was used, in which teachers were hand selected based on the researcher's own judgement of whether they were the most appropriate. Appropriateness in this instance meant that the teachers all possessed the specific qualities and characteristics that were needed and were all:

- Teachers in England. Teachers in England were desired as this was the physical location of the researcher.

- Teachers in a secondary school. The researcher's own career started as a secondary school teacher and much of her subsequent work experience involved working with teachers at a secondary level.

- Frequent users of ICT in their teaching. It was thought that teachers who were frequent users of ICT in their teaching might be more likely to be users of online communities than those who were less comfortable using technology in their work as teachers.
- Self-reported active participants in online communities that they believed had an impact on their teaching. Teachers needed to be participants in online communities that they could describe to the researcher in detail during the interviews.

Three teachers who were known to be active users of technology both in their teaching and for their professional development were selected to participate in the interview portion of the data collection. It was believed that three teachers, each speaking about a different community, would give the researcher enough options from which to choose the community for the main study. Two of the teachers were known by the researcher, who worked with them as part of the Microsoft Innovative Teachers Programme. The third teacher was also part of the same Microsoft programme in recent years, and was recommended for the study by the current manager of Innovative Teachers at Microsoft. (Data collection and analysis for the preliminary phase of the research is discussed later in this chapter).

Main Study Mixed-Methods Design

Since mixed-methods research has gained popularity, researchers have classified the different types of

designs in relation to their purposes and their underlying theories. The typologies of mixed-methods

studies vary based on the order of the quantitative and qualitative studies used, whether the emphasis

is placed on quantitative or qualitative methods and at what point in the research the mixing of the

methods occurs.

When selecting from the list of mixed-methods typologies (or, indeed, selecting a "dynamic" study

design that is not on the list), researchers are advised first to consider the purpose for the research

(Newman et al., 2003; Teddlie & Tashakkori, 2009). In other words, the research question guides the

research, but why is the research asking these questions in the first place? It is thought that there is a

link between research purpose and research methods (Newman et al., 2003).

According to the research purposes set forth by Teddlie and Tashakkori (2009), this study is being

conducted for the following purposes:

- To test intuitions based on previous experiences (described in Chapter 2)
- To improve society and institutions (see recommendations for developers of online communities and for further research in Chapter 9)
- To satisfy the researcher's own curiosity (again originating from the issues experienced and described in Chapter 2)

This research then, is inductive. It is trying to understand a particular phenomenon (teachers' use of

online communities) and seeks to discover characteristics of the communities in which they participate

and the relationships this participation has on their teaching practice (Creswell et al., 2003; Morse,

2003). Normally qualitative methods would be the traditional approach used to explain phenomena, the

context and circumstances surrounding them and their impact. Adding quantitative data permits

different research questions to be asked and allows the researcher to account for more voices in the

research through a larger sample (Newman et al., 2003).

*Selecting a mixed-methods design typology*

Many mixed-methods typologies require the researcher to place an emphasis on either the qualitative

or quantitative strands of the research. In this study, both strands are seen as having equal importance

as they are used to answer different research questions (Teddlie & Tashakkori, 2009). A specific

sequence to the quantitative and qualitative strands was required, at least for two of the strands. Using quantitative methods (in this instance, a survey), data would be collected from a large number of participants in order to get a general idea of characteristics and usage patterns of the "average" teacher in the community. A subset of these first participants would need to be studied in more detail to provide answers to different research questions. These qualitative data would help to inform the quantitative data and would also offer insights into the validity of the survey data. In addition, further qualitative analysis of the online community would need to be conducted against the two theoretical frameworks discussed in Chapter 3 (the Ecology of Resources framework and the communities of practice framework) to help understand what resources are available in the CAS community, and whether it exhibits any characteristics of a community of practice.

For this reason, a sequential mixed research design (also called sequential explanatory design) was selected for the main study phase of the research. In this typology, conclusions based on the results of the first strand of research inform the design of the second strand (Creswell & Clark, 2007). In this study, the quantitative strand would provide the sample of teachers as well as inform the questions to be asked of these teachers in the subsequent qualitative strand of the research. Data analysis for the first strand would occur before the second was conducted. (See Figure 4.1 for the depiction of the sequential mixed design for this study.)

The final strand, which was the qualitative analysis of the online community, could be conducted concurrent to either of the first two strands because it did not rely on data from either. After data from all three strands was collected, inferences would be made based on the data and findings from all three, and used to answer research questions and develop conclusions and policy recommendations from this research.

**Figure 4.1 Sequential mixed design of the first two strands of the main study.**



Source: Adapted from Teddlie & Tashakkori, 2009, p. 277
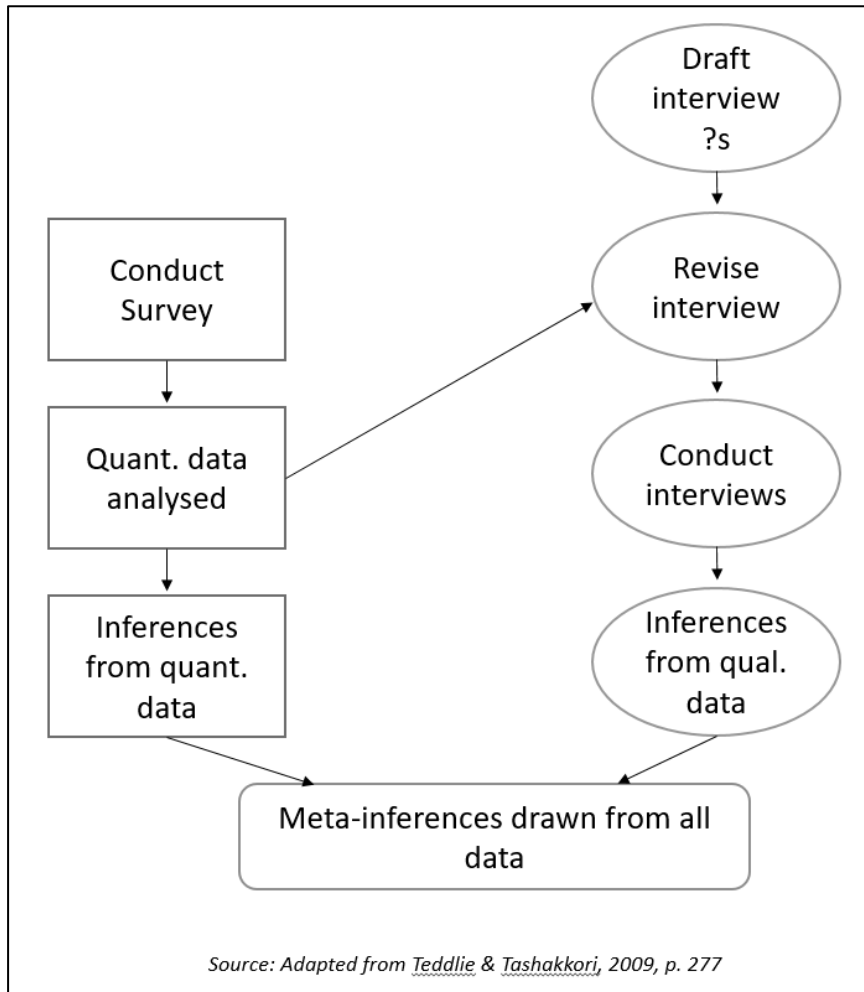
Selecting the quantitative and qualitative methods for the main study

As indicated in the previous section and in Figure 4.1, a survey was selected as the method for the

quantitative strand of the main study, and semi-structured interviews were again used for the

qualitative strand of the main study. In Bryman's 2006 meta-analysis of 232 mixed-methods studies,

these methods were found to be the dominant ones used in mixed-methods studies. In the 232 studies

examined, 57% used a quantitative/qualitative combination that included a survey instrument and a

semi-structured or unstructured interview (Bryman, 2006).

## Phase 1 data collection and analysis: Selecting the online community for the focus of the study

One of the objectives of this research is to examine the relationship between teachers' participation in

online communities of practice and their classroom teaching. In other words, could something a teacher

experienced as part of this community influence or even change the way he or she teaches?

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As mentioned, the first step in the research was to select the community that would serve as the focus of the study. A set of eight criteria was developed to aid in the selection process. The community selected for this study would need to meet these criteria. A study by Hur and Brush (2009) proved useful in developing the selection criteria for this community in this study. In the Hur and Brush research, the researchers tried to understand why teachers chose to participate in self-generated online communities of other teachers. The researcher referred to a definition of an online community from a study by Jones and Preece (2006) :

> An online community can be defined as a group of people who come together for a particular purpose or to satisfy particular needs; they are guided by formal and/or informal policies and supported by computing technology (Jones & Preece, 2006, p. 113).

This definition of an online community is similar to the definition of a community of practice that guides this doctoral research. In addition, Hur and Brush also needed to conduct a search for a particular online community to study. They developed a set of eight criteria to use in their quest for a user-generated online community. They then conducted an online search for user-generated communities that met these criteria. They found three communities that met seven of their criteria and ultimately selected two to examine in the first part of their research.

Four of the selection criteria from the Hur and Brush study form part of the list of eight criteria that were used to select the online community examined in this study. The complete list of criteria with explanations for each follows. The criteria used from the Hur and Brush study are indicated.

Criteria used in selecting the online community

1. **Main target of community should be primary or secondary school teachers in the United Kingdom.**

Hur and Brush also talk about their community members being teachers in primary and secondary schools (K12 in the United States). However, at the time of selecting the community for this study, it was not yet clear whether a community that existed within a social networking site such as Twitter or Facebook would be chosen. For these types of communities, especially those that are formed as the

result of a Twitter hashtag, it becomes impossible to regulate who uses the hashtag and thus becomes a

member of a community via their Tweets. Thus, while the main aim of a Twitter hashtag might be to

provide content, ideas and connections to other primary and secondary teacher of the same subject

area for example, there is nothing to stop a researcher, businessperson, civil servant or even a student

from using the hashtag and thus participating in the community. Furthermore, these participants might

not be restricted to the country in which the community was founded. Thus this criterion was revised to

speak about the main target audience of the community (i.e. who the community is trying to reach),

rather than the location or occupation of the members themselves.

**2.  Community has been active for more than one year.**

This criterion was also used in the Hur and Brush study. The objective in this doctoral research, as in

their study, is to examine an established community in which teacher relationships and participation

have been well established. Wenger et al (2002) also describe the duration as being important to

communities of practice. Short-lived communities might include ones that form around professional

development offerings while longer communities could include those artisans or craftspeople who have

shared practices for centuries. For this study, it was considered that communities that have been in

existence for longer periods of time might also have larger and more stable membership bases. The

stability of the community is necessary to guarantee that the community is still in existence and active

for the duration of this research.

**3.  Participation for teachers in this community should be voluntary.**

In addition to being a criterion of the Hur and Brush study, Wenger, McDermott and Snyder (2002) also

state that membership in a community of practice must be voluntary. Many online communities that

are in existence today have been developed for a specific purpose, such as to accompany a professional

development course or training for teachers (Carr & Chambers, 2006; Chalmers & Keown, 2006;

Holmes, 2013) or as part of a government or academic initiative (Scheckler, 2009). Teachers taking part

in these programmes or training are often required to participate in the accompanying online

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community. In addition, many individual schools have also implemented online communities in which

teachers are required to participate (Wang & Lu, 2012).

As this research intends to examine an online community to identify characteristics of a community of

practice, membership in the online community at the centre of the study needed to be voluntary.

Furthermore, this study aims to look at how an online community and the resources and people it

contains becomes part of a teacher's Ecology of Resources. In other words, what motivates a teacher to

choose the online community to fill this need when other resources might be available to them. This is

another reason that a community with mandated membership would not be appropriate for this study.

If teachers are required to use the community and interact with its members and resources, the

question of motivation does not exist.

4.  **The community should have more than 1000 members.**

The authors of the Hur and Bush study chose 1000 as an arbitrary large number. They wanted a

community that was large enough to support their research needs. This study required a similarly large

community membership to provide a large enough sample to be drawn for the survey and enough

interactions and resources to analyse in the community analysis.

5.  **Community should be web-based, and may be a "traditional" online space or may exist on social media.**

When originally conceived, this research aimed to examine a traditional web-based community with an

online space, such as the Partners in Learning Network community described in Chapter 2. However, as

the use of social networking by teachers and for teaching has been increasingly documented in the

literature (see Kim & Cavas, 2013; Wesley, 2013; Ranieri et al., 2012; Wright, 2010 among others), it was

decided to include the possibility of studying a community that exists in a social media space, such as

Facebook or Twitter.

6. **Interviewed teachers should report having used something from the community to change their classroom teaching behaviour. In other words, teachers report doing something different in their teaching as a result of something they learned on the site.**

Because this research seeks to examine the relationships between teachers' participation in an online community and their classroom practice, the selected online community needed to be one in which member teachers believed that they are using resources (either human or material) or ideas from the community to influence their classroom teaching.

7. **The community should (at least preliminarily) exhibit characteristics of a community of practice, as defined by Wenger.**

The terminology used to describe online communities for teachers varies greatly and not all online communities are communities of practice (Andriessen, 2005). Of all the elements in Wenger's community of practice framework (Wenger, 1998), this selection criterion aims to identify whether there are sociocultural elements of learning present in the online community, as reported by the interviewed teachers. Of particular interest was the journey that a teacher takes in his or her own personal and professional development from novice to expert, and the interactions between members of the community that might provide evidence of legitimate peripheral participation (Lave & Wenger, 1991). The definition of a community of practice provided by Wenger et al (2002) and referenced in Chapter 3 provided guidance as well.

> *Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis... Over time, they develop a unique perspective on their topic as well as a body of common knowledge, practices and approaches. They also develop personal relationships and established ways of interacting. They may even develop a common sense of identity. They become a community of practice (Wenger et al., 2002, pp. 4-5).*

**8. Researchers should be able to research the community.**

Two phases of this research involve the researcher visiting the online space and completing a thorough analysis of the community by first reviewing the resources and interactions between members, and then providing an online survey for members of the community to respond to. This research is only possible if the researcher can gain access to the community at the same level as its members, in order to perform these analyses and if she is granted permission to offer a survey to the members of the community.

## Setting up the initial teacher interviews

After selecting the three teachers through the process discussed earlier in this chapter and obtaining their agreement to participate in the study, each teacher was sent a description of the research and a consent form. They were then sent a 12-question context questionnaire in which they provided some information about their own background and the school in which they currently teach.

Table 4.1 provides the results of the context survey. The context survey itself can be found in Appendix A. In all data collection materials, the selected teachers were labelled Teacher 1, Teacher 2 and Teacher 3. The real names that correspond to these pseudonyms are maintained in a password-protected Microsoft Excel spreadsheet that is saved on the researcher's OneDrive, which can only be accessed with the researcher's username and password.

All three teachers currently teach at secondary schools in the South of England. They have classes with all levels of secondary school students except sixth form; only Teacher 3 teaches classes at this level. Teachers 1 and 3 are men and teacher 2 is a woman; all are between the ages of 31 and 37 and have been teaching for between 10 and 15 years. All three teachers teach at state schools, although Teacher 3's school is an Academy. The highest academic degree completed by each teacher is a Bachelor's degree.

At their schools, they each report having around 25 students per class and their schools' data (collected from the teachers) indicates that between 20-25% of their students benefit from free school meals. Teacher 1 teaches geography and is a member of the school's senior leadership team. Teacher 2

teaches computing and Teacher 3 teaches French. All teachers have had access to professional development in the last three months.

**Table 4.1 Teacher responses to context survey.**

|  | Teacher 1 | Teacher 2 | Teacher 3 |
|---|---|---|---|
| Gender | M | F | M |
| Age | 36 | 31 | 37 |
| Teaching Experience (years) | 11 | 10 | 15 |
| Highest level education | Bachelor's | Bachelor's | Bachelor's |
| Teaching Cert | QTS + PGCE | QTS | QTS + PGCE |
| Subjects | Geography | Computing (officially) + PE, Ethics | French, Integrated learning |
| Years (levels) taught | Years 7-11 | Years 7-11 | Years 7-13 |
| School funding | State funded | State funded | State funded |
| School type | Comprehensive/ community | Comprehensive/ community | Academy |
| Students per class | 1020[6] | 25 | 25 |
| Student SES | 25% | 23% | 20% |
| Teacher CPD | 1,2,3,4,5,6,7* | 1,2,3,5,6* | 1,2,5,7* |

* Type of continuing professional development

1 Courses/workshops (e.g. on subject matter or methods and/or other education-related topics)

2 Education conferences or seminars (where teachers and/or researchers present their research results and discuss educational issues)

3 Observation visits to other schools

4 Qualification programme (e.g. a degree programme)

5 Participation in a network of teachers formed specifically for the professional development of teachers

6 Individual or collaborative research on a topic of interest to you professionally

7 Mentoring and/or peer observation and coaching, as part of a formal school arrangement

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[6] Teacher 1 is a member of the school's senior leadership team and thus gave the size of the entire student body when responding to the question on class size.

## Interviewing the teachers

The three teachers were given the following instructions and definition of an online community and

directed to use this definition to consider the community they would speak about in the upcoming

semi-structured interviews:

> *This research aims to study whether there is any relationship between teachers'*
> *participation in an online community of practice and any changes made to their*
> *teaching as a result. As such, I would like to ask you about an **online community** that*
> *you visit on a regular basis. When identifying this community before our interview,*
> *think of one whose <u>primary audience or membership is teachers</u>, and where*
> *<u>members actively interact</u> with other members of the community. **Interacting**, in this*
> *case, may include discussions between community members and/or the sharing of*
> *resources and ideas.*

Semi-structured interviews were conducted with each teacher in November and December 2014 via

telephone or skype. The interviews were composed of open-ended questions to allow freedom for

follow-up questions and prompting (Cohen et al., 2011). Questions were provided to interviewees

ahead of time so that they could think about answers in advance of the interview.

The interview questions varied slightly based on the conversations in each interview, but the questions

that were sent to the teachers in advance and which were ultimately covered in each interview, follow:

- Tell me about the community you have chosen. What is the name? Describe the online space (website?) and the kinds of resources that are available.
- How were you introduced to the community?
- How did you first learn about it/find it?
- Describe a typical visit to the community.
- Where are you, what time is it, how long do you stay, what do you do? How often do you visit?
- The last time you visited the community, what did you do?
- Which community resources did you use?
- Tell me about a time when you used something (an idea, resource, suggestion, etc) from the community in your classroom that was different from what you normally do.

*Transcribing and analysing the initial teacher interviews*
For the initial teacher interviews, the research employed the full TTCI (tape, transcribe, code, interpret)

process (DuBois et al., 1993). Interviews were digitally recorded and saved then transcribed using a

denaturalistic approach, whereby pauses and other non-verbal elements were excluded. This approach

was chosen because the speech itself is not the subject of the analysis. Rather, this research looks at the

meaning behind this speech as non-verbal elements can, at times, have no bearing on the conversation taking place in the interview and can confuse subsequent analyses of the data (Oliver et al., 2005).

Amongst the elements omitted from transcription are involuntary vocalisations such as sniffing or coughing. However, indications of laughter and response tokens such as "uh huh" or "mm hmm" were kept for ease in following the conversation. Overlapping speech is bracketed in both speakers' remarks, and pauses in speech lasting three seconds or longer are indicated in parentheses. Pauses shorter than three seconds are indicated using ellipses. Other elements of speech that could be said to lack meeting, such as um, uh, you know, sort of, have been retained as they can sometimes modify the meaning.

All personally identifying details were omitted from the transcriptions. Specific names of people exist in the recordings, but are replaced with [Name of Person] in the transcription. Likewise, specified place names are noted in the transcriptions as [Name of Place]. The recorded files and transcriptions in Microsoft Word documents are saved with the teachers' pseudonyms as file names on the secure OneDrive.

*Coding the interviews*
Since there were only three interviews to code, they were coded manually, without the aid of qualitative analysis software such as nVivo, which was used later in the study. New documents were created from the transcriptions whereby only the teachers' responses to each question were transferred into a two-column table. The direct transcriptions of the researcher's sometimes lengthy questions or discussion prompts were omitted from these tables as the main element of interest was the teacher's response, not the researcher's speech. The left-hand column contains the teachers' responses, while the right-hand column contains the researcher's notes as to whether one of the initial eight criteria were addressed in the response. Some of the more nuanced or complex criteria may have been discussed several times by the teacher during the course of the interview. In each instance, responses that addressed these criteria were highlighted in different colours in each document. Figure 4.2 shows an example of the coding table for one question and response from Teacher 1. The darker highlight indicates the teacher discussing possible characteristics of a community of practice, and the

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lighter highlight indicates the teacher providing an example of how he or she used something from the

community to change his or her teaching practice.

**Figure 4.2 Example excerpt from coding table for Teacher 1.**

| Question 5: (follow up) More details on "typical" visit to community | |
| --- | --- |
| So I could probably describe it a bit like a fire hose that's literally just been switched on. Because it tends to be multiple threads amongst multiple things going on. And if you're uninitiated, you'd kind of look at it and kind of go, I'm not getting involved with that, really. Um…which has been, you know, I kind of don't recommend it, you know, to too many people now because of that reason. But if you have the right strategy – so if you kind of just sort of say – what I tend to do is just sort of say a few things about what I think and then you-I might get two or three people and then might come to and fro, basically and we'll have a conversation based around those thoughts, and sometimes it's because they disagree, or sometimes it's because they agree and are asking for-for, kind of examples. Um, and then that would kind of go on to you know, maybe send an email or you know, kind of something else that happens outside of that hour. | Description of site |
| But the initial contact comes within that hour. Um, and I guess a good example would be a couple of weeks ago, which was about geography, and kind of I said something –uh-uh I can't remember exactly what it was – but then that turned into kind of a direct message kind of conversation for a little while Um and then I was like, you know, just email me at my work address, kind of you know, and I'll get back to you with some examples. And that kind of set up, like a little informal support network. And he is basically a head of geography somewhere else [And these] are just examples about bits and pieces. So that hour, if you like, between 8 and 9, is kind of, how you'd get in touch with people. Another example would be when they talked about feedback and marking. And that's where I'm responsible for that whole-school now, and so I was kind of quite interested in that one, and um, so I answered a few questions, and I asked, you know, what I'd really be interested in talking about that particular way of marking. What proof do you have? And then they gave me some links to a blog post, which then led to me sort of sending them an email saying, oh look, you know, I'm, quite interested in this but I've got some questions, um…[and things] so yeah. | Twitter leads to CoP? Twitter enables formation of CoP? Leads to connections, development, etc. |

A spreadsheet was created that enumerated each of the eight criteria for selection for the three

communities spoken about by the interviewed teachers. The spreadsheet was populated with data from

the three interviews to determine whether each community met each of the selection criteria. Direct

quotes from interviews were used when possible and applicable. (Table 4.2 shows an excerpt of these

data. The full table is found in Appendix A).

In some instances, the teachers' responses were not enough to indicate whether the community met

the specific criterion for selection. It was determined that the researcher needed to visit each of the

online communities in order to complete the missing data and make a decision as to which community

to select for this study. This data collection is discussed later in the chapter.

**Table 4.2 Data indicating whether community meets criteria for selection into study.**

*Shaded cells indicate data from teacher interviews. Cells with no shading indicate data from researcher observation of online community.*

| Criteria | #UKEDchat | #MFLTwitterati | Computing at School |
|---|---|---|---|
| **Main target of community should be primary or secondary school teachers in the UK** | Yes: subject specialisation for topic of Thursday conversation each week | Yes: Focused on teachers of MFL | Yes: focused on teachers of computing in schools |
| | Yes | Yes | Yes/No: Aims to promote the teaching of computing in schools. However, different spaces on the site for teachers, IT professionals and parents, and site advertises that their members include "teachers, academics, industry professionals, school governors, parents, etc. |
| **Community has been active for more than one year.** | Yes: Teacher 1 reports using the community since 2010. | Believe so, but can't verify: Teacher 3 reports using this community for a "long time". | Yes: Teacher 2 reports using this community for about 5 years. |
| | Yes: First weekly Twitter-based discussion was 24 June 2010 | Unable to verify existence. | Yes: White paper forming the Computing at Schools working group was published in August 2010. Unclear at present when online community started. |
| **Participation in this community s/b voluntary** | Yes | Yes | Yes |
| | Yes | Yes | Yes |
| **Community should have more than 1000 members** | Depends on the topic that is discussed each week. Could be 50, could be much larger. However, small percentage of teachers are actually on Twitter. | Small percentage of MFL teachers are actually on Twitter | "A few thousand, I think" |
| | Anyone can use or follow the hashtag, so it is impossible to verify unless you count the unique tweets each week. As an example, during a 2-hour period on 13/01/15, there were 50 tweets to the hashtag from 39 unique contributors. | Anyone can use or follow the hashtag, so it is impossible to verify unless you count the unique tweets each week. As an example, during a 14-hour period on 13/01/15 there were 50 tweets to the hashtag from 31 unique contributors. | 16,922 are in the community as of 13 January 2015 16,922 are in the community as of 13 January 2015. |

## Thematic analysis and initial findings

Once this initial coding was completed, the three coded interviews were examined using thematic

analysis to determine whether any patterns or themes might emerge from across the dataset (Braun &

Clark, 2006). In searching for these themes, the researcher looked for topics that were both mentioned

in the literature for online communities and discussed in some manner by all three teachers. It was

hoped that these themes might guide the analysis of the online community in the main study.

In addition, any descriptions made by the three teachers of their interactions with members or

resources that are part of the community were highlighted. The objective here was to see whether

these interactions actually occurred online within the community interface, and thus could be studied

by a researcher visiting the online community, or whether these interactions occurred offline as part of

in-person meetings, telephone conversations or in email or private messaging not visible to a researcher

reviewing the online community itself. Figure 4.3 shows all of the elements that were coded for in the

three interviews, comprising both selection criteria and themes for analysis.

**Figure 4.3 Codes developed for initial semi-structured interviews.**

**KEY**

| Green | Trust of quality of resources, interactions, people |
|---|---|
| Green text | Face-to-face versus online interaction |
| Blue text | Teachers need to be able to judge quality of interactions/resources for themselves |
| Pink | Possible characteristics of CoP |
| Red text | When started using and how learned about it |
| Yellow | Example of using something from community to change teaching/practice |
| Dark blue | Descriptions of interactions |
| Blue | Researcher can research this community |

The three themes that very clearly emerged in all three interviews are indicated in Figure 4.3 and are

- Trust of quality of resources, interactions, people;
- Face-to-face versus online interaction;
- Teachers need to be able to judge quality of interactions/resources for themselves.

Each theme was deemed to be important as it appears in the literature around online communities. The

three themes will be described separately in the sections that follow.

Teachers' descriptions of any interactions they had with people or resources in the communities were also highlighted and reviewed. The nature of these interactions served a large role in the decision of which community to select for this research, as is discussed later in this chapter.

*Trust*

The issue of whether a user of the selected online community can trust the quality of the resources and interactions with other members of the community was one that was raised without prompting by the researcher, and occurred very early on in each teacher's interview. Teachers 1 and 3, who spoke about communities formed from Twitter hashtags both raised the challenges of trusting fellow online community members whom they had not previously met. Teacher 1 put it this way:

> *I think you can kind of reinvent yourself online and it's quite difficult to kind of check the credibility of people.*

Teacher 3 expressed similar issues with trust, saying:

> *You have to be quite – quite careful who you choose to talk to at times… Some people seem to just be promoting themselves, but other people are educated - interested in the pedagogy of it, I guess.*

Teacher 2 expressed the opposite viewpoint in her response to the first interview question, describing the Computing at School online community. She said:

> *It's the go-to place where people share their resources, rather than some of the other sharing sites… So, for my subject, it's really good and you get some really good quality, um, things on there.*

Further in the interview, when the researcher specifically asked her whether she had any issues with trusting the quality of the people or content on the site, she responded:

*Um, not really… I find the quality of the content is usually really good.*

*Face-to-face versus online interaction*

Closely linked to the issue of trust is the issue of online versus face-to-face interactions that may occur as a result of connections made through the online community. Each of the teachers interviewed mentioned that they had met many of the members of their online community in person, at events, conferences, professional development or just down at the local pub. These interactions were highly valued by all three teachers. For Teachers 1 and 3, in-person meetings seemed to be associated with

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whether the teachers felt they could trust another member of the community. Teacher 1 linked in-person meetings to helping him develop trust in a fellow member of the community:

> *Certain people I've met and I trust and I know their work is good. …I quite value their opinions, but I think out of that is probably, around about 20 or so out of thousands that I'd kind of you know, follow, I suppose.*

Likewise, Teacher 2 notes:

> *The main people – there are only a half a dozen people that I personally talk to on a- on a regular basis, if you like. They're the people I tend to go to for marks schemes and that sort of thing. And- and I've actually met them in-in real life.*

Thus, both teachers who discussed online communities on Twitter rely on a very small subset of the online community members as trusted sources of information, and these teachers are ones that Teachers 1 and 3 have met in person.

The situation is a bit different for Teacher 2, for whom trusting another community member is not reliant on whether she has met them in person. Even so, she has met many of her fellow Computing at School community members in person and the person she mentions interacting with the most is one whom she has met more than once. She also mentions Regional Hubs, which are a design feature of the Computing at School community that allows for and encourages face-to-face interaction amongst its members. (Regional hubs and their relevance to the Computing at School community are discussed in Chapter 6.)

*Ability of teachers to judge quality for themselves*

What the previous two sections indicate is that even in online communities in which teachers have been long-time members and have indicated that they have gained knowledge or skills from the community that has incited a change in their teaching, they still might not trust all resources or all teachers from the site. All three teachers commented on the need for members of online communities to have the ability to judge the quality of the members or content on the site for themselves. Perhaps one of the reasons that Teacher 2 felt sure of the quality of people and content on the Computing at School community is that she also felt confident enough in her own abilities to be able to judge the quality, when she said:

> *I can judge how good it is.*

This may prove difficult for new teachers or novice teachers to the subject area. If teachers do not fully understand the subject or the issue at hand, it might be challenging for them to judge the quality of resources or so-called experts on the topic. Teacher 3 mentions this point by saying:

> *Quite often it's just suck it and see. Just see if it does work. And if it doesn't work, I don't tend to listen to that person much more anymore after that.*

Reviewing the online communities to complete criteria

At this point in the data analysis, some of the eight criteria for selection of the online community were still not able to be addressed by the data collected during the interviews. Moreover, for some criteria, it was not possible to find the missing information. For example, it is not possible to ascertain how many people are a "member" of the #MFLTwitterati community (or #UKEDchat for that matter), since anyone at any time could tweet and use the hashtag. Since #UKEDchat runs organised conversations every Thursday evening, it is possible to count the unique users Tweeting during those sessions to get an idea of how many people are actively participating in the community at a given time. However, this would only give an idea of the number of unique users interested in that Thursday evening's topic, rather than the number of people who consider themselves or could be considered to be part of the #UKEdchat community.

Similarly, for both Twitter communities, it is possible to use Twitter analytics software to count the number of unique users tweeting on each hashtag over a certain period of time. This could also give an idea of the number of people in the community. Again, however, this would not be an accurate count of "members" and might be over-inflated, as there might be people who use the hashtag to further the reach of their own tweets without actually following the hashtag or interacting with other community members.

There are a number of Twitter analytics software applications available online for free use up to a certain number of tweets. The analytic tool at TweetReach.com, which is free up to 50 tweets, was used to get a rough idea of the traffic and number of unique users tweeting to each hashtag. For #UKEDchat, during a two-hour period on the 13th January 2015, there were 50 tweets to the hashtag from 39 unique contributors. For #MFLTwitterati on that same date, there were 50 tweets to the hashtag during a 14-

hour period from 31 unique contributors. These data indicate that there was substantially more traffic

on the #UKEDchat hashtag than the #MFLTwitterati hashtag. A further review of some of those tweets

also revealed a lack of interaction between members of the #MFLTwitterati community. Most tweets to

that hashtag raised new topics or suggested new resources or articles. Some tweets asked questions of

other members, but very few responses to those questions were observed. It is also possible that

responses were provided by direct message or other private communication, but this prevents them

from being examined by this researcher.

It was easier to determine the number of members in the Computing at School community, because

there is a live counter on the home page. As of 13th January 2015, there were 16,922 members of the

online community. There were other elements of the community that were unknown; the data were

not present in the interview with Teacher 2, and the community is not open to the public. It was

necessary to apply and be approved to become a member of the community and examine its content

and interactions further.

## Selecting the online community for the study

After the analysis of teacher interview data and the subsequent visit to all three community spaces, the

original eight criteria were revisited to examine which of the three communities met the criteria. Table

4.3 shows the results of this analysis.

**Table 4.3 Summary of online communities in relation to selection criteria.**

| | #UKEDchat | #MFLTwitterati | Computing at School |
|---|---|---|---|
| Main target of community should be primary or secondary school teachers in the UK. | Yes | Yes | Yes |
| Community has been active for more than one year. | Yes | *Can't tell* | Yes |
| Participation for teachers in this community should be voluntary. | Yes | Yes | Yes |
| Community should have more than 1000 members. | Yes | *Can't tell* | Yes |
| Community should be web-based, and may be a "traditional" online space or exist on social media. | Yes | Yes | Yes |
| Interviewed teachers should report having used something from the community to change their classroom teaching behaviour. | Yes | Yes | Yes |
| The community should exhibit characteristics of a community of practice, as defined by Wenger. | Yes | *Can't tell* | Yes |
| Researchers should be able to research the community. | Yes | Yes | Yes |

From this review, it became clear that the #MFLTwitterati community would not work for this study because it was impossible to ascertain whether it met three of the selection criteria. Eliminating #MSLTwitterati left the community formed by the users of the #UKEDchat hashtag on Twitter, and the traditional online community for the Computing at School initiative. At this point, the decision rested on the determination of whether each, either or both of these communities contained elements of a community of practice.

*#UKEDchat*

In the interview with Teacher 1, there were many points during which he described interactions with other members of the #UKEDchat community that seemed to exhibit elements of a community of practice. For example, there were multiple instances in which an initial online contact was made between Teacher 1 and another member of the community, whether initiated by Teacher 1 or the other

member, that then continued with further contact either online or in person. These subsequent

conversations led to face-to-face meetings, resource sharing, additional online conversations and, in

some instances, speaking sessions at or joint organisation of conferences on a particular topic that one

or both parties wanted to learn more about.

A particularly good example of a possible act of legitimate peripheral participation occurred when

Teacher 1 needed to write the policy on the marking of student work for his school. This was an area in

which he felt like a novice, and thus he joined the Thursday evening #UKEDchat session during the week

when the topic was feedback and marking. During that evening's conversation, he asked about a

particular type of marking that was mentioned. This led to resource sharing and further contact with a

fellow member of the community.

> *Another example would be when they talked about feedback and marking. …I was kind of quite interested in that one, and um, so I answered a few questions, and I asked, you know, what I'd really be interested in talking about that particular way of marking. What proof do you have? And then they gave me some links to a blog post, which then led to me sort of sending them an email saying, oh look, you know, I'm, quite interested in this but I've got some questions.*

Teacher 1 was able to use the online community that supports the #UKEDchat discussion to search for

resources around this particular type of marking as well.

> *I was interested in feedback and I- you can just sort of search for specific keywords, so I was just doing that and I just sort of came across something, um, that- that's called RAG 1,2,3, RAG for traffic lights, basically – Red, Amber, Green um…marking, and kind of, so and that was the person that I asked a few questions to and kind of, you know, what is this, and um, and kind of then went away and took a look at it myself.*

Finally, he was able to identify a group of people with whom he had made initial contact in the

community who were interested in the same issues around marking. They formed a support group and

worked together on this topic.

> *I found a few people – one local and then someone in [Name of Place] and someone else fairly local. And we got talking about feedback and we were all in the same boat of like, right, we're all here, and the guy, [Name of Person], he's just up the road and he said, look, why don't we just get together in the pub and kind of, I'll bring along what I've done and we'll just have a chat.*

After working with people and resources from the community, Teacher 1 was not only able to write the school's policy on marking, but his own expertise in this area had advanced from that of novice to someone with enough expertise to defend his marking policy to others and speak about it at conferences.

> *I left that meeting kind of knowing a little bit more and now I'd be confident in defending the policy I've written, and in fact, I've spoken at conference this year about it, and sharing it.*

While this example and others from this interview indicated that the #UKEDchat could exhibit elements of Wenger's community of practice framework, it was notable that while these relationships and interactions may have started through conversations on the hashtag, they continued elsewhere. For example, Teacher 1 mentions using email, direct messaging on Twitter and face-to-face meetings to do most of the resource sharing and community building, participation and reification. Thus, there was no way for the researcher to observe the community of practice simply by studying the conversations that occur on the hashtag. It could be argued then, that the hashtag "community" itself does not constitute a community of practice, but that connections made by people actively using the hashtag for their own professional development could stimulate the formation of smaller communities of practice.

*Computing at School*

Unlike the interview with Teacher 1, the interview with Teacher 2 did not provide enough data to determine whether elements of a community of practice might be present in the Computing at School community. Therefore, it was necessary to examine the interactions on the community itself. As previously mentioned, the Computing at School community is private and requires approval to access the resources and discussions and to contact any other community members. This researcher obtained access to the Computing at School community in January 2015 and spent some time exploring the site to determine whether it exhibited elements of a community of practice.

Two recent discussions on the site were reviewed, as well as select resources and the comments on and edits made to those resources by other community members. The discussions selected for review were

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highlighted on the home page of the community as ones that had recent and frequent (>30 responses)

participation.

The Computing at School initiative reaches beyond classroom teachers to anyone concerned with the

teaching of computing in schools, and the website itself advertises that their members include teachers,

academics, industry professionals, school governors and parents. (A complete description of the CAS

community is provided in Chapter 6. )[7] The profiles of the community members contributing to these

discussions were also examined to establish whether the majority of participants are indeed teachers. A

summary of discussions, in terms of participant makeup and discussion questions, follows.

**Discussion 1:**

- 38 responses to the original discussion from 14th January to 2nd February 2015; read by 383 members (including researcher)
    - 17 unique respondents + 1 discussion starter
    - 17 (94%) are male
    - 10 (56%) are teachers
        - Of those teachers, 80% teach 11-18
        - Of those who are not teachers, 4 are HE academics, 2 are IT professionals, 1 is a journalist and 1 is a retired teacher

**Discussion Starter**

*From our friends at WCIT the following invitation to all CAS members: "WCIT Education & Training Committee I would like to invite you to join us to debate this decade's great IT education debate. The motion is: "Computer Education: The new school curriculum misses the mark. Again" Join the great debate of 2015 – After all the intense battling to bring real computer science back into the classroom, is the newly launched Computing Curriculum still not fit for purpose? Have we missed THE golden opportunity or are we now on the road to creating a generation of world-beating computer experts? With a future set to be increasingly defined by technological advancement are we going about educating our children in the right way? Are we giving them the right tools to ensure the UK can compete with the likes of China and India in the 21st Century? We must continue to discuss and influence the direction of computing education in our schools because it will inevitably impact us all, so…. BOOK HERE to see further, to stretch your thinking, to extend your network and to ask very difficult questions of our debaters at our technology networking dining club with attitude that is the Real Time Club at our dinner-debate on Tuesday 3rd February 2015."*

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[7] The Computing at School online community is explored and explained in much more detail in Chapter 6 of this study . For the purposes of this chapter, a cursory description of only certain elements of the site is provided in order to explain how a decision was made on the selection of the community for this study.

**Discussion 2:**

- 126 responses to the original discussion from 15th September 2014 to 2nd February 2015. Read by 475 members (including researcher)
- 41 unique respondents + 1 discussion starter
  - 37 (88%) are male
  - 30 (71%) are teachers
    - Of those teachers, 63% teach 11-18 and 90% teach secondary (11-16 or 11-18)

**Discussion Starter**

*Having looked through the new A452 tasks, I like the look of the linux one the most. I was just wondering if anyone out there had any ideas on how they might run this task without the use of the Raspberry Pi? We have a windows based network, so I'm thinking along the lines of getting our IT support guys to try and run some sort of emulator. I've found this page: http://www.howtogeek.com/170870/5-ways-to-run-linux-software-on-windows/   I'd welcome any ideas people have that I might be able to take our tech guys*

While the first discussion is mainly administrative (although it does lean toward the philosophical at times), it is in the second discussion that possible characteristics of a community of practice could be observed. In this discussion, a teacher asked a question about a specific problem he was having with a task in England's new computing curriculum.[8] The discussion began on 15th September 2014 and continued off and on through January 2015. Even though it started with one teacher's problem with the computing task and other teachers' feedback on how to address this, different teachers joined in as the months progressed to ask questions or offer suggestions on the same computing task. The participating teachers had different questions or solutions depending on the resources (such as IT equipment) at their schools, and their own personal expertise with the Linux task. Throughout the discussion, teachers were able to ask questions in a "safe" environment and get advice from fellow teachers or others in the field that could both influence what they do in the classroom and further their own development. And, unlike the Twitter hashtag community, the researcher was able to observe evidence of this behaviour online.

The Computing at School online community also contains an area in which teachers can post any classroom resources they have created and wish to share with other members of the site. Other members can then comment on these resources or edit them and repost new versions of the resources.

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[8] Background information on England's computing curriculum is provided in Chapter 6.

Teacher participation in online communities of practice

In this respect, teachers are also jointly creating artefacts which, in the community of practice language, are the results of reification. In other words, Computing at School member teachers are able to work together to create learning objects that are reflective of the learning that occurs in the community (Fuller & Unwin, 2003; Wenger et al., 2002).

## Conclusion

Based on the data collected and analysed in this chapter, the Computing at School online community was selected to be the focus of this study. After interviewing a computing teacher who described herself as an active participant in the community, visiting the community and analysing the text in discussions and comments made to resources, it was determined that the Computing at School met the criteria for the online community needed for this research. In summary, the target of the CAS community is primary and secondary school teachers in the United Kingdom, and in England specifically. The community has been in existence for more than one year and was likely to be active throughout the duration of this research based on its objective of supporting the implementation of the national computing curriculum, which was still in its infancy when the data collection phase for this study began. Teachers are not required to participate in this community; their participation is entirely voluntary. CAS membership was well over 1,000 teachers when data collection started. The teacher interviewed discussed several resources from CAS that she used in her teaching, and the discussions examined showed evidence of conditions that were favourable for a community of practice to form amongst members. Finally, Chapter 5 details the process by which the researcher was given permission to become a member of the community and, as discussed in subsequent chapters, was supported in her endeavours to collect data from its member teachers.

The Computing at School online community is described in detail in Chapter 6. The next chapter discusses the design of the instruments used to collect data in the mixed-methods portion of the main study of this research.

# Chapter 5 – Main Study Mixed Methods

## Overview

The main study data collection had a sequential mixed-methods design, beginning with a quantitative

phase of data collection and continuing with a qualitative strand that relied on the previous strand for

both sample and design. It is this mixed-methods portion of the main study data collection that this

chapter details. The chapter begins by discussing the background to and design of the quantitative

strand, a survey of members of the CAS community. It continues with an explanation of the sample,

design and implementation of the qualitative strand of data collection, which took the form of semi-

structured interviews with CAS member teachers who had responded to the survey. These data were

supplemented by a further qualitative strand of data collection in the form of an analysis of the

community itself against two theoretical frameworks, which is discussed in the Chapter 6.

## The mixed-methods design and data collection timeline

As discussed in the previous chapter, the research questions for this study involve different types of

questions that require different methods of data collection to answer them. Answering each of these

questions involved answering several different sub-questions as well, which required a mixing of

methods in the answers to some of the questions. The mixed-methods study design and the methods

that were selected as being appropriate for each of the research sub-questions are depicted in Figure

5.1.

**Figure 5.1 Mixed-methods study design.**
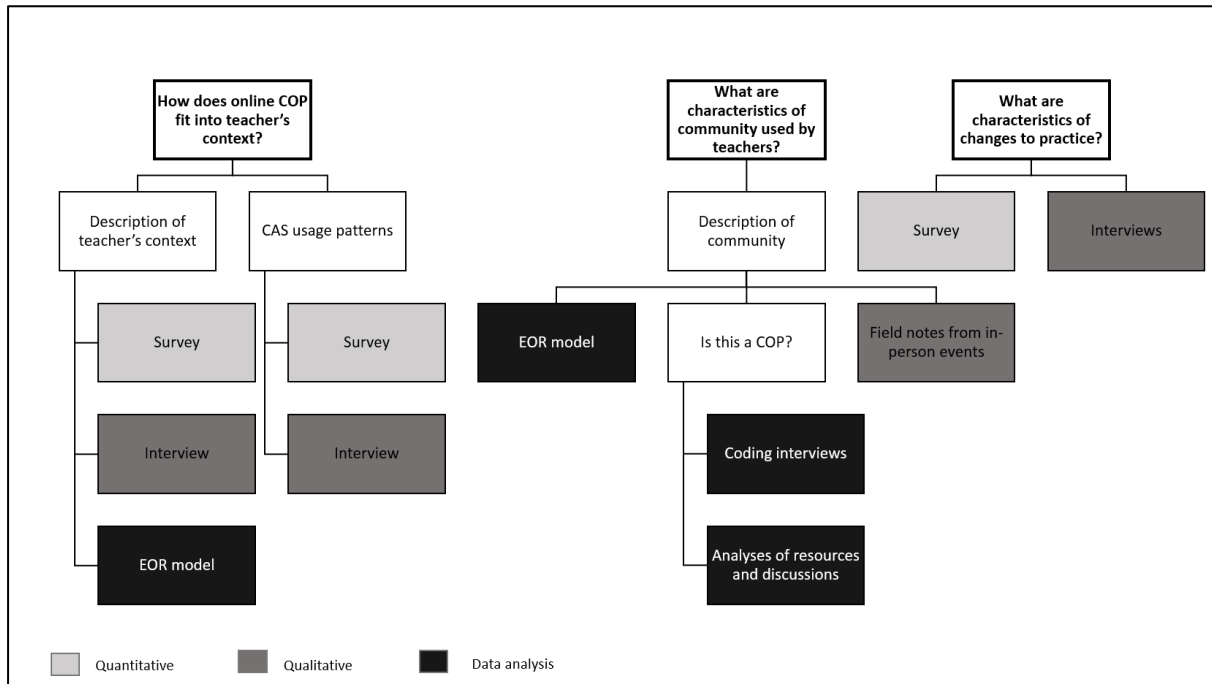


This chapter discusses the design of the instruments used in the mixed-methods phase of the data collection, which included a survey of member teachers on the CAS online community and a semi-structured interview of a subset of the survey respondents, as discussed in Chapter 4. The timeline for the data collection process in the mixed-methods strand of the main study is depicted in Figure 5.2.

**Figure 5.2 Timeline for the data collection process in the mixed-methods strand of the main study.**

| Autumn 2014/Winter 2015 | Design data collection |
| March 2015 | Meet w/CAS leaders for endorsement |
| April - May 2015 | Develop survey → CAS leaders review survey and endorse → Pilot survey → Revise survey |
| June 2015 | Launch survey → Begin dev. of interview schedule |
| July 2015 | Interview sample frame identified → Contact interview sample → Develop interview schedule |
| August 2015 | Pilot interview → Refine interview schedule |
| August – October 2015 | Conduct interviews |
| October – December 2015 | Transcribe interviews |

## Obtaining permission to study Computing at School

In Chapter 4, it was noted that the Computing at School group had granted this researcher permission to become a member of the Computing at School (CAS) online community. Being a member of the community allowed the researcher an insider status to the community, meaning the researcher's presence was indistinguishable from that of other CAS community members. As such, the research could conduct participant observation data collection, which included exploration of the online community, review and participation in discussions, review and downloading of resources and knowledge of possible in-person events to attend. This level of access was adequate for the data collection and analysis that would be required in the second qualitative strand of the main study (discussed in the next chapter), which would involve analysing the CAS community against the Ecology of Resources and community of practice frameworks.

There was some concern that access to the CAS community simply as a member might not be sufficient for the mixed-methods strands of data collection discussed in this chapter. The CAS community had

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approximately 18,000 total members at the time of the study, therefore a large sample size was required for the survey in order to increase confidence in the results and to be able to draw any conclusions about the members of CAS (Cohen, 2013). Furthermore, this study required a significant response rate for the survey strand to be able to answer the research questions and secure adequate numbers of teachers to participate in the subsequent interview strand. Having recently been involved in the process of recruiting schools to participate in the OECD's TALIS 2013 survey, this researcher was familiar with the challenges associated with securing adequate numbers of teachers to respond to a survey. Of the 34 countries that participated in TALIS 2013, 70% experienced challenges recruiting schools to participate in the survey programme. The most common reasons that schools cited for refusing to participate were survey fatigue and time spent on other required national education surveys (OECD, 2014a). Being a new member of the CAS community who was not a computing teacher and, as such, had not participated in discussions or posted resources, the researcher did not have personal relationships with more than a handful of the 18,000 members. This could influence both the level of exposure the members would get to the survey as well as the trust that members might have in the researcher proposing the survey. In other words, if members did not know who was responsible for the survey, they might not take the survey themselves and, more importantly, they might not pass along word of the survey to their colleagues. The concern was that the announcement of the survey could be lost in the myriad of other announcements posted to CAS every day.

Thus, even though membership in the CAS community did allow the researcher to contact individual teachers to ask them to participate in a survey, the response rate might not be as high as if a trusted source was able to send a request to the entire CAS community and ask for participation in this survey. It was decided to contact the leadership of CAS to enlist their authority in terms of obtaining permission to study CAS for this doctoral research, and ideally to gaining legitimacy in the process of recruiting CAS teachers for the survey.

### Meeting with CAS leadership
The researcher was introduced to the CAS leadership team via email, by a former colleague at Microsoft who sits on the board of directors for CAS. The CAS leadership team at the time comprised of four other

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CAS board members, all of whom were involved with CAS and the computing curriculum since their

inception and whose positions are described below.

- <u>CAS National Coordinator</u>: The only full-time employee of the Computing at School initiative, who directs all the work of the in-person and online community.
- <u>CAS research lead</u>: A professor from a London university who volunteers part-time to lead the research initiatives for CAS and the computing curriculum.
- <u>Chair of the CAS board</u>: A senior researcher at Microsoft Research in Cambridge who, until this point, had been the public face of CAS and the computing curriculum.
- <u>CAS platform developer</u>: A professor at a university in Kent who, on a volunteer basis, led the development and support for the online platform for the CAS community.

All four members of the leadership team were supportive of this doctoral research on CAS and pledged

their support in this endeavour. A meeting was held with the research lead in March 2015 and this

provided substantial background information about the development of CAS as an initiative, as well as

the new computing curriculum and the online community. Emails were exchanged with the website

developer and the results of the annual CAS survey (which had been conducted in February 2015) as

well as links to academic articles written about CAS, were shared with this researcher. Much of the

information gathered from these sources is found in Chapter 6. The CAS leadership team also expressed

interest in reviewing the questionnaire to be administered to CAS teacher members, as well as the

desire to add some of their own questions to this survey. Finally, the leadership team agreed to help

promote the survey to teacher members.

## The CAS teacher survey

With the necessary permissions and support in place from CAS leadership, attention could be turned to

designing the survey. It was decided that a survey would be developed with the objective of reaching as

many CAS members as possible to begin to address elements of all three research questions:

- How does an online community of practice fit into a teacher's context?
- What are the characteristics of the online community that teachers are actively using to develop their practice?
- What are the characteristics of the changes teachers are making to practice as a result of their participation in online communities?

The first question begins with "how," which is normally addressed by qualitative research. However, in

order to understand how an online community of practice fits into a teacher's context, we must first

have a picture of what the teacher's context looks like. According to the Ecology of Resources

framework, a learner's context consists of the knowledge and skills they already possess, the environment(s) in which they are learning, and the people and tools they have access to as possible learning resources. The survey, thus, was intended to gather information from a wide sample of CAS teachers about their own personal background, such as their formal education and work experience, gender and age, which might contribute to their knowledge and skills. The findings from the survey would be augmented and expanded by questions asked in the interview and an Ecology of Resources model would be built to examine the context of CAS teacher learners.

For the second question, the survey aims to find out what teachers find useful about CAS in order to learn why, with all the other resources available to help teachers with their learning and development, they are choosing CAS for their learning needs. Questions were developed asking teachers about what motivates them to access CAS, their usage patterns once on the site and what they find most useful on the site. The findings from these survey questions would be supplemented by the interview data and the analyses of the site, which would serve to identify the characteristics of CAS that might identify it as a community of practice, and would describe the kinds of resources available on the online community in detail.

Finally, teachers responding to the survey would be asked questions that allow them to identify resources from CAS that have led to a change in their teaching, and talk about why these resources were especially useful. The data from these questions would also be expanded upon in the interview phase.

## Survey Sample

As mentioned in the previous chapter, a non-probability, purposive sample was used for the survey. Specifically, this was a volunteer sample: the members of the CAS community who opted into this research made up the sample.

The CAS community includes members from many professions other than teaching, such as university-level instructors and researchers, members of industry, teacher trainers, government employees, journalists and more. This research is only interested in teachers' use of online communities of practice.

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The survey was therefore advertised on the CAS online community as only being for primary and secondary (ages 4-18) teachers. However, since a volunteer sample was used, there was no guarantee that the members who chose to respond would fit this profile.

For this reason, the first question in the survey was designed to filter respondents who were not currently working as classroom teachers. Question 1 asked whether the respondent is currently working as a teacher and if he or she answered no, an online message[9]appeared saying "We thank you for your interest but you do not need to continue this questionnaire. This research is studying the participation in the CAS site of current classroom teachers only." If he or she answered yes, the survey progressed to question 2. It was the intention that the remaining respondents to the survey would be classroom teachers.

The second question in the survey was also designed to filter the sample. Question 2 related to the ethics of data use by stating the intended use of the data, and asking participants if they agreed to let their survey responses be used in the following manner:

> *The results of this survey will be presented as a whole as part of a doctoral dissertation or academic journal articles. The data will also be shared with the Computing at School management team. Only references to the full set of respondents will be made and it will not be possible to identify you in any way, unless you choose to volunteer for a follow up interview at the end of this survey. Should you choose to volunteer we will anonymise any responses you provide during the interview.*

If the participant responded "No" to this question, the survey ended in a manner similar to that used in Question 1. If the participant responded "Yes", Question 3 appeared, thereby ensuring that respondents to the survey were also those who agreed to the use of their data for this research.

## Designing the survey instrument

The survey for this study began with an introduction to the research being conducted and instructions for completion, as indicated in Figure 5.3. This is in line with guidance to provide respondents with clear instructions as to how to respond to the survey (Bryman, 2004).

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[9] Once the survey design was complete, it was uploaded into the online survey platform Survey Monkey (www.surveymonkey.com). This is discussed in detail later in the chapter.

**Figure 5.3 Introduction to the online survey, in Survey Monkey.**
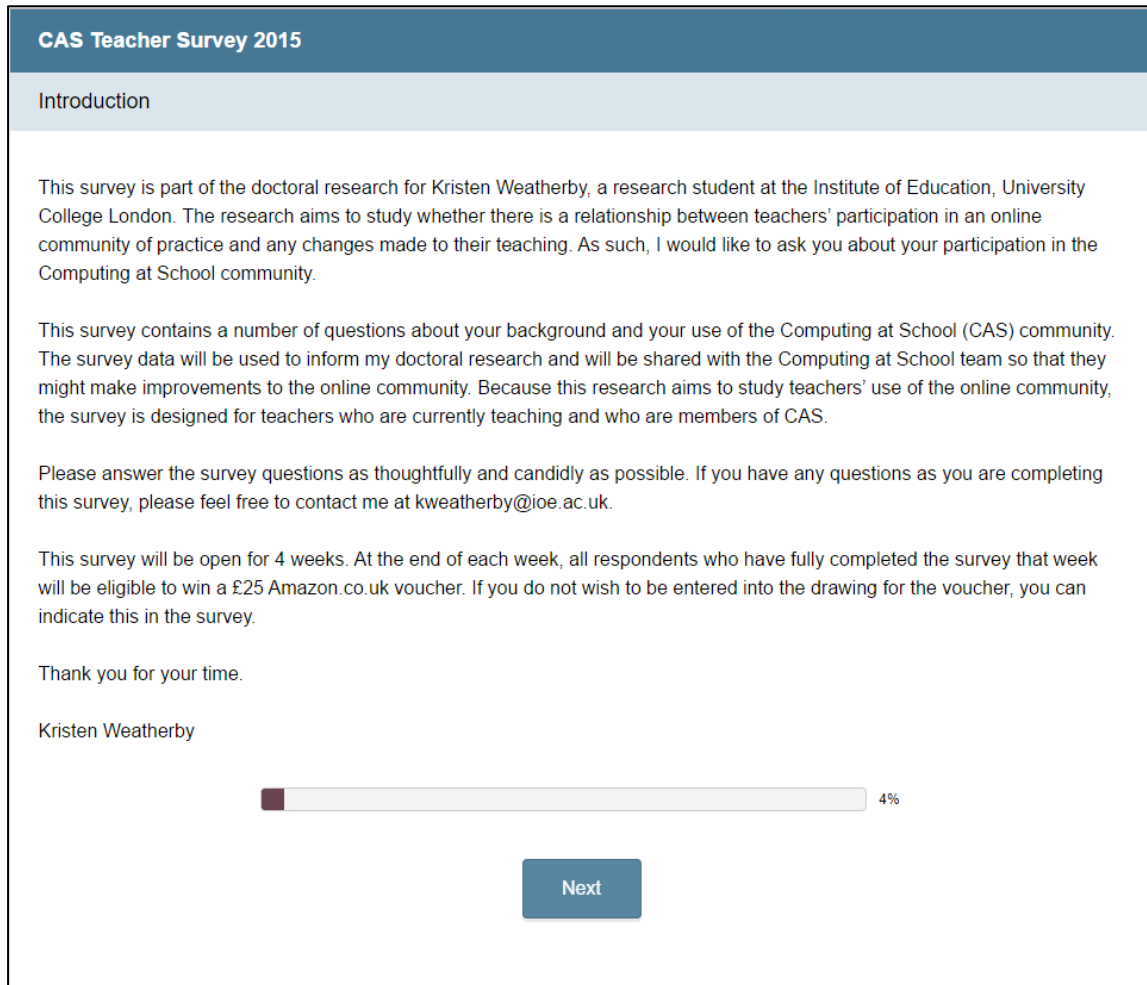


In addition, when responding to questions involving anything other than selecting an option from a simple drop-down menu, the question itself gave users instructions for responding, as shown in Figure 5.4.

**Figure 5.4 Example of individual question instructions, in Survey Monkey.**
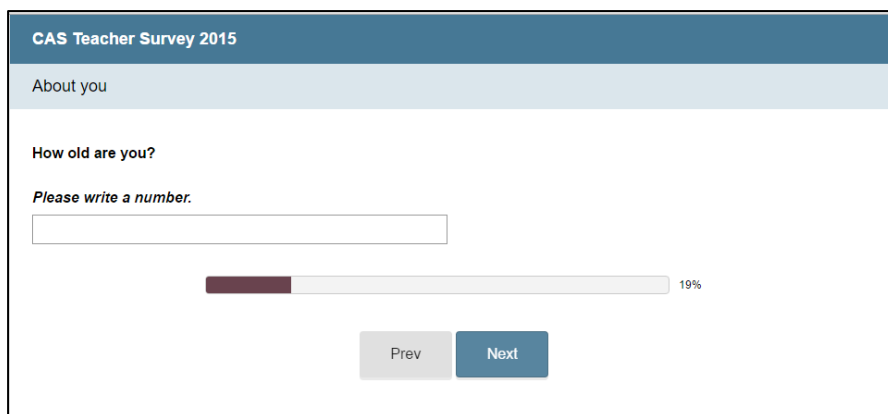
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All questions were designed to be as clear as possible, using familiar language and an absence of jargon.

The researcher was careful to ensure that each question that appeared on screen asked only one thing, so that a response would be easier for the user (Johnson & Turner, 2003).

The questionnaire was designed with mainly closed questions to help simplify the process of analysis. However, there were instances in which open questions were needed so as not to limit participants' responses. To ask teachers which specific resource was most useful to their work and why, respondents needed to be able to write without restriction. Thus, two open-ended write-in questions were designed.

A mix of response types for closed questions was also used. The questionnaire mainly consisted of multiple-choice questions and dichotomous questions, in which respondents could select one response from possible responses found in a drop-down list. The survey also contained the two filter questions mentioned previously, as well as one Likert scale and one ordinal scale (or ranking question). Finally, there were multiple-select questions, which required teachers to tick boxes next to as many options as applied to their situation.

Question types were selected based on the information required from each question. The questions on the CAS teacher survey are described in the sections that follow. The complete questionnaire can be found in Appendix A.

*Background questions*

The CAS leadership team shared the questionnaire they had used in the 2015 CAS National Survey, which is administered in February of every year on the CAS online community. Before beginning to write any questions for this research, the questions and resulting data from the CAS National Survey were reviewed to avoid duplications. (Data from the CAS National Survey from 2015 are reviewed in Chapter 6.) Since the CAS National Survey window was only a few months prior to the survey window for this study, any perceived repetition of questions might increase teachers' reluctance to respond to the survey for this study. In addition, the data from the CAS National Survey could be used to supplement findings from the teacher survey used in this study.

A certain amount of background information was needed from teachers both to help answer research questions and to provide data for analyses. These background questions would come at the beginning of the survey. The first four questions to provide data on background characteristics were taken directly from the version of the OECD's TALIS 2013 survey instruments that were adapted for use in England.[10] These questions were used as they had been thoroughly tested with teachers in England. They provide background information that could be used to develop profiles of the kinds of teachers using the CAS community. In addition, with caveats regarding data collection timeframe, target sample and collection methods, relationships between teachers using CAS and the overall teacher population in England (as surveyed in TALIS 2013) could be explored.

*New questions*
The next two questions completed the background questions but were new to this survey as they were not asked in TALIS. Question 7 asked teachers what subject they teach. A version of this question was asked in TALIS with a different objective and many more response options.[11] The revised question for this survey gave a range of possible answers based on subjects in the national curricula in the UK, and it also gave primary school teachers the option to simply select that they taught primary school. Similarly, Question 8 regarding the age level of the students taught was not asked in TALIS because the sample of teachers for TALIS 2013 was only lower secondary education teachers. The survey sample for this study included all primary and secondary teachers who were members of the CAS community but the data analysis required differentiation between primary school teachers, secondary school teachers and teachers of further education.

Next, to understand teachers' patterns of usage for the site, Questions 9-10 and 12 were designed. These questions were specific to CAS yet were not asked in the CAS National Survey and thus were unable to be drawn from other existing questionnaires. The objectives of these questions were to try to

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[10] The entire TALIS 2013 survey administered in England can be found at this link: https://www.gov.uk/government/publications/teachers-in-secondary-schools-evidence-from-talis-2013
[11] The TALIS 2013 question was two pages long, as the response options were designed to provide appropriate options for teachers in 34 countries. The length and level of detail were deemed unnecessary for a survey of UK teachers.

understand teachers' motivations for logging on to the CAS community and the places teachers visit within the site, to begin to get an idea of what teachers are seeing on CAS as useful for their learning needs.

Question 11 was suggested by the CAS leadership team. They wanted to understand the methods that teachers are mostly likely to use to navigate to the online community. This is less important for this research but fitted well within this group of items in the questionnaire.

The next three items (Questions 13, 14 and 15) sought to understand how the resources on CAS might relate to changes teachers report having made to their teaching. These three questions asked teachers about the changes they are making to their teaching as a result of their interaction with a CAS resource. Again, these questions were designed specifically to address the research questions asked by this study, and, as such, questions from other existing teacher surveys were unable to be used.

Question 16 was taken from one of the key themes uncovered both in the literature around online communities and in the analysis of the initial teacher interviews in the preliminary phase of the research. The question aimed to understand to what extent teachers trust the resources on the CAS site, in terms of their quality, accuracy and usefulness. It was designed as a Likert scale with four response options, to avoid respondents choosing the "undecided" or middle response that a five-response Likert scale would allow (Matell & Jacoby, 1972).

Question 17 and 18 were added by the CAS team to help them make improvements to the site and to understand why some member teachers access the site more frequently than others. Questions 19 and 20 involved post-interview follow up, asking teachers if they were willing to take part in an interview for the next phase of the research and asking if they want to be part of a prize draw. A £25 voucher to Amazon.co.uk was offered to participants at the end of each week as an incentive to respond to the survey. This is the exact offer that was made to teachers for the CAS National Survey, so it was familiar to the CAS membership and approved by the CAS leadership.

## Survey Platform and Piloting

To be able to post the survey on CAS, the questionnaire needed to be in an online format so that it could be accessed via a link within the community. SurveyMonkey was selected as the online platform for this study due to its global popularity and pervasiveness as an online survey provider, as well as the functionality it provided. A survey plan was purchased that allowed 1000 responses per survey and the questionnaire was entered into the online platform. Each of the question types required by the designed survey items was supported by the SurveyMonkey platform, so the questions themselves did not have to be edited to fit the platform. The instructions for responses that were provided to teachers with each question were edited, based on the specifics of SurveyMonkey.

Two members of CAS who were known to the researcher piloted the survey. One of the members was a teacher in the United Kingdom who is a frequent user of the site and provided feedback in terms of wording and terminology relevant to the UK education system, the computing curriculum and the online community itself. The second pilot participant was another doctoral candidate who reviewed the survey from a research point of view, making sure that it adhered to principals of good survey design.

Once the pilot process was complete, the survey was revised according to the feedback, and the link to the final survey was then sent to the CAS leadership team along with the text needed to post it to the CAS online community.

## Launch, promotion and response rate

The survey was launched through a link on the CAS online community on 1st June, 2015. The survey window was four weeks, which was the same as the CAS National Survey and, as such, the survey closed on 28th June, 2015. The CAS team posted a news item providing a link to the survey, and the researcher promoted it within the discussion areas for primary and secondary educators on the site. The announcement that appeared in the CAS news items is shown in Figure 5.5.

**Figure 5.5 Announcement of the CAS teacher survey on the CAS home page.**



NEW CAS Survey for Teachers
02 Jun 2015

Research is being conducted by a PhD student at the Institute of Education to look at how your participation in the CAS online community impacts your classroom teaching. Information from this survey will also be fed back to CAS to help us make improvements to the online community.

The survey will be open for 4 weeks (from 1 June - 26 June). It's short ( <20 questions) and at the end of each week there will be a chance to win a £25 Amazon.co.uk voucher.

Help us make CAS a better online community for you. Click the link below to learn more and take the survey.

https://www.surveymonkey.com/s/CASteacher

Thank you!

Four teachers, who were active CAS members, also kindly agreed to help promote the survey through Twitter, and through their participation in CAS discussions. The researcher used her Twitter account to promote the survey as well, and colleagues known to the researcher who were involved in CAS and in the field of computing tweeted or retweeted to raise awareness about the survey. Finally, the researcher wrote a blog about this doctoral study, which was posted to the popular ICT in education blog Agent4Change.[12] The blog also publicised the survey and is shown in Figure 5.6.

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[12] http://www.agent4change.net/news/2323-teacher-communities-what-makes-them-tick

**Figure 5.6 Promotion of the survey on the Agent4Change blog.**



Finally, the CAS leadership team agreed to send an email promoting the survey to the entire

membership of the online community. This email generated a large spike in survey responses in the last

week of the survey window.

When the survey closed at 15:00 on 28th June, there were 1012 responses in Survey Monkey. Data

cleaning rules were developed and instituted to ensure that only data relevant to the sample remained.

Data from survey respondents were deleted according to the cleaning rules enumerated in Table 5.1.

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**Table 5.1 Cleaning rules for CAS survey data.**

| Delete the respondent's data if: | # of participants |
|---|---|
| Answer to question 1 is NO. (Are you currently working as a teacher?) | 66 |
| Answer to question 2 is NO. (Do you agree that the researcher can use your survey data?) | 2 |
| Answer to question 2 is blank. | 22 |
| Answered question 2 and left entire survey blank after that. | 2 |
| **Total number of survey respondents remaining** | **920** |

*Validity of survey responses*

It is important to note when reviewing the analyses of the survey data that any findings cannot be representative of the population of CAS member teachers as a whole. The nature of a volunteer population means that every member of the overall population does not have an equal chance of responding to the survey. The respondents will be those who, for whatever reason, choose to participate. Without further data, it is impossible to ascertain whether these volunteer respondents are representative of the overall population of CAS teachers.

However, the sheer magnitude of responses received to this survey lends more weight to the validity of the survey responses. When this survey was conducted, 920 responses indicated a response rate of 5% of the overall CAS population of 18,460 members. However, the overall population of CAS members includes journalists, academics, researchers and others in addition to computing teachers, whereas the target population for the survey was only the members of CAS who are school teachers. At the time the survey was conducted, it was possible to see that there were 18,460 members on the CAS site, but it was not possible to calculate how many of those members were primary and secondary school teachers.

During the year following the survey, the CAS community and CAS landing page underwent some upgrades, and charts were added that automatically calculated member characteristics based on the information that CAS members provided in their profiles. It should be noted that these calculations are only as accurate as the user-entered profile information. In June 2016, the charts on the CAS landing page indicated that there were 23,223 members of CAS, and 10,950 (or 47%) of those members identified themselves as primary or secondary school teachers. If a similar ratio of teacher to non-teacher members was used to calculate the approximate number of teacher members at the time the

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survey window closed for this study, that would suggest that of the 18,460 members of CAS, 8,740 were teachers. With a survey response size of 920, this would signify that approximately 10% of CAS primary and secondary teachers were represented by these survey responses. Therefore, it could be said that at a minimum, the data from the survey in this study generalises to the most engaged CAS users and, at a maximum, it acts as a representative sample of all CAS members who are primary or secondary school teachers.

## Developing and conducting the interviews

As part of the sequential mixed design for this study, the qualitative strand of data collection followed and was reliant upon the quantitative strand. The sample for the interview phase of data collection was derived from the sample of survey respondents. The semi-structured interview questions were designed to supplement the data gathered from the survey by delving deeper into certain issues and providing data to answer different research questions. Once the survey was complete and initial analyses had revealed some findings (discussed in Chapter 7), the work on the interview process began.

### Interview sample

The survey window was during the month of June 2015, and school breaks up in mid- to end-July in the United Kingdom. Therefore the sample of teachers to interview needed to be drawn immediately so that initial contact could be made before the summer break began. The first step in this process was to examine the results of Question 18 in the survey, which asked whether survey respondents would be willing to participate in an interview for this study. Of the 920 respondents to the survey, 233 responded yes, that they would be willing to participate in an interview as part of this study. In other words, one in every four survey respondents agreed to be interviewed. Again, this was a volunteer sample (Cohen, 2013), meaning that the sample consisted of those participants who self-selected to participate. To interview approximately 10% of the 233 "yes" respondents, a sample of 20-25 teachers was needed for the interview strand. A sample size of 10% (or n~25 respondents) would be ideal in terms of performing stable T-tests to compare the means of the subsample (i.e. the interview respondents) to those from the main sample (the survey respondents). A T-test would be required to demonstrate that there is no significant difference in the attributes of the subsample when compared

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to the sample. In other words, can it be said that the interview candidates are representative of the

overall population of teachers surveyed? These analyses are discussed in the next section.

*Representativeness of interview candidates*

An interview sample of 20-25 teachers would represent around 10% of the people who agreed to an

interview. This is a small proportion of the overall survey population. If any comments are to be made

about the overall survey population based on the interview data, analyses needed to be conducted to

determine whether the pool from which the interview candidates were selected was representative of

the survey population as a whole.

Key indicators were examined for the whole survey population, for the respondents who agreed to

participate in an interview and for the survey respondents who did not agree to participate in an

interview. A comparison of the data for these three groups is presented in Table 5.2.

**Table 5.2 Representativeness of CAS members who agreed to interview.**

| | Overall Survey Population | | Respondents who agreed to interview | | Respondents who did NOT agreed to interview | |
|---|---|---|---|---|---|---|
| | **Gender** | | | | | |
| Male | 53% | | 60% | | 51% | |
| Female | 47% | | 40% | | 49% | |
| Average Age | 41 | | 40 | | 42 | |
| Yrs Experience | 13 | | 14 | | 12 | |
| | **Highest degree earned** | | | | | |
| GCSE, A levels or below | 1% | | 0% | | 0% | |
| HNC, HND, NVQ at level 4+, Foundation | 6% | | 13% | | 2% | |
| Bachelor's | 67% | | 62% | | 70% | |
| Master's | 25% | | 24% | | 25% | |
| Doctorate | 1% | | 1% | | 1% | |
| | **Level taught** | | | | | |
| Primary and secondary | 4% | | 6% | | 5% | |
| Primary only | 26% | | 18% | | 24% | |
| Some level of secondary | 67% | | 73% | | 69% | |
| FE only | 3% | | 3% | | 2% | |
| | **Frequency of site use** | | | | | |
| Once a day or more | 16% | | 21% | | 14% | |
| Once a week or more | 49% | | 57% | | 46% | |
| Once a month or more | 23% | | 15% | | 26% | |
| Less than once a month | 12% | | 6% | | 14% | |
| | **Anything from CAS prompted change? (Select all that apply)** | | | | | |
| Yes, a classroom resource | 72% | | 72% | | 40% | |
| Yes, discussion | 51% | | 54% | | 27% | |
| Yes, another member | 17% | | 31% | | 6% | |
| Yes, in-person CAS event | 37% | | 46% | | 19% | |
| No | 11% | | 6% | | 7% | |
| | **Trust the quality of CAS?** | | | | | |
| | Agree | Dis | Agree | Dis | Agree | Dis |
| If I ask a question in a discussion, a CAS member will provide me with a response that is helpful. | 92% | 8% | 83% | 17% | 96% | 4% |
| The resources I have downloaded and used from CAS are high quality. | 93% | 7% | 93% | 7% | 92% | 8% |
| I often use resources I have downloaded from CAS in my classroom teaching. | 73% | 27% | 81% | 19% | 69% | 31% |
| When I read discussions on the CAS community, I know that I will be getting accurate information. | 89% | 11% | 87% | 13% | 89% | 11% |

Analyses indicated that the group of teachers who agreed to be interviewed contained slightly more men than the overall survey population (60% versus 53%), but the average age and years of teaching experience are similar. Fewer of the "Yes" respondents report earning Bachelor's degrees as their highest level of education (62% versus 67% of the overall survey population), while more report HNC, HND, NVQ at level 4+ or Foundation degrees (13% versus 6% of the overall survey population). This

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could indicate that more of the possible interview participants came from industry into teaching than

the overall CAS survey population.

There are also slightly fewer teachers of only primary school students in the pool of possible interview

candidates. This was considered positive for this study, since the interviews were to focus on secondary

school teachers. (See the next section for an explanation of the reasoning for this.) These teachers also

use the online community more frequently than the overall survey population. Results to the questions

on frequency of site use indicate that the interview subsample is likely more engaged with CAS than the

main sample. Again, this upward sample benefits this research study, which seeks to understand how

usage of the CAS online community could be helpful to teachers. However, it should be noted that with

such a sample, any findings produced from this study will come from more frequent users of the CAS

community. In other words, there is a population of CAS members who might not be represented in this

research (i.e., those who do not find CAS useful for meeting their learning needs at a given time).

Finally, while the possible interview candidates are slightly more likely than the overall CAS population

to say that an interaction with a resource or another CAS member prompted a change in their teaching,

they are also slightly less trusting of the accuracy or helpfulness of CAS discussions. However, they do

seem to have more faith in the quality of the resources.

*Testing significance of variations between samples using a T-Test*
The minor differences in means between the overall survey sample and the sample of CAS members

who agreed to participate in an interview suggested that the variations between these two samples

were not significant. To be certain, a T-test from two samples assuming unequal variances was

performed in Microsoft Excel using the data from the Overall survey population and Respondents who

agreed to interview columns in Table 5.2, earlier.

The results of this T-test showed the p-values as >.05, which means that there is no significant

difference between the mean averages of the two samples.  In other words, the population of CAS

members who agreed to the interview do not have significantly different attributes to the main sample

of survey respondents. This would allow comparisons between the two samples to be made in the data

analysis phases of the study.

*Criteria to reduce list of possible interview candidates*

The sample for the interviews required 20-25 teachers to be selected from the 233 survey respondents

who agreed to participate in an interview. Criteria were therefore developed to reduce the list of 233

teachers to the target sample of 20-25. Teachers who were contacted for interviews all met the

following criteria:

- **Teach at a secondary or FE level.** This is the area of expertise of the researcher, who trained as a secondary school teacher in the United States and managed a global survey of secondary school teachers in 34 countries for the OECD.

- **Completed every question in the survey.** All teachers who had not completed every question in the survey were not included in the list of teachers to contact. To learn more about users of CAS and create profiles of users or understand their context, as much data as possible was necessary. Hence any teachers with incomplete surveys were omitted from the sample.

- **Are teachers of computing (as a subject).** The CAS community is designed to support the new computing curriculum, so those teachers who teach subjects other than computing and/or do not teach computing at all, are not the targets of CAS and thus might not give an accurate picture of the usefulness of the online community.

- **Have found useful CAS resources.** A few teachers stated that they had not found any resources on CAS that have influenced a change in their teaching. Since one of the aims of the interview, in particular, is to understand the relationship between CAS and classroom teachers' practice, teachers who have not found anything on CAS that they have used in the classroom will not be able to provide any insight here.

- **Have classroom teaching experience.** Teachers who reported that they had zero years of teaching experience were deleted from the list.

After these criteria were implemented, the list of 233 possible candidates was reduced to 86. A formula

in Microsoft Excel was written to randomly select 60 of those teachers. These teachers were all emailed

in July 2015 to ask if they would still be willing to participate in an interview. Exactly 25 teachers

responded positively and were told that they would be contacted again at the end of August to

schedule interviews for September.

Unfortunately, when these 25 teachers were contacted in late August, many did not respond, even after

reminders were sent. Consequently, the remaining 26 teachers (the 86 original teachers minus the 60

randomly selected for invitation) were contacted to request interviews. Many of these 26 also did not

respond and, in total, 20 interviews were scheduled out of the 86 teachers contacted. Interviews were

scheduled for September and October 2015.

## Developing the interview questions

To develop the interview questions, the survey findings were reviewed against the research questions

to determine which elements of the research questions remained unanswered and required interview

data. In addition, the analysis of the CAS online community against the Ecology of Resources framework

was started (see Chapter 6) to determine what questions still existed about the resources available in a

teacher's context. The identified gaps became the focus of the interview questions.

The final interview schedule contained 28 questions and can be found in Appendix A. The questions

were divided into five categories, each explained below:

- **Past experience and available resources:** Questions in this section asked interviewees about their working, teaching and other experience as well as their current teaching responsibilities and the material and human resources available to them for the teaching of computing in their schools.

- **Attitudes towards the computing curriculum change:** These questions explored teachers' feelings of preparedness for and views about the change to the computing curriculum in 2012, as well as how much time and support they received in implementing the change in their schools.

- **Usage of CAS:** These questions examined in more detail teachers' use of the in-person and material resources that are part of the CAS community. Teachers were asked whether they were active participants in CAS and to describe their participation in any other online communities.

- **Relationship between CAS and classroom teaching:** In this section, teachers were asked to refer to the specific resource they had mentioned in Questions 14 and 15 of the survey as having had the most impact on their teaching. Other questions asked teachers about the usefulness of CAS in relation to the computing curriculum as well as any relationships teachers may have developed with other CAS members.

- **Other available resources:** Questions in this section explored other resources outside CAS to which teachers had access for development or support. This included professional development or training, regular support from within their schools, a network of others outside of school or anything else the teachers cared to mention. Teachers were also asked about motivations and barriers to seeking support for their teaching.

Many of the questions were tailored to include specific references to interviewees' responses to the survey. In the complete interview schedule (found in Appendix A), the text highlighted in yellow was replaced with each teacher's responses to the CAS teacher survey before the interview was conducted. In this way, the interviews were personalised for each teacher and the burden on respondents to provide repeated answers to questions was reduced.

### Piloting the interview

Before using the interview to collect data, it was piloted with another CAS member teacher, also known to the researcher but not involved in the research thus far other than to publicise the survey via his Twitter account. This teacher also fitted the criteria used for selecting interviewees (i.e. he is a secondary teacher of computing). The only difference is that the researcher did not have access to his survey data beforehand.[13] The relevant survey questions were asked of this teacher before the pilot interview began.

This teacher's interview data was not transcribed or included in the overall analysis of interview data since the interview questions changed slightly after the pilot. The pilot teacher's interview was recorded so that discussions between the teacher and researcher on the wording or meaning of the interview questions themselves could be reviewed afterwards. In general, it was found that the draft interview schedule worked well in terms of providing the teacher data that was needed to answer the research questions. However, a few interview questions required some additional introduction or rewording in order to make their intended objective clearer to teachers. For example, when teachers were asked in Question 5 to describe their school, the researcher was interested in a description of the computing resources available to teachers at their school, rather than a picture of the entire school.

### Conducting the interviews

As mentioned, all 86 teachers were contacted via email in July and August 2015 to first determine whether they were still interested in participating in an interview, and then to schedule the interview.

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[13] The teacher who participated in the pilot did complete a CAS teacher survey, but it was impossible to identify his data from amongst the 920 survey respondents. He had not agreed to participate in an interview (which would have allowed the researcher to identify his data by using the email address he provided) because he was participating in the pilot of the interview.

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Once teachers responded to the first email confirming their willingness to participate in an interview, they were sent the second email to set up the interview. This second also contained a copy of the interview schedule to review in advance, if needed, and an interview consent form. (The emails and consent form can be found in Appendix A.) The email addresses, response status and interview schedule and status for all 86 possible interviewees were recorded in an Excel spreadsheet that exists only on the researcher's password-protected Microsoft OneDrive. The signed consent forms are in the same place.

All interviews were conducted via telephone or Skype between August and October 2015. All interviews lasted between 20 minutes and an hour. Some teachers elected to conduct interviews during a break in their school days, but most teachers chose to do their interviews outside of school hours, often from home (although sometimes from school after school). Some of the interviews conducted on Skype had difficulty with the connections and, if the Skype connection failed, this is indicated (with timing) in the transcripts. In two cases, interviews had to be momentarily stopped while the interviewer obtained a phone number and switched to telephone instead.

### Transcribing the interviews

By the beginning of October, 15 of the 20 teachers had been interviewed and the transcription process had begun. As with the initial three interviews conducted in the preliminary study, the researcher transcribed all interviews herself and continued transcribing and conducting interviews until the last interview was conducted on 30th October. The last transcription was completed in early December.

As with the initial three interviews, everything the teachers said during the interviews was transcribed, and pauses and emphases were noted. The same transcription principles were followed as those described in Chapter 4. Notably, any non-intrusive affirmations from the researcher of what teachers were saying were not recorded, unless they were more than three to five words in length or they interrupted or changed the flow of the teacher's speech. This decision was made so these utterances would not appear in the data analysis. In most instances, they served to move along or encourage the flow of the conversation and did not interrupt the teacher's speech. Similarly, when the researcher needed to speak for a longer period of time than usual (to introduce the last set of questions on the

interview schedule, for example) this speech was not transcribed, as the introductory text was nearly the same for every interview.

Due to the volume of interviews needing to be transcribed, an online application called Transcribe[14] was used to help the transcription process move faster. The Transcribe app provided automatic playback, pause and repeat, which allowed the typist's fingers to remain on the keyboard, thus speeding up the transcription process. Once each interview was transcribed, each transcription was then reviewed against the recording to identify and correct any errors.

## Conclusion

The development and implementation of the survey and interview of CAS teachers marked the quantitative and qualitative mixed-methods strand of this study. The data collected from these phases would serve to describe CAS member teachers' context, their usage of CAS and the characteristics of the changes they report making to their teaching practice. The survey data, while making this data available for a larger sample of CAS teachers, would need to be supplemented with interview data, which would allow a deeper exploration of issues that could not be addressed by survey questions. Data analyses for the survey and interview phases are presented in Chapter 7 and onwards in this dissertation. Data collection and analyses presented in the next chapter focus on the remaining research sub-question, and served to describe characteristics of the CAS community and ascertain whether it exhibited qualities of a community of practice

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[14] https://transcribe.wreally.com/

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# Chapter 6 – Main study review of CAS Community

## Overview

This chapter reports methods for data collection conducted for the main study. It also provides a description of the CAS community, its origin and its components. In December of 2013, the Department for Education in England agreed to abolish the existing ICT (information and communications technology) curriculum in favour of a more robust programme of study in computing and computer science. This new computing curriculum would be mandatory from primary education upward and would include a GCSE in computing and new exams for computer science at A-level. The Computing at School online community emerged to support the implementation of the new computing curriculum in England, Scotland and Wales. The community includes an online forum for members to share resources, participate in discussions, connect with other members and attend in-person or online events.

This chapter describes the history of the development of the computing curriculum and the CAS online community to support it. It enumerates the second qualitative strand of data collection, which involved a content analysis of the CAS community against two theoretical frameworks: the Ecology of Resources framework and the community of practice framework. Finally, the main study included data collection from in-person elements of the CAS community, including a hub meeting and the national conference.

## History of the computing curriculum

The idea of adding computing to the national curriculum in the United Kingdom was born out of a need expressed by the technology industry. While the computer science industry in the UK was growing in the early 2000s, the country was experiencing a decline in admission to computing courses at the university level (Bradshaw & Wollard, 2012). As a result, the output of skilled computer scientists emerging from the UK education system was not keeping pace with what was required by industry. While an A-level exam in computer science did exist, it was not robust enough to merit entry into any university computer science programme (Brown et al., 2013).

The state of computer and technology education in UK schools was not such that a computer science curriculum could be immediately implemented and supported. What little coursework that had existed

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in the 1980s dedicated to computing topics (such as programming) had largely given way to the advent

of teaching ICT (information and communications technology) in the 1990s and early 2000s (Brown et

al., 2014). The ICT curriculum became increasingly popular with schools and colleges in England,

specifically, because students' results in ICT were given extra weight in the league tables used to rank

schools in England (Bradshaw & Wollard, 2012). While ICT focused mainly on teaching students the skills

to use technology and software, it did not examine how either were created. Absent from the teaching

of ICT were topics such as programming and design, as well as so-called transferrable skills that could be

taught without computers, such as computational thinking.

Computing at School was at first a self-described grass-roots organisation advocating for the need to

offer computer science in UK schools. It was a volunteer group composed of representatives from

industry, academia, schools and awarding bodies. This notion of volunteerism and acceptance of

members from a variety of fields still influences the work of the CAS community (Brown et al., 2013).

After much lobbying from CAS and their partners, the Department for Education agreed to develop a

national curriculum for computing for all levels of schools. This curriculum was launched in England's

schools in the Autumn term of 2014.[15] The four key aims of the national curriculum are as follows:

The National Curriculum for computing aims to ensure that all pupils:
- can understand and apply the fundamental principles of computer science, including abstraction, logic, algorithms and data representation
- can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems
- can evaluate and apply information technology, including new or unfamiliar technologies analytically to solve problems
- are responsible, competent, confident and creative users of information and communication technology[16]

## The computing and computer science curricula today

When the computing curriculum was released for use in English schools in Autumn term 2014, it

consisted of mandatory components for Key Stages 1-4 (primary and secondary schools) as well as a

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[15] The curriculum and CAS were initially developed for England's schools. However, both have expanded to Wales and Scotland in the years since. This study focuses on the main implementation of CAS in England.
[16] Source: National Curriculum in England: Computing Programmes of Study. Accessed on 10/06/2016 from https://www.gov.uk/government/publications/national-curriculum-in-england-computing-programmes-of-study/national-curriculum-in-england-computing-programmes-of-study.

new GCSE in computer science and new A-level exams in computer science. Table 6.1 shows what pupils

in primary and secondary education were required to know at the end of Key Stages 1-4.[17]

**Table 6.1 Primary and secondary computing curriculum objectives.**

| Pupils should be taught to: | |
| --- | --- |
| **Key Stage 1** | **Key Stage 2** |
| Understand algorithms, how they are implemented and how programs are executed | Design, write and debug programs that accomplish specific goals |
| Create and debug simple programs | Use sequence, selection and repetition in programs |
| Use logical reasoning to predict the behaviour of simple programs | Use logical reasoning to explain how simple algorithms work and to detect and correct errors in algorithms and programs |
| Use technology to create, retrieve and store digital content | Understand computer networks and the internet and what they do. |
| Recognise common uses of technology beyond school | Use search technologies effectively and understand how they work. |
| Use technology safely | Select and combine a variety of software on a range of devices to design and create a range of programs. |
| | Using technology safely (more advanced) |
| **Key Stage 3** | **Key Stage 4** |
| Design, use and evaluate computational abstractions | Develop their capability, creativity and knowledge in computer science, digital media and IT |
| Understand several key algorithms that reflect computational thinking | Develop and apply their analytic, problem-solving, design and computational thinking skills |
| Use two or more programming languages (one must be textual) | Understand how changes in technology affect safety. |
| Understand simple Boolean logic | |
| Understand the hardware and software components that make up computers and how they work with each other | |
| Understand how instructions and data types are stored and represented within computer systems | |
| Undertake more challenging development and creation projects | |
| Understand the nuances of using technology safely, responsibly and securely | |

*Source: Department for Education, England, 2013 and 2013a*

GCSE

The GCSE exam has changed since the original inception of the computing curriculum. After a

consultation conducted in 2015, it was decided that for the 2016 academic year, Ofqual would require

nationally that the GCSE exam consist of 20% of non-exam assessment and 80% of exam-based

assessment. The 20% non-exam assessment allows pupils to demonstrate the practice skills they have

obtained in computing by requiring them to create a computer program in response to a complex

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[17] The computing curriculum discussed throughout this study is the national computing curriculum for England, which is what the CAS community was developed to support.

problem that is presented to them (Ofqual, 2015). Prior to this, the exam boards could choose their own

proportion of exam-based and non-exam assessment items (Ofqual, 2015a) Thus, exam boards would

need to revise their GCSE exams to fit this standard and teachers of computing would be teaching to

new exams in the 2016 academic year.

### AS- and A-level

The content and skills needed for the AS- and A-level exams are substantial, as they build on what

students have learned in KS4 and prepare them for further studies in computer science at the university

level. The current exams at this level require students to develop:

- An understanding of and ability to apply the fundamental principles of computer science
- The ability to analyse problems in computational terms through practical experience solving such problems and writing programs to do so
- The capacity for thinking creatively, logically, innovatively, analytically and critically
- The capacity to see relationships between different aspects of computer science
- Mathematical skills (specific skills are detailed separately on the DfE's website)
- The ability to articulate the moral, social and legal and cultural opportunities and risks of digital technology (Department for Education, 2014)

## Developing the Computing at School community

By the time the English computing curriculum was announced by the DfE in December 2013, the CAS

group had already shifted focus from being a policy advocacy group to a membership organisation. CAS

had been given grants in excess of £2 million from 2013 through 2015 "to develop a network of teaching

excellence in computer science."[18] CAS was now responsible for building a community with objectives of

becoming self-sustaining and containing 400 "master teachers" across the country by 2015. These

master teachers, in conjunction with business, academic and other school-based partners in their

region, would each be expected to provide professional development and teacher-created resources to

40 schools, thereby ensuring that 16,000 schools would receive support in implementing the computing

curriculum.

Preparing teachers to teach the new computing curriculum was – and is – no small feat, especially

considering that people can spend entire careers refining and developing their computer programming

skills. The DfE was expecting schools to be ready to teach the curriculum by Autumn 2014 – nine

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[18] https://www.gov.uk/government/news/teaching-the-new-computing-curriculum

months from the announcement. In secondary schools, the job of teaching computing would likely fall

to the existing ICT teachers in schools, many of whom had been co-opted from different subject areas to

begin with, and did not themselves possess in-depth training in computer science (Brown et al., 2013).

In many primary schools, a single teacher who expressed an interest or background experience in

computers might volunteer or be given the task of directing the implementation of the computing

curriculum for the school. Many of these teachers would not have had a formal education in computer

science, nor would they have had experience working in the computing industry. Thus, they would need

professional development and continued support as they implemented the new curriculum. CAS

endeavoured to provide that support.[19]

## Creating a digital habitat for CAS

When CAS started, communication between members was conducted via email, which was manageable

when the group consisted of only 22 members, as it did in 2008 (Bradshaw & Wollard, 2012). As the

original group expanded, a digital habitat for the CAS community was developed in the form of a Google

group (Brown & Kolling, 2013). However, as membership quickly grew in preparation for the launch of

the new curriculum, the Google group was replaced with a custom-designed community website in

August of 2012 (Brown et al., 2013). The new functionality included more robust discussion capabilities

as well as resource sharing and the ability to collaborate on resource development. At that time, there

were 2526 members of the Google group, and 1311 of them activated their accounts in the new online

community (Brown & Kolling, 2013).

The online community platform has continued to develop to support its large membership and the

unique needs of its members. There is a landing page for the Computing at School organisation, but also

a separate web address and log-in page for the online community itself. In this respect, the online

community is a "walled garden" that requires a sign-in and password for entry (Brown & Kolling, 2013).

Users sign up for the site using their real names (rather than invented usernames) and once they

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[19] In addition to CAS, the British Computer Society – the Chartered Institute for IT was given £1.1 million by the DfE to develop a computing readiness programme for primary school teachers who had no previous experience with computer science.

become members they are encouraged to complete a profile by posting a photo of themselves and

completing some background data. This is meant to emphasise that the community contains "identified

professional individuals"[20] and is part of a concerted effort by the leadership to grow trust amongst

members. Furthermore, users must provide evidence of their identity and affiliation with the education

or the computer science industry for their membership to be approved. This evidence includes an email

address and a web page indicating the association with their institution. Volunteer administrators

review and determine the membership status of each application. Once members are accepted, they

are automatically positioned on a map on the website based on their stated location, thus becoming

visible to other members.

The online platform itself has changed considerably since 2012, based on the needs of the ever-growing

membership. As of early 2015, the membership of CAS was increasing consistently at a rate of

approximately 500 members per month on average (see Figure 6.1). The site owners attribute the rapid

membership expansion equally to swift transition to the new computing curriculum and the urgency for

support that generated (Brown & Kolling, 2013). The online community originally contained only spaces

for discussion and for uploading and collaborating on resources. A space for events was added to reflect

the fact that much of the CAS teacher outreach and support is conducted in the form of face-to-face

meetings and training.

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[20] This quote comes from an email received by the researcher from a member of the CAS leadership team in 2015.

**Figure 6.1 Community at School membership growth over time.**



Notes: This graph shows the amount of current CAS Community members who joined in each month. The graph is biased to show more recent high rates, because ex-members (who joined and subsequently left) will not be shown. Although the site only opened in August 2012, imported members retained the joining date from when they joined CAS via previous mechanisms (e.g. the mailing list).
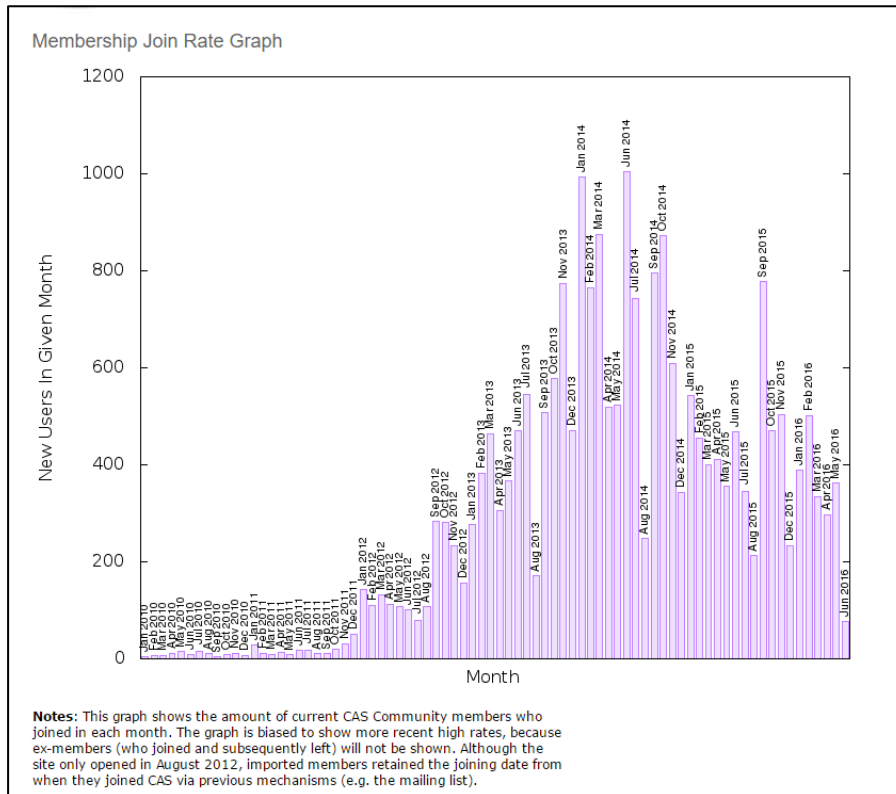
*SOURCE: Computing at School accessed 9 June 2016*
*http://community.computingatschool.org.uk/users/join_graph*

## Administering the CAS online community

The online community is not formally managed. In other words, there are no discussion moderators and no policing of the resources posted by users. However, there is some oversight as to the participation on the site, and changes to participation guidelines have been made accordingly over the years. For example, CAS master teachers and the management team regularly post in discussions and promote CAS resources or events, along with other resources. They also monitor the resources and discussions section to a limited extent to make sure solutions to exam questions are not being shared, for instance.

The members of the CAS leadership team responsible for the development of the CAS online platform acted as "digital stewards" for the site. They are what Wenger defines as the "people with enough experience of the workings of a community to understand its technology needs, and enough experience with or interest in technology to take leadership in addressing those needs" (Wenger et al., 2009). Many of the development changes made to the site have been a result of feedback from members of the site.

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CAS members have noted in the past that some discussions are dominated by a small number of people, or that some discussion comments are made in a less-than-collaborative tone. To address this, the site developers instituted automated warnings based on the length or number of a person's posts, as well as contacting so-called "repeat offenders" directly. In the first half of 2015, the CAS developers created a system of trimming or hiding posts that received complaints from other members, rather than removing them altogether. Long posts are automatically truncated to a set length, with an option for users to click "Show More" to view the rest of the post. Members can rate posts as to whether they "Like" them or find them "Not Helpful." Posts with a certain number of "Not Helpful" votes and no "Like" votes are automatically hidden, with a "Show Post" option presented.

Furthermore, the CAS developers have tried to organise "regional" discussions several times but, according to the site developers, this reorganisation has not made the discussions easier to find or access. They began by having one discussion forum per CAS hub, then one per region and then switched back to one discussion per hub.

The organisation of resources on the site has also changed several times in an effort to make searching for resources easier. At first, users could define and set the tags they associated with their own resources. Then the site developers instituted a fixed set of tags. Now there is a tagging system that is a category tree that maps to the various UK computing and computer science curricula.

## Entering the online community

As mentioned previously, there are two websites affiliated with Computing at School. The first is the website for the organisation (http://www.computingatschool.org.uk/) (See Figure 6.2). This website contains information about the organisation, its origin, its governance and its partners. It supports the policy advocacy work by providing videos and other materials. It also includes documentation made available by the CAS working group on the development of the national computing curriculum and GCSE for computing, as well as the curricular frameworks themselves.

**Figure 6.2 The Computing at School organisation home page.**
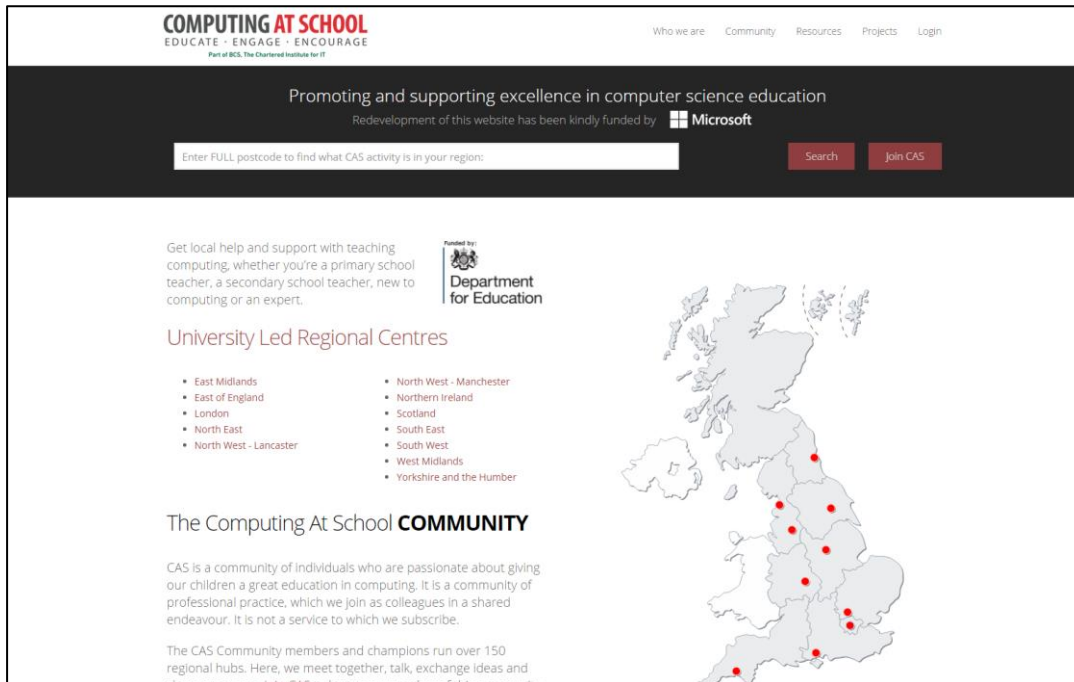


*Source: Computing at School, Accessed 10/06/2016*
*http://www.computingatschool.org.uk/*

This home page for the organisation also provides a link to the members-only community itself, which is

the website that will be the focus of this study. (http://community.computingatschool.org.uk/) (See

Figure 6.3.)

**Figure 6.3 Home page of Computing at School online community when logged in.**

Once members log in to the community, they see the home page featured in Figure 6.3. The home page includes a column for the latest news and upcoming events, which are sorted according to the events that are geographically closest to the physical address of the logged-in member. Users can see the latest statistics on the number of members, resources and hubs, as well as a numerical summary of the activities in the last 30 days.

The main column on the front page of the online community is dedicated to the latest activity in the community itself. It is continually updated as participation within the community occurs and the list shows every time a member contributes to a discussion, uploads, comment on or edits a resource, or

posts information about an event. With each new action in the community, the member's photo is displayed along with a hyperlink to their name, which leads to their profile. The name of the resource, discussion or event that is the subject of the activity is also a live link, allowing other users to navigate to the resource or information in question.

As discussed previously, the main areas of the site are resources, discussions and events. These areas are each discussed in the sections that follow. The other areas of the site that appear in the navigation bar on the left of the home page are described in the list below.

- **Members:** Clicking this link leads to a list of all the members of the CAS community, with the most recently-joined members listed first. The list includes the member's photograph, if they have added one, a hyperlink to their profile and any badges they may have earned.[21]

- **Master Teachers:** This link leads to a list of Master Teachers for CAS. These teachers offer continuing professional development relating to the computing curriculum to other teachers in their regions.[22] Members can filter the list geographically (by county, town, local authority or region) or by the level taught (primary or secondary) in order to connect with the most appropriate Master Teacher for their needs. Clicking a Master Teacher's name leads to their profile.

- **Hubs:** Clicking this link takes the user to a page listing the Hubs that are within 25 miles of the user's stated location. A Hub provides an in-person meeting space for teachers in a particular region. It is most likely located at a school and the meetings, which vary in frequency, are organised by a volunteer teacher. The closest counties to the member are listed according to the location specified in the member's profile. Clicking the county names will take the user to the Hub page for that county, displaying a list of upcoming events, past events, a description of the Hub and links to the Hub discussions in the community as well as to the local Master Teachers supporting that region.

- **About**: The About section, as one might expect, describes the objectives of the CAS community and provides links to guidelines for participation and posting of comments and resources. It also includes information about the CAS partners and the site licencing agreements.

- **Map:** A map provides a graphical representation of the Hubs, Master Teachers, members and announced events throughout the United Kingdom. It also indicates the location of schools belonging to the Network of Excellence. (More information on the Network of Excellence can be found later in this chapter.) Users can choose to suppress or display each of these elements on the map.

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[21] Badges are automatically awarded to users based on the length of their membership in CAS and the frequency with which they post resources and participate in discussions.
[22] More information on the CAS Master Teacher programme can be found at this link: http://www.computingatschool.org.uk/index.php?id=noe-master-teachers

## CAS resources

The resources section of the site includes a selection of resources on the home page that can be viewed either by resource popularity or by latest update. The popularity of a resource is measured by the number of times it has been downloaded. When the site was viewed on 10th June 2016, the most popular resource was one titled Algorithms Handout, which had been downloaded 13,158 times since it was originally created on 18th December 2013. There is also a tick box that members can select allowing you to view only the resources they have previously viewed and have "liked".

Members must tag resources as they post them so they can be searched for by other members. Members can filter resources by levels according to the English or Scottish computing curriculum, by programming language or platform, by subject knowledge, by students' age range and by resource type. As with any search engine of this type, the search capacity is only as good as the tagging; in other words, resources are easier to find if they have been accurately tagged with these search conditions by the person who created and posted the resource.

Figure 6.4 shows an example of a typical web page describing a CAS resource. There is a brief description of the resource, a link to download the files and a place for members to add feedback and comments on the resource. Once members have downloaded a resource, they are automatically prompted by the website to post a comment or feedback on the resource they have downloaded.

**Figure 6.4 Web page for CAS Resource.**
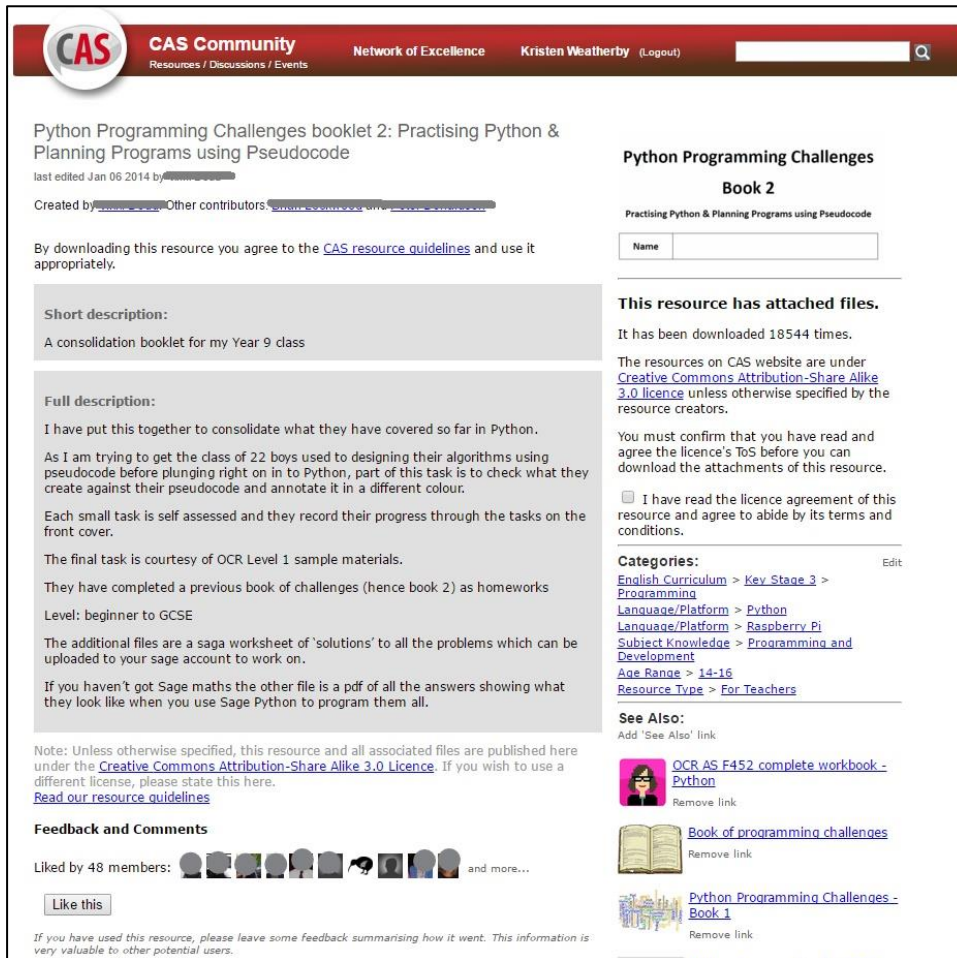
CAS discussions

The discussion section of the CAS site is divided into three main categories of discussions. The General

discussions forums are mainly directed at teachers of the computing curriculum. A list of the General

discussion forums is pictured in Figure 6.5.

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**Figure 6.5 The home page for CAS discussions.**
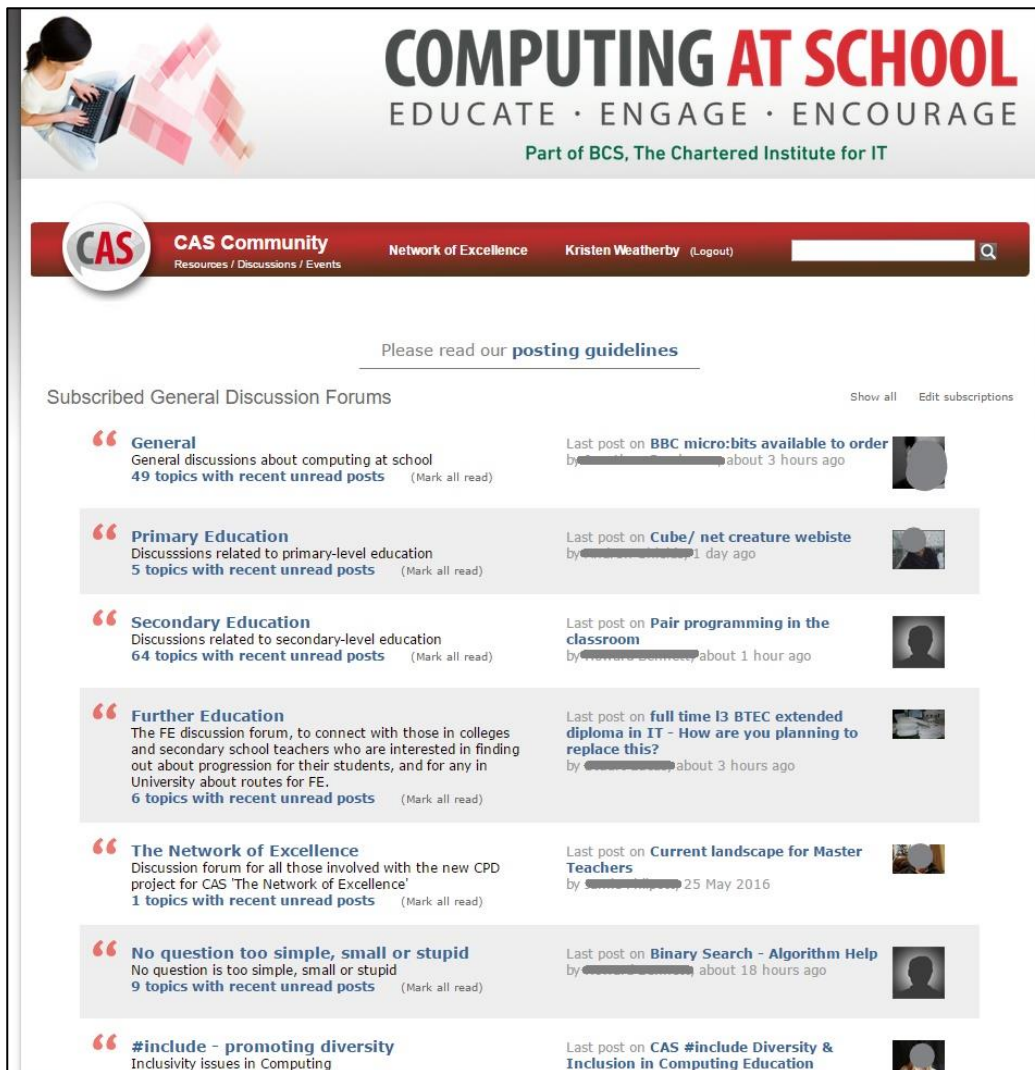
In addition to the General discussions, there are also Special Interest Discussion Forums, which are

directed toward audiences other than teachers who might be involved in CAS. This section includes

discussions for IT professionals, teachers in English international schools, school governors, researchers,

commercial entities and those concerned with networks in schools. There are also discussions in which

CAS members can look for job vacancies or post issues with the website.

The third and final discussion category includes the Hub discussions. There is one per hub throughout

England and Scotland, as well as some international hubs (Bangkok, for example).

CAS events

The CAS Event page lists the events sponsored by CAS in the coming month. It allows users to search for

a specific event near them (based on the location posted in their profiles) or to view the events by

looking at a map of the country. Figure 6.6 shows the events page. There are three different types of

events represented in Figure 6.6, differentiated by their event logo: CAS Hub meetings, CAS events and

Network of Excellence events.

**Figure 6.6 The home page for CAS events.**
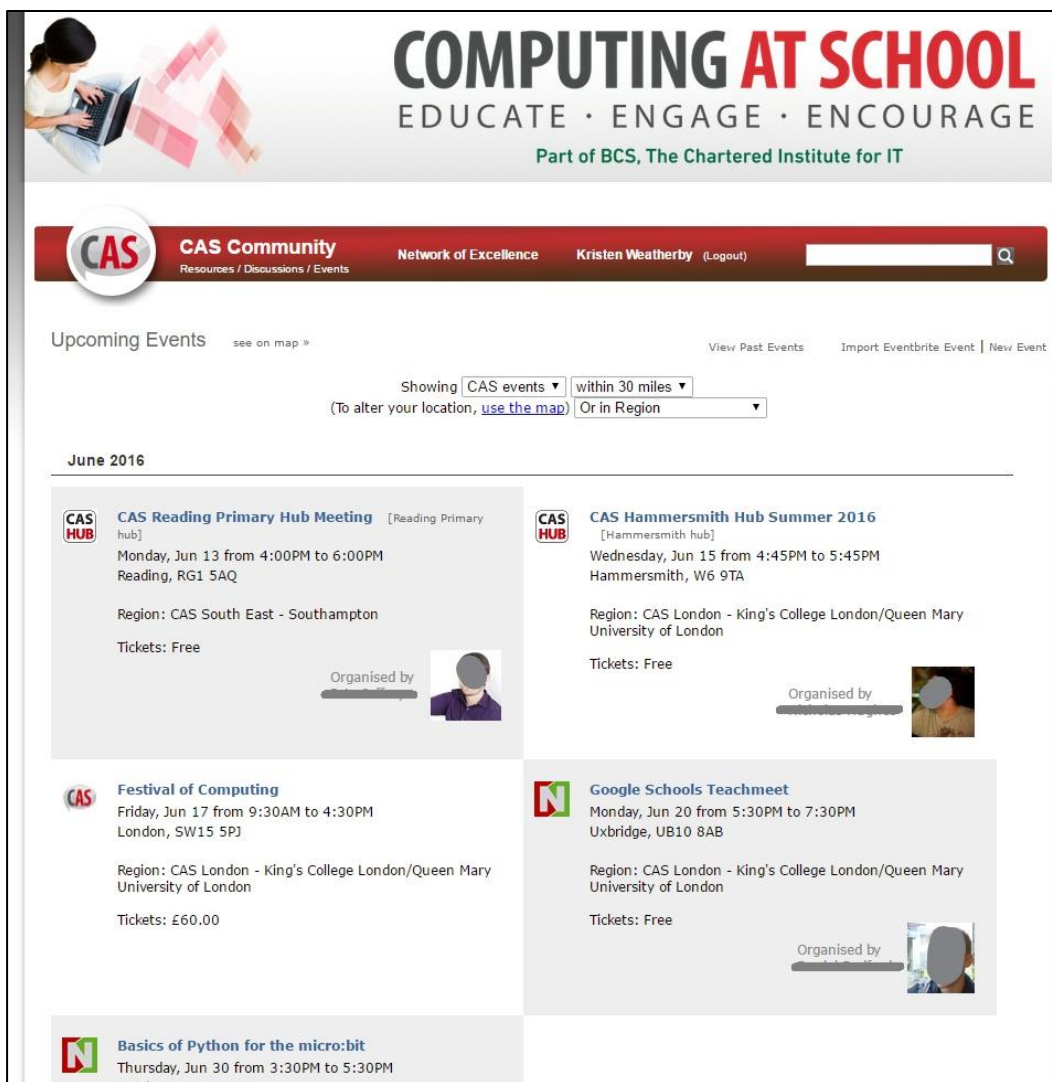


Other elements of CAS

One of the objectives for CAS and a justification for the funding provided by the Department for

Education for the Computing at School work, was to develop a "network of teaching excellence" around

computing. To do this, the CAS leadership developed both the Master Teacher programme described

earlier, and the Network of Excellence (NoE) programme. Membership in the NoE is at school level,

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rather than at teacher level. When schools apply to have Member status, they get access to a network

of training and support from providers that are either part of or have been recognised by the NoE or

Master Teacher programmes on CAS. Schools can also join the NoE as a Lead school, which includes

other commitments, such as supporting and sharing practice with other local schools and reporting

annually on the activities conducted with other schools during the year. The NoE landing page is shown

in Figure 6.7. By 18th July, 2016, the CAS website indicated that over 700 schools were part of the NoE.

**Figure 6.7 The Network of Excellence on CAS.**



## CAS in-person events

In the interview with the research lead for CAS, she stressed the importance of the in-person contact

between CAS members. According to her, the CAS online community served as a method of connecting

and supporting members who were participating in the in-person events associated with CAS, and thus

the in-person events took priority over the online community. In a journal article written by two other

members of the CAS leadership team however, they state that CAS members are "supported by face-to-

face meetings: a national conference, local hub meetings and termly working members meetings but, in

respect of establishing the organization, these have been overshadowed by electronic interactions"

(Bradshaw & Wollard, 2012, p. 4.).

Later chapters discuss in further detail the findings from the survey and interviews that relate to teacher

attendance in the CAS in-person events and the relationship between in-person and online interactions,

if any. To better understand the nature of CAS in-person events, two were attended: the CAS National

Conference in June 2015 in Birmingham, and a local hub meeting for the Reading hub. Both events are

described in the sections that follow.

## Reading Hub meeting

The Reading hub is aimed at primary school teachers responsible for the computing agenda at their

schools. This researcher attended a meeting on 11th June 2015 at 16:00, which was the group's second

meeting. At that time, the hub meetings, communication, agenda and leadership were organised by a

volunteer teacher, and CAS provided nominal funding that was used to supply refreshments at the

meeting. Venues for the hub meetings are often schools, who donate their facilities for these meetings.

The Reading hub leader was a primary school teacher from the local area and the venue for the 2-hour

meeting was a computer lab at Reading University. This particular hub was planning three meetings for

both the 2015 and 2016 school years, although the frequency and number of meetings vary by hub.

The topic for this meeting had been selected by attendees of the previous meeting. Including the

researcher and hub leader, there were nine attendees at the meeting, most of whom did not know each

other. All of them were teachers who were responsible for implementing the computing curriculum at

area primary schools.

Each attendee sat in front of a computer terminal as the lead introduced them to a software application

that could be used to create online quizzes for primary pupils. Attendees then took a quiz that informed

the lead as to their knowledge of that meeting's topic.

The meeting was dedicated to using CAS resources to help plan a computing curriculum for a school.

Participants were shown the CAS "progression pathways" document which discusses the skills and

competencies in computing that pupils should have at each stage in their learning. Attendees then

navigated through the CAS online community with the help of the lead, and learned about the resources available for primary teacher on CAS and how to find them. Teachers were then tasked with selecting a computing topic they wanted to add to a possible computing scheme of work at their school and choosing an appropriate CAS resource to help them teach that topic. Attendees shared their selected topic and resources with the rest of the group. The rest of the meeting was left for questions and discussion. The group asked many questions. The tone was casual and comfortable as the hub leader served as moderator of the discussion, but acted more as learner than expert.

The benefits of this meeting for teachers of computing were immediately obvious, both in terms of connecting primary teachers to the resources available on CAS and to each other. Most of the attendees were not familiar with the search functionality of the Resource area on the CAS community and, as such, had not explored the resources available to them for their teaching. Nor were they aware of the progression pathways work that could aid them in planning a primary school computing curriculum.

The teachers also expressed gratitude for the connection to other teachers that the CAS hub meeting provided. All attendees were the only teacher interested in computing at their respective schools; hence they were solely responsible for planning and implementing the curriculum. Many expressed frustration at having no one at their own school to ask for assistance with this task and at the perceived vagueness of the CAS guidance on planning a computing curriculum. The conversation did not have a negative tone however, as attendees responded to each other with planning and lesson ideas that had been successful for them. There was much joking and laughter and at the end of the meeting many attendees shared contact details with each other.

## CAS National Conference

The CAS National Conference is a much more formal affair. It is planned by the CAS leadership each year and held at the University of Birmingham, which offers all seminar and plenary rooms to CAS free of charge for the conference. It is a one-day event held on a Saturday in June with optional pre-conference activities on the afternoon prior to the conference. There is a nominal fee for attendance (£35 in 2015; £40 in 2016) and the event was fully subscribed in both 2015 and 2016.

The format of the event in 2015 included opening and closing plenary sessions and four workshop sessions throughout the day. Attendees were required to register for workshops in advance, all of which were led by computing teachers and provided content about a variety of topics for teachers of varying technical abilities and age groups. In 2015, the opening plenary session included talks by the National Coordinator and research lead for CAS, as well as teachers who discussed their own experiences after their first year of implementing the computing curriculum. There was also a keynote given by a noted computer science professor from a London university. Workshops spanned a range of topics, and this researcher tried to attend workshops that varied in content, technical level and target age range. The workshops attended were as follows:

- Computing Education Research: What we found and how we did it
- Computational thinking: Are we giving students enough opportunities to think outside the box?
- Helping secondary schools to deliver the new computing curriculum successfully using the QuickStart CPD Toolkit for teachers
- Using the TouchDevelop platform: A hands-on session

Throughout the day there were few opportunities for participants to network outside of the sessions other than the two coffee breaks and an hour for lunch. The closing plenary included talks by representatives of key corporate partners for CAS.

## Results of the CAS National Survey, 2015

In 2014, the CAS leadership team began running what they hoped would be annual surveys of the online community members with the goal of learning more about their membership and their implementation of the computing curriculum. The survey was also designed to discover ways in which the CAS team could improve both the website and the overall support experience for teachers of computing and other CAS members. The CAS leadership team shared the CAS National Survey results for 2015 with this researcher, along with the survey instrument itself (as mentioned in Chapter 5). The results are summarised in this section.

The CAS National Survey in 2015 garnered 1465 responses, of which 82% of respondents were members of CAS and 1159 (79%) were teachers. Because one objective of the survey was to learn more about how the computing curriculum was being implemented across the United Kingdom, it contained several

questions about the schools in which the CAS teachers were located, including location, type and level of school, computing curriculum provision (i.e. availability of GCSE and A-Level), programming languages taught and the breakdown of students by age and gender in GCSE and A-level computing courses.

Other findings discussing teacher characteristics were perhaps more relevant to this research. For example, CAS National Survey data indicate that teachers' self-reported confidence levels in teaching the computing curriculum has increased from 2014 to 2015. The percentage of primary school teachers belonging to CAS has risen from 21% in 2014 to 31% in 2015. The number of hours that teachers report the computing curriculum being taught has also grown, according to the data depicted in Table 6.2.

**Table 6.2 Number of hours teaching computing in an average week, from 2014 to 2015.**

| # of hours | 2014 | 2015 |
|---|---|---|
| **Zero** | 11% | 2% |
| **1-4** | 38% | 34% |
| **5-9** | 21% | 20% |
| **10-14** | 12% | 18% |
| **15+** | 18% | 26% |

When asked what they felt was the most useful type of professional development activity, over a quarter (26%) of responding teachers named sharing of good practice, while 22% said attending training events and 20% felt it was trying out new ideas in the classroom. Over 80% of teachers responding said that they had spent greater than six hours in the past year on self-study as a method of professional development, which was the most frequently reported type of professional development by far. Finally, teachers responding to the CAS National Survey in 2015 ranked the two most useful aspects of Computing at School as the resources that other teachers have uploaded, and discussions about approaches to teaching (in that order).

## Looking at CAS through the community of practice lens

To this point, the chapter has described the CAS online community in terms of its features and user interface, as well as its intended role in supporting the implementation of the computing curriculum in schools in the United Kingdom. To answer the research questions considering teachers' use of an online

community of practice, it is necessary to determine whether CAS could be deemed a community of practice.

In an article describing the early days of the CAS community that existed prior to the creation of the current website in 2012, Bradshaw and Wollard (2012) also questioned whether CAS could be considered a community of practice. By studying the email transactions of the members at that time they determined that CAS could be described as a community of practice.

The CAS community today looks entirely different from the one investigated by Bradshaw and Wollard. (At that time, CAS was only 1195 members who communicated exclusively via email.) Therefore it is worth asking again whether CAS in its current incarnation could be deemed a community of practice.

## Wenger's description of a community of practice
When Wenger (2002) describes communities of practice, he highlights certain characteristics they have in common and defines communities of practice in terms of the following qualities:

- **Size:** What is the overall size of the community, and is it divided into any subgroups? Communities of practice can be of any size but, as they start to grow, subgroups begin to form. These subgroups may develop their own identities, but they still maintain the identity of the larger community.

- **Life span:** How long has the community been in existence? Some communities are short-lived, meaning they have been in existence for only a few years. Others, such as communities of artisans honing their craft, may have endured for centuries.

- **Location:** Does the community exist in one physical location or is it distributed amongst multiple locations? The practice of some communities may require that their members are in close physical proximity to one another. Technology can provide a way to bridge the physical distance and connect members through a digital habitat for the community.

- **Backgrounds of members:** Do the members come from similar (homogenous) or different (heterogeneous) backgrounds? Community members can share the same occupation or can come from differing fields but have a common interest.

- **Boundaries:** Does the community exist inside the boundaries of one organisation or does it cross boundaries within or across multiple organisations?

- **Origin:** Did the community spontaneously organise, or was its development deliberate? Some organisations intentionally establish communities to meet a recognised need, while other communities of practice are organic.

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- **Recognition:** Is the community unrecognised by a larger organisation(s) or has it been institutionalised?

When the CAS community is examined in light of these criteria, it is evident that the online community itself is quite large (23,597 members as of 19th July, 2016) but there are many subgroups. The categories of discussions might provide natural division for the smaller communities within CAS, such as those for primary, secondary or FE teachers. Smaller communities might also organise by region, forming as a result of regional hub meetings or their accompanying discussion groups. CAS members self-select the communities they belong to within the larger CAS community by choosing the discussion groups in which they participate and the events they attend.

This is not a long-term community that has been in existence for decades or more. It has endured and continued to grow since the development of the computing curriculum and throughout its implementation. It is a distributed community, with members practicing all over the United Kingdom (and some internationally) but connected by the online space. In the larger community, members come from different professional backgrounds and are connected by their interest in supporting the computing curriculum in the United Kingdom. However, if subgroups can be identified by members' participation in discussion or hubs, it can be said that members of community subgroups are more likely to have their profession in common (teachers, academics, IT professionals, etc).

The CAS community spans the boundaries of many organisations in the United Kingdom and internationally, by design. It was intentionally developed to connect teachers and schools across the United Kingdom with the objective of supporting their use of the computing curriculum. Finally, the CAS community as a whole is a recognised group, receiving funding from the government and partnering with industry and other related organisations.

This description is not enough to ascertain whether the CAS online community can be considered a community of practice. The content analysis that was performed to make this determination is explained in the sections that follow.

## Examining the online community against the community of practice framework

At the same time that the quantitative and qualitative strands of the mixed-methods portion of the main study data collection were occurring, content analysis had begun on the online community itself. As mentioned in the literature review (see Chapter 3), at the foundations of this study are two theoretical frameworks: the Ecology of Resources framework and the community of practices framework. To answer the research question looking at how an online community of practice is integrated with teacher's Ecology of Resources, two things needed to happen. First, the Ecology of Resources for the teacher needed to be drawn. Second, an analysis needed to occur to understand whether the CAS community was indeed a community of practice. These analyses would enable understanding of the types of users for which CAS became a part of their Zone of Proximal Adjustment (ZPA) and whether CAS being a community of practice influenced teachers' participation in and learning from the community.

### How other researchers employ the community of practice framework

Other studies have used the COP framework to analyse in-person or online communities and determine whether they exhibit characteristics of a community of practice, according to selected elements of Wenger's framework. However, much as the nomenclature for learning communities differs depending on the researcher who names them (Andriessen, 2005), so does the interpretation of what constitutes a community of practice. The studies examined used Wenger's framework to identify whether their target community could be called a community of practice, or to help develop the characteristics of a community of practice in their existing community. The studies all used elements of the community of practice framework to identify or measure whether their communities were or had become communities of practice. However, the selected COP characteristics were different for nearly every study mentioned below.

In Wenger's original 1998 work on communities of practice, he provides 14 characteristics that indicate whether a community of practice has formed. They are as follows:

- Sustained mutual relationships - harmonious or conflictual
- Shared ways of engaging in doing things together
- The rapid flow of information and propagation of innovation

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- Absence of introductory preambles, as if conversations and interactions were merely the continuation of an ongoing process
- Very quick setup of a problem to be discussed
- Substantial overlap in participants' descriptions of who belongs
- Knowing what others know, what they can do, and how they can contribute to an enterprise
- Mutually defining identities
- The ability to assess the appropriateness of actions and products
- Specific tools, representations, and other artefacts
- Local lore, shared stories, inside jokes, knowing laughter
- Jargon and shortcuts to communication as well as the ease of producing new ones
- Certain styles recognised as displaying membership
- A shared discourse reflecting a certain perspective on the world

*Source: Wenger, 1998, p. 125*

Boud and Middleton (2003) set out to identify learning patterns within the workplace and studied groups of learners in an education space that included teachers of a specific subject area, educational planners and human resource representatives. They interviewed the different groups of learners and identified patterns of learning in the transcripts. They then used Wenger's list of 14 criteria, previously enumerated, to identify whether the characteristics were or were not present in the behaviour of each of these groups. They concluded that while each group exhibited some of the criteria of a community of practice, none displayed all 14 indicators. They resolved that communities of practice were not present.

Boud and Middleton's study was the only one found that made use of the complete list of 14 indicators from Wenger's original communities of practice work in their analyses. Other studies focused on much smaller subsets of COP attributes. Indeed, Wenger himself shortened the list a great deal in his later works, identifying just three key elements of a community of practice (Wenger et al., 2002; Wenger et al., 2009):

- The domain of knowledge
- The community, or the social aspect of learning
- And the practice itself

Gunawardena et al (2009) believed that these three elements of a community of practice were equally apparent in communities formed through social networking as they were in face-to-face communities. Their research examined how each of the three criteria might apply to social networking in general. Then they analysed their own learning as a group of graduate students forming a community of practice. Clarke (2009) added a fourth element to this list, which she claimed came directly from

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Wenger after he reviewed her research. The fourth element in her list is "brokering across the boundaries of a community", which involves the ability of individuals who are members of multiple communities to make connections between them. As a professor of initial teacher education, she analysed the discussions in which her students participated on their virtual learning environment and also applied Wenger's criteria when examining the e-portfolios of the students' work. She used these analyses to help develop an original model of student learning for initial teacher training.

In Wenger's original 1998 work, he also provides a list of three dimensions in which practice brings about the coherence of community. Wenger noted that a community of practice could be defined by associating practice and community using these three elements. These are:

- Mutual engagement (of participants)
- Joint enterprise and
- A shared repertoire

Aguilar and Krasny (2011) observed what they initially thought were communities of practice developed in after-school environmental education programmes for Hispanic students in the United States. The authors found that the concept of identity formation, while central to the learning that occurs through legitimate peripheral participation (transformation from novice to master), is a contested theory (Gee, 2000). They looked at a learner's perceptions of his or her own identity, and how it is defined through negotiated practice, their own personal knowledge (or lack thereof), their experiences within and between communities and the reconciliation of belonging and negotiation of membership to multiple communities (Aguilar & Krasny, 2011).

Kolikant et al (2006) altered this list slightly, choosing to examine domain instead of joint enterprise. Their study considered the learning through LPP that occurred amongst a group of engineering learning scientists and domain experts. The group was located in various higher education institutions throughout the United States and was tasked with creating learning materials for engineering students. They met and interacted both in person and virtually over the course of the material development. The researchers conducted semi-structured interviews and analysed the transcripts to determine that the group had indeed become a community of practice according to these three criteria.

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Finally, some researchers chose to deviate from the specific lists of characteristics provided in Wenger's work and make their own interpretations of indicators of communities of practice, either based on some elements of Wenger or from their own observations. Barab and Duffy (2000) used a lens of legitimate peripheral participation to review a variety of existing educational communities, both online and face-to-face, in the effort to determine whether they were merely "practice fields" or whether they could be classified as communities of practice. They introduce the idea of practice fields as being the space on the periphery of a community that enables learners to have the same experience as if they were "on the field" as full members of the community. The authors assert, supported by evidence, that practice fields are not "the game"; they often rely on groups coming together to solve a problem or work on a project and, as such, are temporary and do not have the history of a community of practice (Barab & Duffy, 2000). Barab and Duffy offer four characteristics of a community of practice:

- The group must have a common purpose, which creates the reason for the group to come together and function in the first place.
- There must be a shared history that will continue to be sustained by the community and its members. This heritage contributes to the culture that is also shared by community members and aids them in communication and negotiation of meaning.
- Community members and the community itself are part of something that is bigger than themselves. This interdependency manifests itself in members who become more connected to the community and the community itself having a purpose that is connected to the society in which it resides.
- There must be a reproduction cycle for the community, whereby new members are able to move from membership on the periphery to core membership through their interaction with experts in the community.

*Source: Barab & Duffy, 2000, pp. 41-42*

Cuddapah and Clayton (2011) used Wenger's COP lens to observe a cohort of new teachers to see what elements of a COP were present and whether LPP was possible if there were no experts as part of the group. The four most important identifiers of a community of practice for their work were labelled as meaning, practice, identity and community and all of their observational data were assigned codes that fell into one of these categories.

## Developing the criteria for identifying the characteristics of a community of practice

Simply applying Wenger's descriptive characteristics of communities of practice to the CAS community

suggests that the CAS community might exhibit characteristics of a community of practice. However, to

conduct a content analysis of interactions on the CAS online community, codes needed to be developed

that reflected Wenger's criteria for existence of a community of practice.

Any codes developed to conduct this content analysis needed to stay as close to Wenger's defined

characteristics of a COP. However, when reviewing the 14 criteria that Wenger developed to indicate

whether a COP has formed, some seemed to overlap ("absence of introductory preambles" and "very

quick setup of the problem to be discussed" for example). In addition, when reviewing the

aforementioned studies that also used Wenger's criteria to identify communities as COPs, the one study

that employed all 14 criteria did not produce any evidence of a COP. Indeed, Wenger's own work

reduces this list of 14 criteria over time, creating fewer and more general criteria with each iteration.

The studies mentioned previously that used these reduced lists of criteria were more successful in

identifying and labelling communities as COPs.

For this research, it was determined to use the three characteristics of a COP - domain, community and

practice from Wenger et al, 2002 - to establish whether CAS could be considered a COP. The definition

of a COP used in this study also originates in this source, which provides consistency. It was then

determined to use as many of the criteria from Wenger's original list of 14 characteristics as codes, to

support and refine the data that were coded as falling into one of these three larger categories.

Additional codes and sub-codes related to a COP were also developed as the review of CAS was

conducted. The coding is described in detail in Chapter 7.

## Developing criteria for selecting data for the content analysis

It was decided that eight discussions would be selected and analysed in relation to the community of

practice framework. This quantity of discussions enable the researcher to look at a variety of topics and

multiple target audiences (primary and secondary teachers, for example) to get a broader idea of the

communication that occurs within the community. Criteria were developed to select the discussions to

be analysed and coded for characteristics of a community of practice, described below:

- **Discussion participants should be mostly teachers.** This study is concerned with teachers' use of the CAS online community, yet many members of CAS are not classroom teachers. Thus, it was vital to select discussion topics in which the participants were more likely to be teachers, as opposed to more general discussions in which journalists and academics might find it easier to participate. It was not difficult to identify such discussion topics, as it became obvious when looking at the discussions which were started by teachers needing help with their teaching. Discussions started by academics or journalists were often philosophical in nature, and generated a great deal of conversation amongst CAS members, including teachers. In fact, these types of discussions had some of the highest numbers of responses on the site. Example topics included "What do we replace ICT GCSE/A-level with?" or "Computer science: Is it disappearing as a main-stay subject?" While these types of discussions might be interesting to read, they would not provide any indication as to whether teachers were learning or building their own skills or knowledge. In other words, these such discussions would provide less of an indication as to whether the CAS community exhibited characteristics of a community of practice.

- **Discussions must be from a variety of CAS categories.** To get a broader idea of the kinds of conversations occurring on CAS, discussions were drawn from a variety of different school-teacher-centric categories on the CAS site. Of the seven possible teacher-focused discussion categories, discussions were selected from the Primary Education and Secondary Education categories in order to ensure that most of the participants were teachers involved in primary and secondary education. As the survey sample included both primary and secondary teachers, it was decided to look at two discussions in the Primary Education category. Discussions in this section were also selected because the researcher is not a computer programmer, and wanted a better chance of being able to understand the content of at least some of the discussions on the site. (This is also why no discussions from the further education (FE) category were selected, as further education teachers teach A-Level computing, which is beyond the realm of this researcher's comprehension.) Four discussions were selected from the Secondary Education category as this is the target sample for the interviews. Finally, two discussions were selected from the No Question Too Small or Too Stupid category. This category was developed in 2013 to help encourage participation from members who were too timid to post in the other categories.[23] It was selected for analysis to provide information as to what kind of questions novice computing teachers have and how they are responded to by more able members.

- **Discussions must have at least 20 replies.** Longer discussion threads were required to analyse more in-depth communication and exchanges between CAS members. When reviewing the discussions in Spring 2016, it appeared that most of them had fewer than 10 replies by other members. Thus, it was slightly challenging to find discussions that had at least 20 replies.

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[23] http://community.computingatschool.org.uk/forums/63/topics/994

- **Discussions continued within four months of the initial search date.** To keep the data collection from CAS members across the strands of the study to a similar point in time, the discussions needed to be active within four months of the search period (Spring 2016).

Text and graphics associated with the discussions selected were pasted into Microsoft Word documents for each discussion. An example of a copied and pasted discussion can be seen in Figure 6.8. Each time a member comments as part of a discussion, his or her profile picture, name, occupation category and his or her badges appear alongside the comment.

**Figure 6.8 Example CAS discussion pasted into Microsoft Word for analysis.**
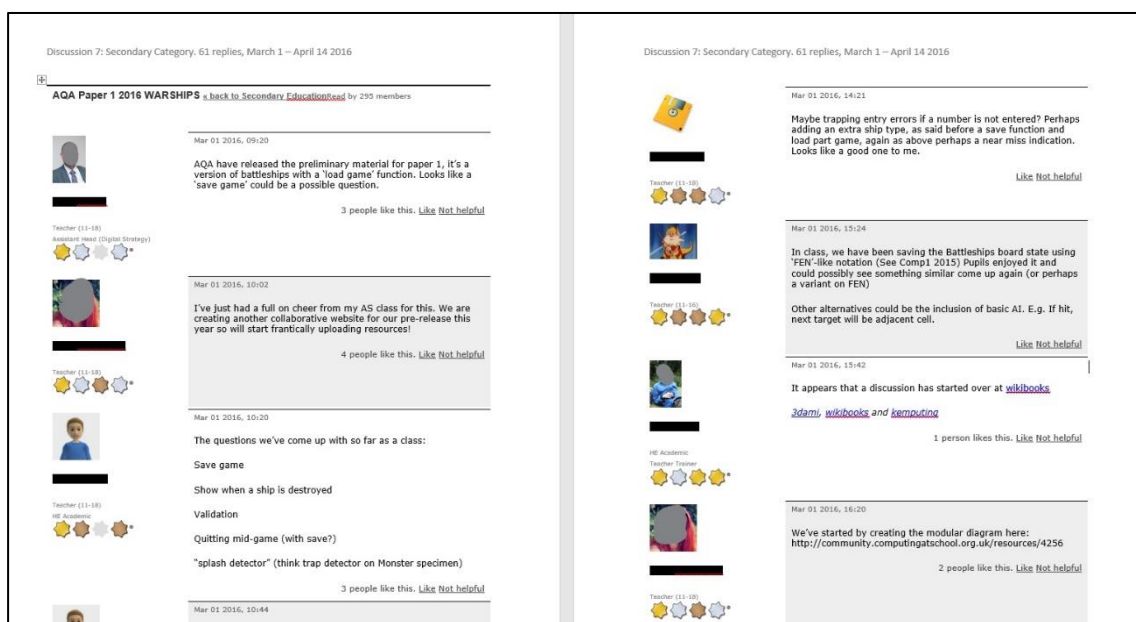


*Issues with selecting discussions for analysis*
Collecting discussions using these criteria was not straightforward. Several issues arose once the discussions were reviewed in detail. For example, one discussion that met the criteria was unable to be used because early in the discussion a teacher offered his solution to the exam item being discussed and said he would send it to anyone who emailed him. After that, 17 of the total 37 responses from other members were teachers saying something like "thanks, I've emailed you" to the teacher who had offered his exam solution. Thus, even though this discussion had more than 20 comments, the majority of them were unhelpful for a content analysis that had as its objective the identification of characteristics of a community of practice.

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Upon further review, it became apparent that many discussions in which a teacher was asking for help were just simple question and answer, and required very few replies in order for the teacher to get the help they needed. In other words, they were not discussions at all. A teacher would pose a question and several other teachers with more experience would respond with what they knew or had done in their own classrooms. This kind of interaction was helpful to the teachers who posed the questions and is indicative of the kind of support that CAS members provide as discussed by teachers in the interviews (See Chapter 7). However, these short questions and answers did not provide the level of dialogue needed to analyse whether the CAS community aligned with the community of practice framework.

The discussions that were selected and analysed were:

- **OCR and the 2017 Coursework**: No question too small or to stupid category. 30 replies, 7 June 2015 to 10 Sept 2015
- **Delivering Computing GCSE for the first time**: No question too small or too stupid category. 26 replies, 6 Nov 2015 to 7 Dec 2015
- **How to Develop a Primary Computing Curriculum**: Primary education category. 20 replies, 22 June to 11 July 2015
- **Pi Based Robotics**: Primary education category – 21 replies, 12 July to 9 Dec 2015
- **OCR A453 Troubleshooting system**: Secondary education category: 40 replies, 21 July 2015 to 5 Jan 2016
- **AQA Population Model 2017**: Secondary education category. 36 replies, 29 July 2015 to 14 April 2016
- **AQA Paper 1 2016 Warships**: Secondary education category. 61 replies, 1 March to 14 April 2016
- **OCR GCSE A453**: Secondary education category. 42 replies, 13 October 2012 to 16 Dec 2015

*Selecting resources for analysis*

Similar to the discussions, criteria were developed for selecting the resources that would be reviewed. Resources on the CAS community are often commented on by other users. This is likely to be because users are automatically prompted by the CAS site to provide feedback on a resource after it has been downloaded. Sometimes teachers who use the resources in their own classrooms provide corrections or comment on adaptations they have made to the resource. In addition, resources are often edited by other teachers and re-posted. Often, the comments are simply compliments to the teacher who has created the resource or expressions of gratitude for sharing. Even so, the element of possible collaboration on shared artefacts that is characteristic of a community of practice made it worth looking through several resources to see if elements of COPs were present.

The criteria developed for selecting the resources that were analysed are described below.

- **Must be for England's curriculum.** Since all but one of the interviewed teachers were from England and since CAS was originally designed to support England's computing curriculum, the resources selected should be from England's curriculum.

- **Must span all age ranges.** One resource was selected from each of the possible age range categories on CAS: 7-, 7-14, 11-14, 14-16 and 16+.

- **Must have at least 30 comments from other teachers**. As mentioned previously, many of these comments were not useful, so there needed to be a substantial number of comments to increase the likelihood of finding evidence of a community of practice.

- **Must have been created by a teacher.** Some resources were provided by corporate entities, trainers or exam boards, and the examination of resource comments endeavoured to analyse interactions between teachers.

To select the resources meeting these criteria, all resources in each of the age range categories were sorted by "most popular", in the hope that the most popular resources on CAS might have also been the most helpful teachers and have generated the most comments. The description of the resources provided by the teacher was downloaded and copied to a Microsoft Word document in which all of the comments by teachers were also pasted. The number of comments on each resource as well as the total number of downloads for each of the files (which included previous versions of the files, when applicable) were also noted. All of the files associated with the resource itself were also downloaded for review. An example of a resource Word document is shown in Figure 6.9. The same community of practice codes created for the discussion were used to code the resources.

**Figure 6.9 Example of document created for analysis of each resource.**
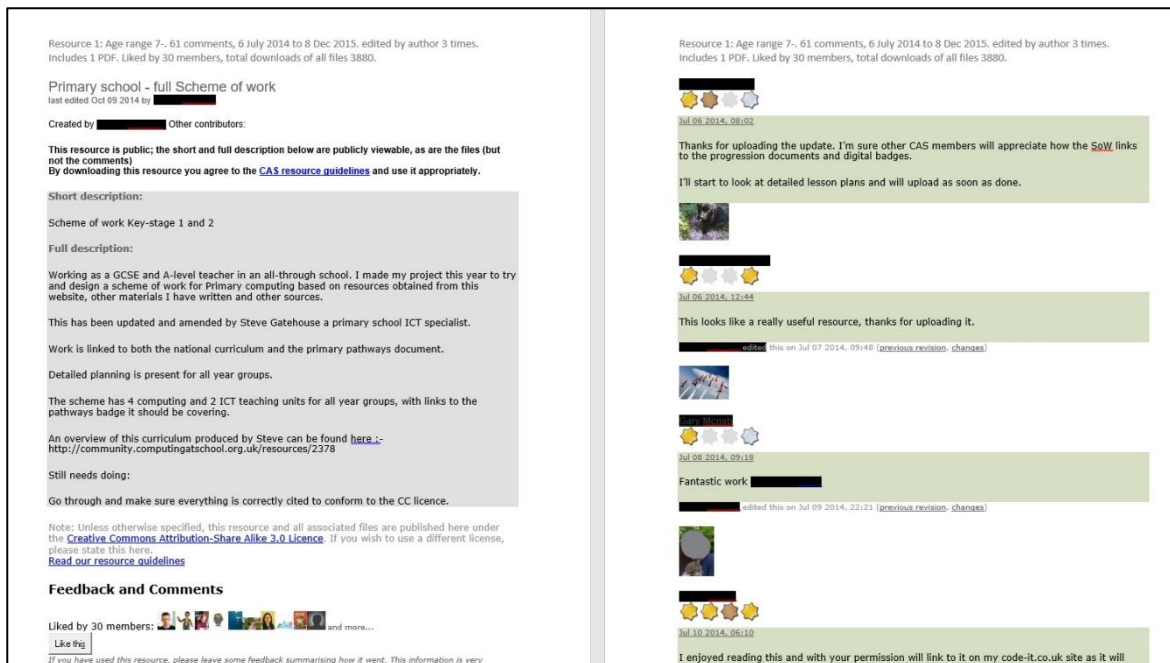


The resources that were selected and analysed were:

- **Primary School Full Scheme of Work:** Age range 7-. 61 comments, 6 July 2014 to 8 Dec 2015. Edited by author 3 times. Liked by 30 members. Total downloads of all files (1): 3880
- **Python Scheme of Work:** Age range 7-11. 60 comments, 30 Sept 2013 to 5 Dec 2015. Liked by 45 members. Total downloads of all files (9), 17,659
- **Challenging Questions in Computing:** Age range 11-14. 164 comments from 18 April 2014 to 6 Jan 2015. Liked by 88 members. Total downloads of all files (1): 6839
- **Python Programming Challenges Booklet 2: Practising Python & Planning Programs using Pseudocode**: Age range 14-16. 134 comments from 26 Nov 2012 to 3 December 2015. Liked by 46 members. Total download of all files (4): 16,669
- **Book of Programming Challenges:** Age range 16+. 218 comments from 19 Sept 2012 to 6 Jan 2016. Liked by 89 members. Edited by the author and another user. Total downloads for all files (2): 8164

Analyses of the resources and discussions against the communities of practice framework are described

in Chapters 7 and 8.

## Using the Ecology of Resources framework

The content analysis of the CAS online community continued using the second theoretical framework,

the Ecology of Resources framework, which would aid in understanding how and why a teacher chooses

to use CAS and its resources to fill his or her learning need. The Ecology of Resources (EOR) is primarily

used as a framework for the design of resources for learning in such a way that the learners themselves

participate in the design process[24]. It provides a way to match models of learners with the models of their context so that opportunities for scaffolding can be identified (Luckin, 2008). Much of the literature referencing the EOR (or studies using the EOR) emphasises the use of the framework in designing new learning resources. The design work ranges from educational technology applications for learners at a school level (Avramides et al., 2013) to language learning applications for mobile devices (Underwood et al., 2012), to the use of simulations to train people in the healthcare and policing professions (Hall, 2012; Söderström, 2014). In all of these studies, researchers found the framework particularly useful in identifying the learning resources to which learners already have access as part of their Zone of Available Assistance (ZAA), and identifying the interactions between each. Researchers were concerned with identifying the more able partners (MAPs) that existed either within the software application itself (in terms of feedback provided by a simulator, for example (Söderström, 2014)) or amongst the other learners present in the group of learners (Hall, 2012).

There are other uses for the ecology resources model as well. For example, it is interesting to examine the interactions and relationships that exist between the elements within a learner's context and between the learner herself and those elements (Luckin, 2009). Studying these interactions and relationships could improve the teaching and learning process overall for that learner (Luckin, 2008).

The Ecology of Resources framework also proves informative when analysing existing technology applications that are used for learning. Since the EOR framework provides a basis for analysis of the relationships that exist between learners and the technology application, further study might indicate whether those relationships are the appropriate ones for that learner. In this light, the framework has been used to analyse learners' context in order to understand what resources might better support them as part of an online community, for example (Luckin & Weatherby, 2012).

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[24] The involvement of the learner in designing his or her own learning resources is similar to Engeström's theory of expansive learning, in which learners also create a new object for their activity (Engeström & Sannino, 2010).

Teacher participation in online communities of practice

It is this third application of the EOR framework that is used to discover how an online community of

practice might become part of a teacher's zone of proximal adjustment. The CAS online community for

teachers of computing was analysed using the EOR framework. The CAS community itself was

considered the zone of available assistance, for example teacher "learners" and models of the available

resources, the relationships between those resources and each other, and between the resources and

the learner are examined.

## Adapting the EOR framework for use

The framework used for analysing the CAS community has been slightly adjusted from the version of the

EOR framework presented in Luckin 2010. The differences lie in the expressed purpose for the use of

the framework, as mentioned previously. As the EOR framework is being used to analyse learners'

contexts rather than to build technology solutions, some of the steps and analyses proposed are not

necessary. The steps that were used in the adapted framework are below:

**Phase 1:**

1. **Brainstorm potential resources in Ecology of Resource**. Examine the descriptions and analyses of the CAS online community to provide a map of the resources available to learners (i.e. member teachers) on CAS. In-person CAS resources were also reviewed. Analyse the interview and some survey data to reveal the resources that learners have access to outside of CAS.

2. **Specify focus of attention**. The focus of attention is the specific part of the learner's context that relates to the purpose for creating this model in the first place. In this instance, the purpose of creating the EOR model is to understand what resources CAS provides that assist in teachers' development and support their teaching of the computing curriculum.

3. **Categorise the resource elements.** Review the list of resources and divide them into the categories of People, Tools, Knowledge and Skills, and Environment.

4. **Identify potential resources filters**. Use interview data to discover people or elements that might limit, prevent or promote a learner's access to resources identified in the previous steps.

5. **Identify the learner's resources.** Use interview and some survey data to pinpoint the resources that learners bring with them (such as knowledge and skills and education or work experience).

6. **Identify More Able Partners (MAPs)**. Specify which resources have the possibility of or already act as MAPs for the learner in terms of developing and sustaining a learner's zone of proximal assistance. MAPs should be described in terms of their role, the relationships they have with learners and the resources they bring to learners.

**Phase 2:**

1. **Identify the relationships within and between the resources and filters of the Ecology of Resources**. Using the data produced in the previous phase, as well as any supplemental information gleaned from the interviews, identify not only the relationships between resources and filters but also how these relationships meet the needs of learners, if at all.

**Phase 3:**

1. **Understand how relationships that are identified in Phase 2 might be further supported**. The objective of this phase is to understand how scaffolding or adjustments might be developed in order to help support learners in their progress and to identify learners' zone of proximal development. For this study, this involves an examination of the resources and filters and their relationships, and how they all interact with the learners' own resources to understand, ultimately, how CAS becomes a part of these learners' ZPA.

## Conclusion

This chapter provides a description of the origins of the Computing at School initiative and the CAS community, as well as the computing curriculum whose implementation in schools the community supports. It outlines the content analysis of the CAS online community in relation to two theoretical frameworks: the communities of practice framework and the Ecology of Resources framework. While the data collected from the survey and interview in the mixed-methods strands of this study begin to provide information as to CAS users' context, these analyses will enable further description of the resources available to CAS teachers through the online community and in-person CAS events. Content analysis of the resources and discussions will help determine whether the CAS community can be considered an online community of practice (rather than just an online community). The next chapter discusses the coding of community of practice elements of the CAS community and starts construction of a CAS learner's Ecology of Resources.

# Chapter 7 – Data Analysis and Results

## Overview

The aim of this study is to discover the relationship, if any, between a teacher's participation in an online community of practice and the development of his or her teaching practice. To learn whether such a relationship exists, the research needs to understand how an online community of practice fits into a teacher's context, and recognise the features of the online community that teachers are using and whether this online space is a community of practice. The data also need to provide insight into the nature of changes teachers are making to their practice as a result of their participation in the community.

This chapter provides a summary of the analyses that were conducted on all data collected for this study, including the survey, interviews, reviews of the website against two theoretical frameworks and the field notes from attendance of in-person events. (A summary of the data collected for this research and the research questions to which it pertains can be seen in Figure 5.1 in Chapter 5.) The first part of the chapter details initial findings from the survey data and how they were influential in the development of the interview questions that were ultimately used. The chapter then discusses the coding and thematic analysis of the interview data and the coding of community of practice elements, which included the discussions, resources and field notes from in-person events. Finally, the discussion turns to the development of a map of CAS members' zone of available assistance, from the data collected thus far, which begins to enable the understanding of how the CAS community might become part of a teacher's context.

## Purpose of data analysis

The overall purpose of data analysis was primarily to determine answers to the research questions. The central research question that drives the work in this study, as well as the sub-questions used to further understanding, are as follows:

**What is the relationship between participation in online communities of practice and the development of a teacher's practice?**

- How does an online community of practice fit into a teacher's context?
- What are the characteristics of the online community that teachers are actively using to develop their practice?
- What are the characteristics of the changes teachers are making to practice as a result of their participation in online communities?

Data analysis provided an opportunity to explore the themes within teachers' data that, when analysed in conjunction with their background characteristics, might help reveal the relationships between a teacher's profile and his or her usage of the CAS online community. Data from all sources, both quantitative and qualitative, needed to be analysed individually and together to address the research questions, uncover patterns and develop profiles of teachers and their usage of CAS.

Prior to the process of coding the data, an initial list of objectives and possible questions to be answered during data analysis was developed, containing questions that might be answered by the data. Figure 7.1 shows what kind of information the data analysis process was intended to reveal from across the different data sources.

**Figure 7.1 Some possible objectives of data analysis process.**

| To describe | • The teacher's context<br>• The teacher's use of the online community<br>• The characteristics of the community that teachers are using to develop their teaching<br>• The characteristics of the changes teachers are making to their practice as a result of their participation in the online community. |
|---|---|
| To notice themes | • What makes this online community in particular useful for teachers?<br>• What makes this site different from other online communities? |
| To notice patterns, similarities or differences | • Is there a particular profile of teacher who benefits from this site rather than others?<br>• Is there a particular profile of teacher who is finding what they need from this site?<br>• Is there a particular profile of teacher who is finding what they need from online communities in general?<br>• Is there a pattern to the kinds of changes teachers are making who use this community?<br>• Is there a pattern to the kinds of changes certain profiles of teachers are making who use this community?<br>• What are the similarities and differences between those teachers who attend in-person events and those who don't?<br>• Is there a pattern to the profiles of teachers who attend in-person events and how they use the site?<br>• Do teachers who receive more or less support from their schools use the site differently? |

## Analysing the survey data

The primary purpose of the survey data in this study was to provide quantitative data from a large number of CAS members in order to begin to answer some of the research questions posed in this research. However, the collection of survey data also had a secondary purpose: to aid in the development of the interview questions for the second phase of the main study that involved mixed-methods data collection (as discussed in Chapter 5). Once initial survey results were analysed, the researcher was able to ascertain which parts of the three main research questions remained unanswered, and which were partially answered and required more data to be collected from the

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interview phase. The unanswered or partially answered questions informed development of the

interview questions outlined in Chapter 5.

## Data cleaning

The survey was conducted using the online platform SurveyMonkey. Once the survey window closed,

the raw data were downloaded from SurveyMonkey into a Microsoft Excel spreadsheet for cleaning.

The total number of survey responses as of 15:00 on 28th June was 1012. However, after an initial

review of the response statistics provided by SurveyMonkey, it was determined that the software had

included in the respondent count those teachers who had answered "No" to the two filter questions

(i.e. they were not teachers and did not agree that their data could be used in this research). Therefore,

the following cleaning rules were developed:

Respondent data were deleted if:

- Answer to Question 1 (Are you currently working as a teacher?) was NO
- Answer to Question 2 (Do you agree that your survey data can be used for this research?) was NO
- Answer to Question 2 was blank
- Answer to Question 2 was YES but all other questions in the survey were left blank

After application of these cleaning rules, 920 unique survey respondents remained.

### Survey non-response

As with any survey, there was a certain amount of non-response that varied with each question in the

survey and tended to increase as the participants advanced through the survey. All percentages and

means that are reported in the results were calculated by using the actual number of survey

respondents per question, rather than the overall number of survey respondents (920), in order to

account for those who left the question blank. For this reason, results should be interpreted as being

representative of those teachers who responded to the question, rather than of all survey respondents

(although for some questions, there is very little non-response). The total number of non-responses per

question on the survey is indicated in Table 7.1, below.

**Table 7.1 Survey non-response, by question.**

| Question | # non-response | |
|---|---|---|
| 3 | 7 | *Questions 1 and 2 were filter questions and any non-response to these was already deleted in the cleaning process. |
| 4 | 9 | |
| 5 | 9 | |
| 6 | 13 | ** Question 18 was a question written by the CAS team, the results of which were not used in this study. |
| 7 | 12 | |
| 8 | 12 | |
| 9 | 20 | ***Questions 19 and 20 were administrative questions and the results are not analysed and presented as findings. |
| 10 | 48 | |
| 11 | 47 | |
| 12 | 57 | |
| 13 | 56 | |
| 14 | 228 | |
| 15 | 217 | |
| 16 | 110 | |
| 17 | 122 | |

The survey non-response for questions 14 and 15 was high, but this is to be expected as these questions placed more of a response burden on participants, who were required to write in survey responses rather than simply ticking a box or selecting an option from a list. However, there were still 692 and 703 responses to these questions respectively, which provided ample data for the analyses that were required. It is also interesting to note that question 14, which asked participants to name a resource that prompted them to make a change in their teaching, had a lower response rate than question 15, which asked teachers to describe the resource they named in question 15. However, upon reviewing the write-in responses for both questions it became clear that many teachers left question 14 blank because they could not remember the name of the resources, or they could not think of a specific resource. Yet in responding to question 15, they still described one or more resources, events or interactions on CAS that were helpful to them.

## Data analyses and results

Many of the multiple-choice or dichotomous survey questions were relatively simple to analyse and no advanced statistical analyses were needed to obtain results that addressed this study's research questions. Descriptive statistics were used to distil the large number of participant responses into percentages or averages that could help describe the characteristics and beliefs of the sample of teachers that took the survey.

*Teacher background characteristics*

Teacher background characteristics were reviewed to discover more information about the population

of teachers that responded to the survey. (These data were also used in more complex analyses to

create profiles of teachers. This is discussed in Chapter 8.)

Of the teachers who responded to the survey questions, 47% were female and 53% were male. The

average age of these teachers was 41 and they had been teaching for an average of 13 years.

These data were compared to the data from the TALIS survey in England, which was collected from

teachers of lower-secondary education[25] in 2013. Although the sample and survey window were

different, the questions that collected these data were identical and enabled a rough comparison of the

population of computing teachers responding to these survey questions with the overall population of

lower-secondary teachers in England. This comparison can be found in Table 7.2.

**Table 7.2 Demographic information for CAS and TALIS survey respondents.**

| CAS respondents | TALIS England data |
|---|---|
| 47% female | 63% female |
| 53% male | 37% male |
| Average age: 41 | Average age: 39 |
| Average years of experience: 13 | Average years of experience: 12 |

The most interesting finding from this comparison is gender difference. In England – as well as in nearly

all countries surveyed by the OECD in TALIS 2013 – the majority of teachers were female. However, the

majority of computing teachers responding to this survey, with a volunteer sample, was male.

Two thirds of the CAS teacher survey respondents report having achieved a Bachelor's degree as their

highest level of education, as indicated in Figure 7.2, below.

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[25] In England, this includes teachers from all types of schools teaching pupils in Key Stage 3, (Micklewright et al., 2014)

**Figure 7.2 Highest level of formal education.**
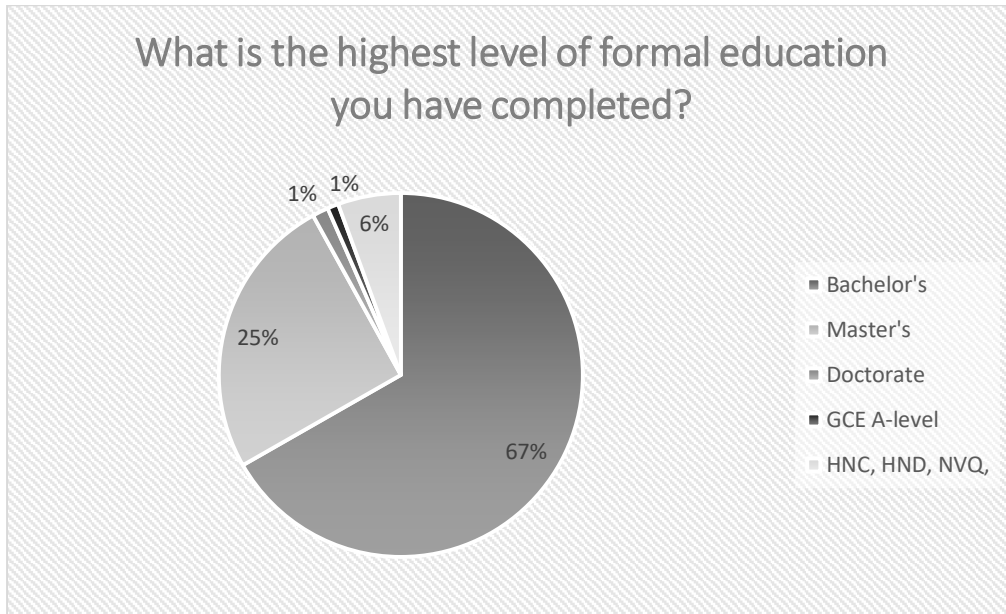


The majority of survey respondents teach some level of secondary education, whether that be at a primary school that includes secondary students, a middle school, an independent school, an academy or a school or college that includes A-level students. (See Figure 7.3)

**Figure 7.3 Percentage of survey respondents teaching all levels of students.**
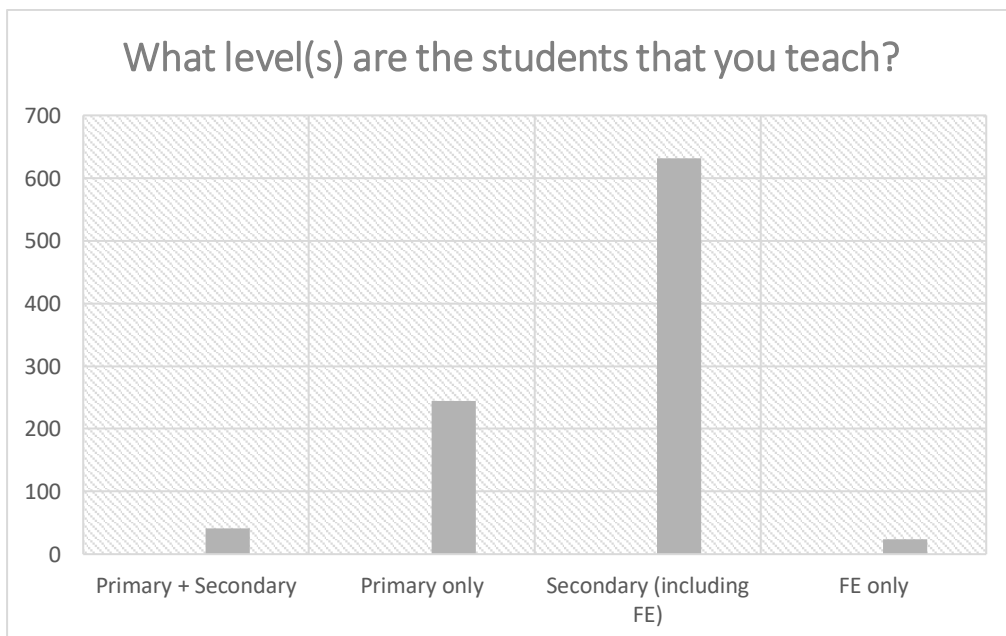


Of the respondents to these questions, 73% of CAS teachers report teaching computing at a secondary level (school or FE), and 26% report teaching primary pupils (which includes teaching computing

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amongst other subjects).[26] Of those teachers who report teaching secondary computing, 60% report

teaching only computing and no other subject, while 40% report that they also teach other subjects. The

most common subjects taught by those teachers who teach more than one subject are information and

communication technology (ICT) (25%) and mathematics (22%).

*Teachers' use of CAS*
The next survey questions were designed to help understand teachers' patterns of usage of the CAS

online community. As Figure 7.4 indicates, nearly half (49%) of respondents report accessing the CAS

site frequently, at least once a week or more.

**Figure 7.4 Frequency of accessing the CAS online community.**
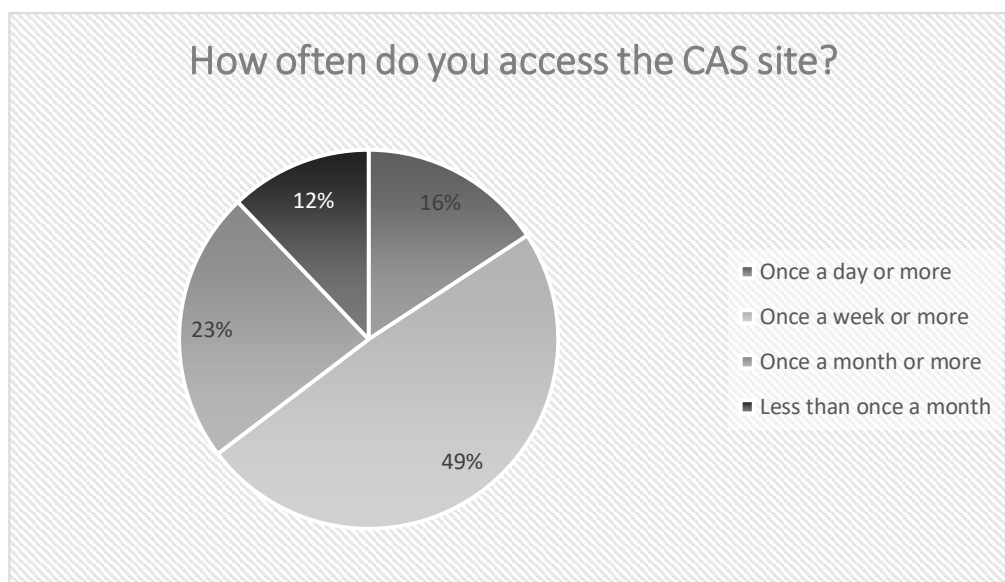


The top three motivations that teachers report as prompts for them to access the CAS site are:

1. Seeing something in the regular notification email and want more information;
2. Needing to download a resource for classroom use;
3. Needing information or having a question or problem regarding a certain topic.

Nearly half (45%) of teachers who responded to this question reported that seeing something in the

regular CAS notification email was their primary motivation for accessing CAS.

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[26] The figure of 26% of primary school teachers is also interesting to note, given the finding from the CAS National Survey reported in Chapter 6 that the amount of primary school teachers on CAS has increased over the community's lifetime (meaning it used to be even less significant than this).

Over 60% of teachers also reported that when they log in to the CAS community, they look first at the

resources uploaded by other teachers, as indicated in Figure 7.5.

**Figure 7.5 Areas of CAS that teachers visit first.**
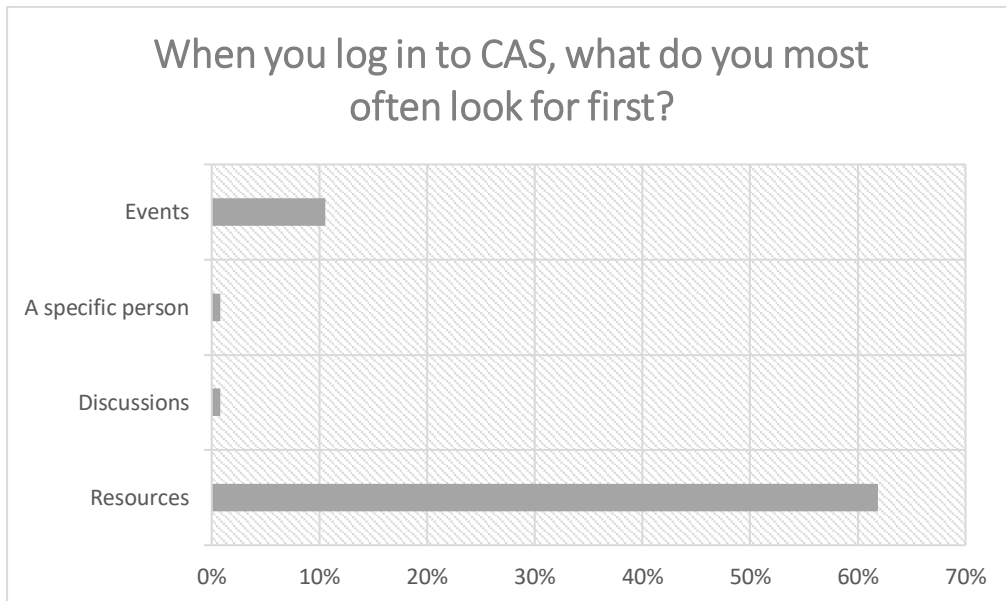


*Relationship between CAS resources and teaching*
The next three questions were key to revealing answers to one of this study's research questions, as

they asked teachers about resources on CAS that might have prompted a change in their classroom

teaching. Overwhelmingly, teachers responded that CAS resources have prompted a change in their

teaching, with only 12% of teachers who responded to Question 13 reporting that nothing from CAS has

impacted their teaching. (See Figure 7.6.)

**Figure 7.6 Influence of CAS resources on teaching practices.**
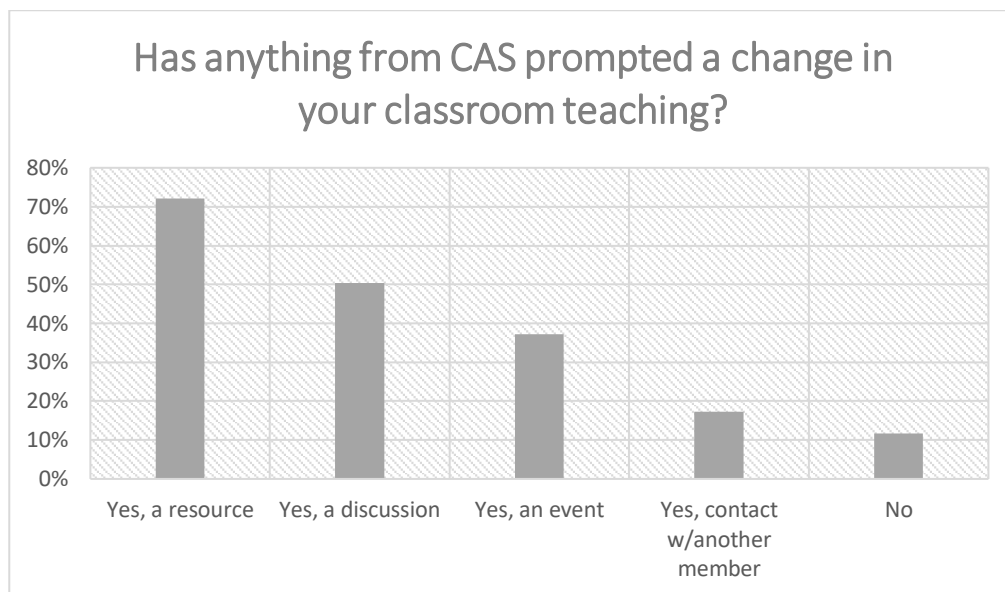


Analysing the open-ended questions

The open-ended questions that appeared next in the survey asked teachers to write the name of the specific resource that had the most impact on their teaching and then describe why that resource was so useful.[27] The results from these questions required more extensive analyses, both because all write-in answers needed to be read and categorised, but also because the responses to this question would provide data needed to answer research questions and shape the semi-structured interview schedule.

To analyse these results, the write-in data needed to be cleaned. First, all negative responses to Questions 14 and 15 (no, I don't know, dunno, dumb question) were deleted, as these did not provide any data to answer research questions or inform interview development. Responses to Question 14 that were some form of "too many to mention" or "uploaded resource" with nothing in Question 15 were also deleted, as they did not provide any additional information to what was already provided in Question 13. (See Figure 7.5.) Responses to Question 14 that indicated "can't remember" were kept because in most cases the respondent seemed simply unable to remember the name of the specific resource, yet still provided a description of why the particular resource was useful in the response to

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[27] There were four other open-ended questions in the survey. Questions 7, 11 and 17 all included an "Other" response option in which teachers could write in a response. Responses for Questions 7 and 11 were analysed and reported on with the rest of the responses to those questions. Question 17 as well as the final write-in Question 18, were questions specifically requested by CAS and were not relevant for this research. Therefore those write-in responses were not analysed.

Question 15. Responses to Question 14 that were left blank were also kept if there was a description of the resource provided in Question 15. After cleaning, there remained 663 resources for analysis.

The resources were then grouped into general categories to help describe the kind of resources that were being named by teachers. The act of developing these categories was relatively straightforward as in most instances the name of the category was indicated in the answer to Question 14 or 15. Resources were distributed amongst the categories that were created, and a count performed to understand how many of the 663 resources mentioned by teachers fitted in each category. Not all resources fitted one of these categories, however. Of the 663 resources, 446 fitted into these larger categories and the remaining resources either did not fit into any category as no other teacher mentioned them, or they fitted into a category but only four or fewer teachers cited them. The results of these analyses and a list of most frequently reported categories are shown in Figure 7.7.

**Figure 7.7 Resources cited by teachers as having impacted their teaching, by category.**
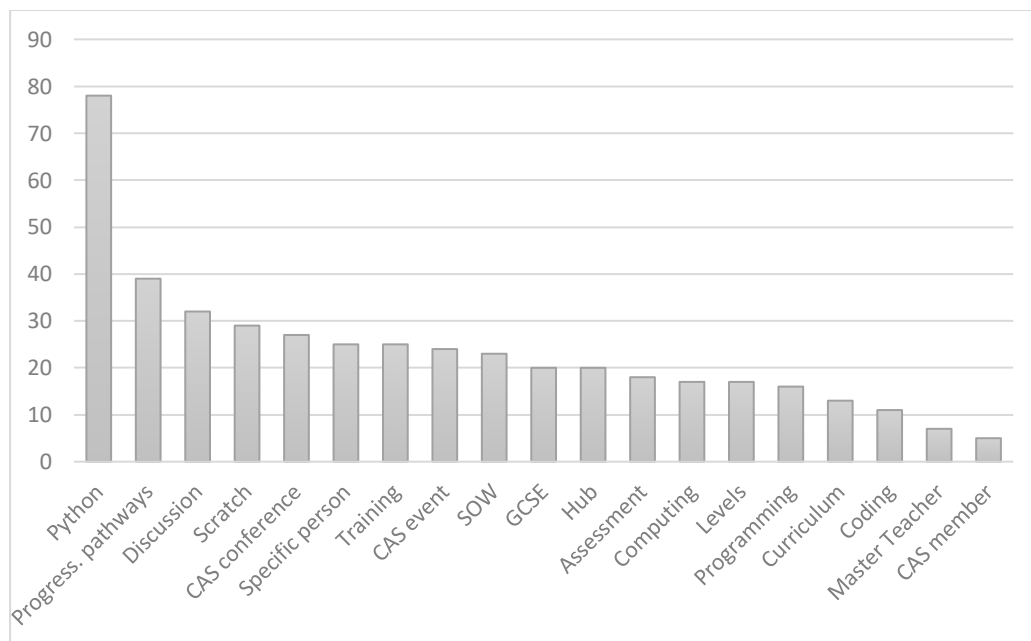


Most of the category headings describe the kinds of resources that were mentioned in each category. ("Python" refers to Python resources, for example.) Some are less clear and are described below:

- **CAS conference**: CAS National Conference (in England, Scotland or Wales) only. Any other CAS events are categorised under CAS event
- **Specific person**: A named member of CAS or computing expert whose resources were used or who was helpful

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- **SOW**: Scheme of work
- **GCSE**: Any resource relating to teaching the GCSE in computing
- **Training**: Any kind of course or workshop taken for CPD
- **Hub**: Anything having to do with a hub meeting or CAS hub
- **Master teacher**: Anything having to do with the CAS Master Teacher programme
- **CAS member**: Contact with another member of CAS who was unnamed

Similar analyses were then performed on the responses to Question 15 to develop categories to describe the reasons why teachers felt these specific resources were helpful. The breakdown of these categories is depicted in Figure 7.8.

**Figure 7.8 Reasons cited by teachers as to why these resources were helpful.**
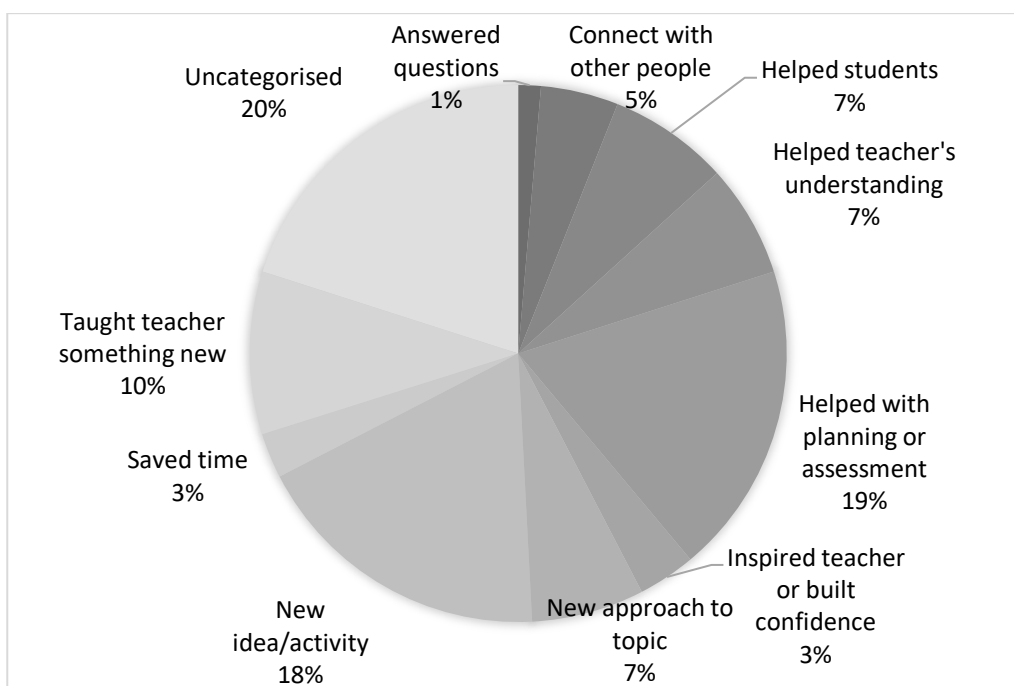


Again, some of the categories are self-explanatory, such as saved time, new idea/activity and inspired teacher or increased confidence. For the remaining categories, descriptions are below:

- **Answered questions**: Answered a specific question the teacher had.
- **Taught teachers something new**: This is different to just providing teachers with a new idea. It has more to do with teaching the teacher new content or a new skill (such as a programming language).
- **Helped teacher's understanding**: Again, different to just a new idea or skill. This is about changing the teacher's thinking in some way.
- **Connect with other people**: Allowed the teacher to meet, make contact with or network with other people.
- **Helped students**: Anything the teacher says that is student-related, such as providing work specifically for students, students were motivated or enjoyed it, or it helped students' understanding.

- **Helped teacher's understanding**: Again, different to just a new idea or skill. This is about changing the teacher's thinking in some way.
- **Connect with other people**: Allowed the teacher to meet, make contact with or network with other people.
- **New approach to topic**: More than just a new idea or activity that was used once by a teacher. This means a teacher has changed the way they teach a topic from what they had done previously.
- **Taught teachers something new**: This is different to just providing teachers with a new idea. It has more to do with teaching the teacher new content or a new skill (such as a programming language).

### A description of the resources CAS teachers find most useful

The analyses of the first open-ended question (depicted in Figure 7.6) indicate that most teachers responding to this question find resources on the Python programming language to be the most useful resource they have used from CAS. The second most useful type of resource, according to teachers, is anything to do with the Progression Pathways, developed by CAS to indicate to teachers and schools the computing skills and competencies that students should have at different points in their schooling. Most of the Python resources mentioned by teachers were actual classroom resources that teachers used with students. They were categorised as something that "Helped Students" or something used by teachers as a "New idea/activity". The vast majority of these Python resources were ones that appear to be online resources, rather than face-to-face, although for some the description is unclear. In all but one instance, the Progression Pathways work was helpful for teachers in their planning and assessment, either aiding them in the development of a scheme of work or other planning for their computing courses, or in creating assessments or dealing with the new assessment requirements that do not allow teachers to assign levels to their students.

It is interesting to note that four of the top five categories of resources labelled most useful by teachers are mainly online resources: Python resources, the Progression Pathways guide, online discussions on the CAS community and resources for the Scratch programming language. However, the online discussions on CAS involve making connections with other CAS users, as do the next four resources named most useful by teachers: CAS conference, contact with a specific person on CAS, training[28] and a

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[28] It is possible that some of the training that teachers mention here were online trainings in which they may or may not have had contact with other people.

CAS event. Thus, it is not only the online component of CAS that teachers are finding useful, but also the opportunity to connect with other teachers, either in person or online.

## Employing analysis software for data analysis

The extensive nature of the data collection for this study required that data analysis software was employed to aid the coding and analysis of all data collected. The use of software to aid in data analysis is not new, and it does not prevent the researcher from being intimately familiar with the dataset. However, in large datasets with multiple data sources, qualitative analysis software can help with the management of data and the discovery of patterns within the data. (Bazeley & Jackson, 2013). It was possible to code by hand the interview transcripts used in the preliminary phase of this research because there were only three of them, and they could easily be compared side by side. Hand coding and noticing patterns across 20 interviews would be much more challenging. In addition, data from all sources in this dissertation needed to be analysed individually and together to meet the objectives of describing phenomena, noticing themes and identifying patterns or similarities and differences. The software selected for use in this study was the nVivo 10 qualitative data analysis software, as it offered the capabilities of managing data from a variety of sources, asking queries of the data, visualising the results and reporting on those results, if needed (Bazeley & Jackson, 2013).

### Uploading data to nVivo

Analyses of the data for all survey respondents provided an overall picture of these teachers' background characteristics, usage of CAS and reports of useful CAS resources. To discover information relating to subsequent research questions, survey data and interview data would need to be analysed together. Since only 20 teachers participated in both the survey and the interview, only those 20 teachers' survey data was uploaded to nVivo.

A new Microsoft Excel spreadsheet was created containing the survey data from the 20 interview respondents, as well as their unique identifiers. The unique identifiers used were the response numbers assigned to survey respondents by SurveyMonkey.

In addition, each teacher was given a pseudonym to make reporting on the data easier. To connect the teachers' survey and interview data, case nodes were created in nVivo for each teacher. Each interview transcription was coded so that it was also associated with the person's case node. The interview questions and responses were AutoCoded to Interview Question Response nodes, and double-checked to assure that the right content went to each node. This allowed perusal of all interviewees' responses to one question at a time. It also made it easier to identify when interviewees had not responded to a question, which was infrequent. At times the non-response was intentional. For example, one teacher, Harry[29], became a teacher after the computing curriculum was already being used in schools. Therefore, he was not asked how he felt about the change to the new curriculum, because he had not taught using the former curriculum. In other instances, the non-response was unintentional. It may have seemed that the respondent answered the question during the interview but upon further review post-interview, it became apparent that the question was not answered. Finally, the survey data were AutoCoded in nVivo so that the open-ended survey questions were all grouped under one parent node called Open-Ended Survey questions. Each of the questions' responses had their own node.

The Microsoft Word documents containing transcripts of each teacher's interview were then uploaded to nVivo and associated with the teacher's case node. Documents containing field notes, CAS resources and CAS discussion transcripts were also uploaded for coding. Finally, before beginning coding, each interview transcript was read through and initial impressions were added to the notes taken during and after each interview was initially conducted. These notes were also uploaded to nVivo and associated with each teacher's case node. Suggestions for possible codes were also recorded for the development of the codebook for the study. The codebook developed for this study is found in Appendix B.

## Beginning to code the interviews

Coding interviews helps identify themes and make connections across teachers' reported experiences. The process of coding has been compared to indexing a book, allowing the researcher to both sort the data by theme and make references to certain topics within the data (Bazeley, 2013). Coding develops

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[29] All proper names used in these chapters are pseudonyms.

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during the act of coding; thus, a researcher's codes evolve and may be deleted or replaced during coding. In preparation for coding, themes were identified from the literature on online communities and communities of practice, and were added to the list of suggestions for possible codes recorded when the interview transcripts were re-read in preparation for coding.

## Developing the codebook

A codebook is useful whether there is one person coding data, or multiple people coding the data, in terms of making sure each code is applied consistently throughout the coding process. Bazeley (2013) suggests developing two versions of the codebook. The full version of the codebook should contain the name of the code, description, guidance on when to use it and when not to use it, and an example of coded text. A shorter version of the codebook should be created as well, so that descriptions of codes can be easily referenced while the researcher is coding.

For this study, the full codebook was created in Microsoft Excel. An excerpt from this codebook can be seen in Figure 7.9 (The full codebook can be found in Appendix B.) The shorter version of the codebook was created directly in nVivo in the Properties area of each code.[30] There, the definition of each code was added so that it could be viewed easily during coding.

**Figure 7.9 An excerpt of the codebook from this study.**

| Code | Definition | Use when… | Don't use when… | Example |
|------|-----------|-----------|-----------------|---------|
| People (nested) | People that the learner accesses to help him or her | A teacher speaks about people they turn to when they need help or support. Also use when a teacher says they do NOT have people they can access for help or support. | Do not use for just social situations. People node does not aggregate from child nodes so it should NOT include CAS members - only discussion of people the teacher interacts with who are not CAS members. | "also a lot of people with kind of we have a special |
| CAS member (nested) | Another member of the CAS community that the teacher has interacted with, either online or in person | A teacher speaks about another CAS member or members of CAS in general with whom they have interacted in the past. | Do not confuse with non-CAS members | "we have like a you know that are regular attender that I sent – you know, it' organising it and I'm not |
| Tools (nested) | Things that the learner accesses to help him or her | Could be any number of tools (including technology) such as books, etc, that the teachers uses when he or she needs help and support. Do use for PD but also code in PD category. | Do not use for a general discussion of resources, as this doesn't talk about what a teacher is using/has access to. | "we've purchased into a companies that offer res ZigZag" |

At the beginning of the coding process, the codebook contained codes that emerged from the literature explored in the literature review as well as the two theoretical frameworks used for the content analysis of the community (communities of practice and Ecology of Resources). Codes were developed from possible themes that were identified both during the transcription process and as interview transcriptions were re-read in preparation for coding. Some codes were created to help answer the

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[30] Codes are called Nodes in nVivo, but in the interest of consistency the term code is used throughout this dissertation.

research questions for this study. This initial list of codes was small. However, at the end of the data analysis process, the codebook contained over 60 unique codes.

Some of the codes developed were nested under larger parent codes. For example, under the *Ecology of Resources* code were codes for *Available Resources* and *Filters*. Under the *Available Resources* code were further codes for *Environment*, *Knowledge and Skills*, *People* and *Tools*. The *CAS members* code was nested under the *People* code. In nVivo, there is the option to aggregate coding for child codes to the parent code. This was done in the instance of the *People* code, for example, so that searching on text coded with *People* would return all people coded in the data, whether they are coded as *CAS members* or not. Not all parent codes were aggregated with their child codes. There was never an instance when all data under all child codes associated with the *Ecology of Resources* code were needed, as it was simply too much data to group together.

Certain codes were developed with the express purpose of analysing certain data points. For example, interview Questions 18 and 19 refer teachers to the resource(s) they mention in their survey as being the most useful, and ask them to describe the resources and why they were useful in more detail. Therefore, the same headings that were used to categorise the survey data (shown earlier in Figure 7.8) were added as codes here, and the teacher responses were coded accordingly. These codes were not used elsewhere in the data.

## Coding the interviews

As recommended by Bazeley (2013), the first interview selected to code was not the first interview conducted and transcribed. Rather, it was expressly selected as an "average" interview that might have been representative of the group of interviews. In other words, in terms of responses to the questions or the profile of the teacher, the interview was not an outlier in any way. The first few interviews were hand selected to code in this manner. This enabled the researcher to solidify the definitions and uses of existing codes and made it more likely that any new codes developed during the coding process were more likely to be used in other interviews as well (Bazeley, 2013). Notes were also made as to the order in which interviews were coded.

During the coding process, many new codes were developed and added, with definitions, to the codebook. In the case of some of the later-emerging codes, it was also noted in the codebook at which point in the coding of interviews the codes were created, so that earlier interviews could be recoded with those codes in mind. Memos were also written in nVivo to record issues occurring with coding, as well as any thoughts about how to conduct future analyses.

After coding a few interviews, it became obvious that there were some questions that might be challenging to code and would need special attention. Some questions were more dichotomous in nature and the response that was sought was either yes or no. For those questions, a simple tally of responses provided the required data. Other questions had very individual responses (such as Questions 14 and 15 discussing the resource that was most useful for teachers and why) but there were similarities or themes within the responses that needed to be coded. Finally, responses to some questions required the development of codes that would likely be used only for those questions but provided information that was vital to later analyses. These questions were not coded at the same time as the rest of an interviewees' transcript; rather, responses to these questions were coded for all interviewees at once. The process of coding then became one of alternating between coding the transcripts for one or more interviews in their entirety and then coding one of the more individual question responses. This provided variety and acted as a break from coding, which was recommended by academic practitioners (for example, Cohen, 2013).

*Ensuring consistency in coding*

After coding all of the interviews and the individual questions, all codes and interviews were re-checked for accuracy. This involved opening all codes in nVivo to ensure that the data coded to did indeed match the definition and guidelines provided in the codebook. The codebook was edited where needed and examples of coded text were added. (The final codebook can be found in Appendix B.) Each interview was reviewed to code for any new codes that were created during the coding process, and to recode for codes that were not very heavily coded. In some instances, these codes had been overlooked; in others, they simply did not occur frequently.

The responses to Questions 18 and 19 regarding the most impactful resources were reviewed a second time to ensure that they were coded correctly and thoroughly. Identifying patterns in the responses to these questions was challenging at times, so notes were made about common themes and initial impressions about these resources. This information was uploaded to nVivo in Word document format.

### Issues associated with the coding process

Any issues encountered during the coding process were recorded in a memo dedicated to coding issues inside nVivo. During the course of coding and recoding, these issues were addressed and resolved. Many of the possible problems recorded involved the nuances or boundaries of an individual code. As more interviews were coded, the limits of each code became clearer. The definitions and guidelines for use were edited in the codebook. When the code was opened in nVivo, coded phrases that did not fit the refined code could be uncoded and, during recoding, new data could be added to the code if necessary. For example, at first, every time a teacher mentioned receiving support or a lack of support from their school in terms of instituting the computing curriculum, the code *Support* was applied. However, it then became apparent that the *Support* code was more nuanced in that the teachers might view their schools or school leadership as supportive in some instances but not others. Thus, the negative mentions of support were removed from the *Support* code and a new code was created reflecting a lack of support. The objective for this was that differentiating between codes in this manner would aid in future analyses.

Other issues were more specific to certain respondents. For example, during one teacher's interview, some inconsistencies with the teacher's survey responses were detected. Pat was (mistakenly) assumed to be male based on her response to the third question on the survey. Pat's gender was not clear from her first name, which could have been male or female. During her telephone interview however, Pat's voice sounded feminine. This raised concern that the survey data were incorrect. When Pat answered the question regarding the computing department at her school, it became clear that she was indeed female. When asked if she was the only computing teacher at her school, she answered:

> *There is three and a half of us. Three women and half a man.*

Pat is a full-time teacher in the department. Therefore it was assumed she must be one of the women. She continued by saying that the male teacher teaches mathematics in addition to computing which, according to her other interview responses, is a subject she has never taught. Because her real name was known to the researcher, her profile on the CAS community was verified and it included a photo of a woman. Pat's gender was therefore changed in the classification sheet[31] in nVivo so that subsequent analyses would not be affected. In addition, during the interview, Pat said that she had only been teaching for five years, rather than the 10 years indicated in her survey responses. This was also edited in the classification sheet. This entire episode raised some reliability issues with the remainder of Pat's data. Her survey and interview responses were reviewed together to identify any other inconsistencies, and none arose. In addition, since a tailored interview process was used, in which interviewees were prompted with their own survey responses in several of the questions asked of them, many of Pat's survey responses were verified with her during the course of the interview, and no other issues arose. Therefore, it was determined that Pat's corrected survey and interview data could be trusted.

*Challenges of a single coder*

The coding process is challenging and subjective, and ensuring consistency across the application of codes is difficult. When multiple coders are involved, their work can be compared and inconsistencies can be examined and addressed through recoding. Due to timing constraints, this researcher was the only coder of all the data for this study, and although the process of examining inconsistencies and recoding was observed, there was not another person involved to help eliminate subjectivity in coding.[32]

However, to make the coding as accurate as possible, coding was alternated with other tasks so that the coder remained fresh and alert. Recoding occurred as new codes were developed and the codebook as kept up-to-date. All coding was verified and corrected at the end of the coding process (Bazeley, 2013).

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[31] The classification sheet in nVivo contained data from survey responses.

[32] The coding of data for this data took place in the midst of the Institute of Education's transition to the University College London. The extra administrative burden that this caused prohibited the location of another graduate student to review the coding for this dissertation, and it was decided not to delay the research by waiting for one to become available.

Preparing for later analyses during coding

Coding was done with the original objectives for analyses (depicted in Figure 7.1) in mind. As such, some analyses were tested throughout the coding process to see if expected results would be returned based on the codes that had been developed. If successful, the queries developed during coding were saved in nVivo to run once all data were coded.

Sets were created in nVivo to group data on which queries would be run at a later stage. For example, sets were developed dividing teachers into groups as to whether they felt they were part of a personal learning network (PLN).[33] Attributes for belonging to a PLN were also added to each teacher's case node. As coding continued, patterns began to emerge that indicated a possible influence of a teacher's background work experience on other behaviours relating to participation in CAS and the teaching of computing. Teachers were thus divided into sets based on the following criteria:

- Experience working in the computing industry
- No industry experience but more than 5 years' experience teaching computer science
- Neither of the above criteria

These criteria were also added as attributes to each of the teachers' case nodes in nVivo as it was unclear at this point which analyses would be performed and which would require attributes or sets.

## Coding for community of practice attributes

A set of codes to identify whether CAS exhibited characteristics of a community of practice was also developed. These codes were used primarily for coding resource comments and discussions, as mentioned in Chapter 6. However, they were also applied when coding the interviews if the teachers' responses to questions indicated that CAS might be a community of practice. As discussed in Chapter 6, it was decided not to use all of Wenger's (1998) original 14 elements of a community of practice in coding. Rather, codes were developed to identify three elements of a community of practice: domain, community and practice. Certain of Wenger's original 14 characteristics of a COP were added as codes under each of these headings. New codes were also developed to provide evidence of the three

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[33] A personal learning network is a group of friends, colleagues, family members and others who help augment teachers' knowledge and understanding about the world and their work in particular (Warlick, 2009). Personal learning networks for teachers will be discussed further in Chapter 8.

Teacher participation in online communities of practice

characteristics of a COP named by Wenger. The three elements -- domain, community and practice --

were defined and their associated codes were listed below. Codes taken from Wenger's original 14

criteria for a COP are indicated in *italics*.

- **Domain**: The domain is the **subject area or area of interest that brings the community together in the first place**. Community members have this domain in common, and there are boundaries to the domain. By design, all of the interviewees in this study are members of the same domain, in terms of being teachers of computing at a secondary level, in England. However, some of these teachers have different objectives for using CAS, or different views of what the CAS community has to offer.

  - **Common Goal**. Indicates evidence of a common goal shared by members of the CAS community;
  - ***Common Vocabulary***: Instances of speech that are common amongst CAS members and require no preamble or explanation.

- **Community**: A community can be defined as **continuous interactions between members that form the social aspect of learning**. The community aspect is what differentiates a community of practice from simply an online content repository. The ongoing interaction of members is what makes it a community. The CAS discussions that were analysed show evidence of interaction of members. However, elements of the discussions themselves, as well as the interviews and other data, are also tagged to show how members' interactions with others in the community also aid their own learning and development from novice to master in certain areas.

  - **Developing relationships**: Discussion of interpersonal relationships that have developed between the teacher and other CAS members;
    - ***Sustained relationships***: Identifies relationships that members say have developed on CAS and have continued over a sustained period, whether they are harmonious or conflictual;
  - **Progression from novice to master**: Evidence of a teacher learning something from another member's contribution to CAS.

- **Practice**: Practice in the COP is defined by the tools, resources, shared language, styles, frameworks, and so forth that members understand once they have been a part of the community for a certain amount of time. Members of CAS already have many tools in common in the curriculum they are required to implement, the programming languages they use and the exams for which they prepare their students. However, they also show evidence of collaborating on practice.

  - ***Shared ways of engaging in practice****:* Evidence of members collaborating on the development of practice relating to the teaching of computing.

When these codes were developed, resources, discussions and notes from attendance at CAS in-person

events were coded, double-checked and recoded or uncoded in accordance with the aforementioned

process for coding.

## Analysis of interview data

After coding was complete, further queries were developed in an effort to answer the research

questions for this dissertation. In addition, the sets relating to teachers' background experience

(Industry, CS teaching and Neither) were re-examined to understand what specific behaviours or

characteristics might be related to teachers' stated background experience. For the remainder of this

study, these sets are referred to as teachers' *profiles*. The matrix coding queries that were developed

are listed below.

- **Attitudes and preparedness by profile**: Displays the positive or negative attitudes expressed towards the new computing curriculum, and the reported preparedness for teaching it depending on whether the person has industry experience, greater than five years CS teaching experience or neither;
- **Confidence by profile:** Displays the mentions by teachers of their own confidence, according to their profile;
- **Twitter use by profile:** Displays the mentions of teachers using Twitter, according to their profile;
- **Usage of CAS by profile:** Displays where and when teachers report using CAS (from home, school, mobile or anytime), according to their profile;
- **Motivator to check CAS by profile:** Displays what teachers stated motivates them to check CAS (aside from survey question responses), according to profile. Categories are email notification, need to find out or learn something and when planning;
- **CPD and motivation to seek support by profile:** Displays any mentions of CPD or training teachers have attended, according to their profile. Also shows teacher responses to the question about what motivates them to seek further support or development for their teaching, according to their profile;
- **Knowledge and skills and pedagogy by profile:** Displays any elements from the interviews coded as knowledge and skills (EOR code) and any mentions teachers made about their knowledge of the pedagogy required to teach computing, according to their profile;
- **People and Tools by profile:** According to users' profile, displays any elements from the interviews coded as People and Tools resources from the Ecology of Resources framework. These were further divided in the coding to CAS and non-CAS resources, and the CAS resources under Tools were divided into CAS discussion, CAS event and CAS resource;
- **Filter elements by profile:** According to the users' profile, displays any elements from the interviews coded as filters from the Ecology of Resources framework. The overall parent node Filter was captured here as well as the child nodes of Barrier and Catalyst to describe how the filters were behaving in the coded text.

The data provided from these queries, although not significant since the samples are so small, began to

provide the researcher with a picture of how different profiles of teachers use the community, and

which areas of the community are most beneficial. These findings are discussed in Chapter 8.

## Developing the Ecology of Resources map for CAS teachers

Learning from the survey and interview also informed the development of an Ecology of Resources for

CAS teachers, which would aid in understanding how the CAS online community might become a part of

a teachers' Zone of Proximal Adjustment. In other words, it enabled the researcher to probe the

question: How does CAS become part of a learner's context as a useful resource that the learner

chooses to fill his or her learning need?

As outlined in Chapter 6, data from the survey and interviews were used during the progression through

the phases of the Ecology of Resources framework. At first, this allowed generation of an overall picture

of the CAS online community as the Zone of Available assistance, as well as identification of other

resources available to these teachers outside of CAS. The Zone of Available Assistance encompasses all

of the possible resources that are available to a learner to assist with their learning at a point in time.

It was sufficient to look at a "typical" CAS user when building the early phases of the Ecology of

Resources framework. In other words, based on the survey and interview findings, the steps in Phase 1

of the model could be mapped out for the average CAS teacher: brainstorming the possible resources,

specifying a focus of attention, categorising the resources, identifying possible filters and examining the

learner's own resources However, as the phases and steps of the EOR framework advanced a more

detailed look at CAS members became necessary. For this section of analyses, the teacher profiles were

employed and three maps of teachers' EORs were created according to the three profiles: Industry, CS

teaching and Neither. The findings based on EOR profiles are discussed in Chapter 8. The remainder of

this chapter elaborates on the CAS teacher overall.

## Phase 1, Step 1 and 2: Brainstorm available resources and specify focus of attention

This step aims to identify the resources that are part of the Zone of Available Assistance for the learner

(the CAS teacher in this case). For this study, that involved examining the resources available as part of

the Computing at School community (which includes both the online community and the in-person

elements associated with it), as well as those resources available to the CAS member teacher that might

help them in their work of teaching computing. (See Tables 7.3 and 7.4.)

**Table 7.3 Available Resources within CAS (both online and in-person CAS).**

| | | |
|---|---|---|
| Email digest | Resources page | Upcoming events list |
| Regional discussions | General interest discussions | Age-range discussions |
| Special interest discussions | Hub meetings (in-person) | PD or training (in-person or online) |
| Links to latest activities on community | Other member teachers | Other member teachers in the same region |
| Other member teachers with similar backgrounds | CAS management team | Lesson plans |
| Career resources | Activities for students | Quizzes and assessments |
| Schemes of work or curricula | Posters | Academic research |
| Meta-resources[34] | Video tutorials | Commercial resources for certain software/hardware |
| National conference (in-person) | Lead schools in Network of Excellence | Member schools in Network of Excellence |
| Member profiles | Member badges | Industry representatives |
| Government representatives | HE academics | Colleagues/friends met through CAS |
| Map of other members | Map of Hubs | Map of events |
| Latest news | Map of Master Teachers | Master Teachers |
| Map of Network of Excellence schools | Barefoot Computing project | QuickStart computing guides |
| Secondary computing guidance book | Comments made to resources by other members | Edits made to resources by other members |
| Progression pathways document | Switched on newsletter | CAS National Conference |
| Assessment resources | Planning resources | |

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[34] Meta-resources, as described on CAS, includes things like materials describing computational thinking, MOOCs teachers can attend, and lists of "favourite URLs" from experts, etc.

**Table 7.4 Other resources that could aid teachers in teaching computing.**

| | | |
|---|---|---|
| Computer/laptop | Tablet | Gaming devices |
| Internet | Wireless connection | Email application(s) |
| Twitter | Instagram | Facebook |
| Other social media | Mobile phone | In-person meetings w/ teachers |
| Parents | Books | Internet articles |
| School building | Classroom | Staff room |
| Curriculum room | Computer lab | Home office |
| Rest of home and things in it (furniture, desk, chair, lighting, electricity | Other internet access | Mobile internet access |
| Software/hardware | Students | Other teacher-focused websites |
| User groups | School curricular materials | National curriculum for computing |
| Colleagues at school | Friends | Teachers' formal education |
| Teachers' knowledge of computing | Teachers' experience teaching computing | Teachers' experience working in a computing space |
| Teachers' knowledge of programming languages | Teachers' knowledge of general pedagogy | Teachers' knowledge of computing pedagogy |
| Pinterest | Computing teaching practice | Student skills in computing |
| Conferences | Hub meetings | Other outside meeting space |
| National conference | Training rooms | Pubs |
| Google+ community | Raspberry Pis | LinkedIn |
| Computer Science UK | Code Academy website | HashDiverse |
| British Computer Society | Google Drive | Macromedia |
| Windows PCs | NAACE resources | Google Sketchup |
| Teach-ICT website | TeachMeets | Paid-for resources |
| Trolleys of mobile devices | OpenOffice | App inventor |
| GCSE computing.org | Linux PCs | Raspberry Pis |
| Free Technology for Teachers website | Windows default apps | ZigZag (paid resources) |
| Hudder VLE - dynamic learning | Microsoft Surface pros | Adobe master collection |
| Flowell | TES | TV studio |
| Microsoft Office | Windows PCs | Notepad |
| Arduino robots | Textbook | Prezi |
| Google group | Flash | Sonic Pi |
| BBC Microbit | Virtual desktop | Local university |
| Google Apps | Photoshop | Flowell |
| Tablet computers | MovieMaker | Electronics |
| Lego Mindstorms | Pixel resources | Arduino boards |
| GameMaker studio | OCR MOOC | Minecraft |
| iPads | Google | Books |
| CC4N | OCR hub | YouTube |
| CIE | | |

Phase 1, Step 3: Categorise the resource elements into Knowledge and Skills, People and Tools and Environment

Once the CAS resources were listed, they were largely separated into the category of people and tools,

and the interview coding and transcripts were consulted to identify the CAS teacher resources that

might fit into the categories of knowledge and skills and environment. These can be seen in Table 7.5.

**Table 7.5 Categorisation of resource elements for CAS teachers.**

| Knowledge and Skills | People and Tools | Environment |
| --- | --- | --- |
| Teachers' knowledge of computing, teachers' formal educational background, teachers' knowledge of general pedagogy, teachers' knowledge of computing pedagogy, teachers' experience teaching computing, teachers' experience working in industry, teachers' knowledge of programming languages, teachers' knowledge of computing, classroom teaching practice, student skills in computing | Switched On newsletter, resources page, upcoming events list, subscribed regional discussions, topical discussions, age-range discussions, subscribed special interest discussions, hub meetings (in-person), PD or training (in-person or online), links to latest activities on community, other member teachers, other member teachers in the same region, other member teachers with similar backgrounds, CAS management team, lesson plans, career resources, activities for students, quizzes and assessments, schemes of work or curricula, posters, academic research, meta-resources, video tutorials, commercial resources for certain software/hardware, national conference (in-person), lead schools in Network of Excellence, member schools in Network of Excellence, member profiles, member badges, industry representatives, government representatives, HE academics, colleagues/friends met through CAS, map of other members, map of Hubs, map of Master Teachers, map of events, latest news, map of Network of excellence schools, Master Teachers, Barefoot Computing project, QuickStart computing guides, secondary computing guidance book, comments made to resources by other members, edits made to resources by other members, computer, tablet, gaming devices, internet, wireless connection, email application(s), Twitter, Instagram, Facebook, other social media, Pinterest, mobile phone/phone, in-person meetings with teachers, parents, books, internet articles, other internet access, mobile internet access, software/hardware, students, other teacher-focused websites, user groups, school curricular | Home office, rest of home (furniture, desk, chair, lighting, electricity), school building, computer lab, classroom, curriculum room, staff room, pub, conferences, hub meetings, other outside meeting space, national conference, training rooms, discussion forums on community, resource space on community, event space on community, Facebook groups, Facebook platform Twitter hashtag chats, Twitter platform, other online community platforms |

materials, national computing curriculum,
colleagues at school, friends, Google+
community, Raspberry Pis, LinkedIn, Computer
Science UK, Code Academy website,
HashDiverse, British Computer Society, Google
Drive, Macromedia, Windows PCs, NAACE
resources, Google Sketch up, Teach-ICT
website, TeachMeets, Paid-for resources,
Trolleys of mobile devices, OpenOffice, App
inventor, GCSE computing.org, Linux PCs,
Raspberry Pis, Free Technology for Teachers
website, Windows default apps, ZigZag (paid
resources), Hudder VLE - dynamic learning,
Microsoft Surface pros, Adobe master
collection, Flowell, TES, TV studio, Microsoft
Office, Windows PCs, Notepad, Arduino robots,
textbook, Prezi, Google group, Flash, Sonic Pi,
BBC Microbit, Virtual desktop, Local university,
Google Apps, Photoshop, Flowell, tablet
computers, MovieMaker, electronics, Lego
Mindstorms, Pixel resources, Arduino boards,
GameMaker studio, OCR MOOC, Minecraft,
iPads, Google, Books, CC4N, OCR hub, YouTube,
CIE, regular email digest, progression pathways
document

## Phase 1, Step 4: Identify possible filters

Interviews, survey data and the literature about online communities aided in the development of

general categories for possible filters. Filters are defined as elements that might influence (either

positively or negatively) a learner's access to available resources. Possible filters identified from the data

can be seen in Table 7.6. Some resources themselves might be filters. In Table 7.7, interviews were

consulted to further separate the filters into categories depending on whether they might influence a

teacher's access to professional development in general, to their use of the CAS online community or to

their attendance at CAS in-person events.

**Table 7.6 Filters to accessing the CAS online community.**

| | |
|---|---|
| Teachers' experience teaching and/or experience teaching computing | Teachers' knowledge of computing topics |
| Teachers' confidence with the subject area | Teachers' confidence with pedagogy |
| Internet connection | Available hardware/software/platform at home and at school |
| National curriculum | National exams |
| Computing GCSE | Teachers' course/workload |
| Family commitments | Time – outside of class for learning/planning |
| Motivation | Passion/interest for subject area |
| Organisation of CAS site | Tagging of resources on CAS |
| Search capabilities of CAS | Bandwidth |
| School firewall | Understanding of national curriculum |
| Understanding of programming concepts | Teachers' attitudes towards computers/computing |
| Relationships with others in CAS community | Teachers' confidence to meet new people |
| Trust of others on site | Open-mindedness to new ideas |
| Time – in class for new activities | Motivation of students |
| Knowledge/skill level of students | Rating system for resources |
| Attitudes of others in discussions | Physical proximity for in-person events |
| Time to attend in-person events | Financial commitment to attend in-person events |
| Student skills in computing | Attitude of teacher in discussion |
| Subject taught by teacher | Stress |
| Ofsted | Teacher evaluation |
| Specific exam tasks | Changes to exams |
| Changes to curriculum | Availability of appropriate training |
| Cost of hardware, software, equipment, training | Capacity of others in the computing department (in terms of time, ability) |
| Priority of computing within school | Support of school leadership |
| Teacher confidence in general | Teacher familiarity with online communities |
| Teacher's willingness to participate/share in general | Search capability on CAS |
| Organisation of CAS | User interface of CAS |
| Attitudes of other members on CAS | Past experiences on CAS |
| Backgrounds of other members on CAS | Speed of CAS site |
| Speed of user's internet | Problems with log-in to CAS |
| Need for help or development | |

**Table 7.7 Filters to accessing specific resources for development.**

| Filter for PD | Filter for use of CAS | Filter for attending CAS in-person events |
|---|---|---|
| No appropriate training available | Search engine on CAS | Proximity to home/school |
| Time out of school | Teacher's own confidence | Time out of school |
| Who is offering/running the PD | Common interest with other CAS members | Timing of events |
| Relevance of content | Quality of resource tagging | Relevance of content |
| Cost | Teacher's available time | Teacher's available time |
| Proximity to home/school | Cost of CAS (free) | Cost |
| Teacher's available time | Size of CAS (big) | Duration of event |
| Feedback on quality | No appropriate content available | Who is offering/running the event |
| Transport | Not enough new content | Conflict with school schedule |
| Need for supply teacher | Skill level of other CAS members | Ease of finding out about the event |
| Ease of finding offerings | Online/24-7 availability of platform | Priority of computing within school |
| Family obligations | UI/technical capabilities of platform | Support of school leadership |
| Timing of offering | Teacher familiarity with online communities | Capacity of others in the computing department (in terms of time, ability) |
| Need for help or development | Search capability on CAS | Need for help or development |
| Priority of computing within school | Past experiences on CAS | |
| Capacity of others in the computing department (in terms of time, ability) | Speed of CAS site | |
| Support of school leadership | Problems with log-in to CAS | |
| | Teacher's willingness to participate/share in general | |
| | Organisation of CAS | |
| | Attitudes of other members on CAS | |
| | Backgrounds of other members on CAS | |
| | Speed of user's internet | |
| | Need for help or development | |
| | Priority of computing within school | |

Phase 1, Step 5: Identify the learner's resources

In general, teachers should have some common knowledge and skills around teaching computing. These

are listed in the previous sections, and include: teachers' knowledge of computing, teachers' formal

educational background, teachers' knowledge of general pedagogy, teachers' knowledge of computing

pedagogy, teachers' experience teaching computing, teachers' experience working in industry, teachers' knowledge of programming languages, among others.

However, a learner's resources include everything he or she brings to the learning process, and are not just limited to their own cognitive knowledge or skill set. These learner resources also include things like motivation for learning, past experience (either work experience or experience with learning), attitudes, beliefs and cultural norms. Interviewed teachers discussed many of the internal motivations and attitudes that would cause them to seek out support for their learning. The reasons for seeking out professional development or additional support were relatively similar across all teachers interviewed. Nearly half (9/20) of teachers said that their main motivation for seeking out professional development or support for their teaching was an identified gap in their own knowledge. The next most common reason, expressed by 7/20 teachers, was that teachers seek out support when there is an area they want to strengthen in their teaching. Six teachers mentioned their students as a motivator, with 4/20 saying they wanted to do their best for their students and 2/10 saying they didn't want to look stupid in front of their students.[35] The remaining motivators for seeking out support or development were expressed by one teacher only and were:

- Wanting a challenge;
- Needing to stay current with the subject;
- Needing to understand the students' struggle when they learn something new;
- Wanting to meet new people or network;
- Having an inherent passion for learning;
- Being frustrated and wanting to know how to solve a problem.

However, CAS teachers appear to have different resources inherently available to them based on their own work experience or background. It is at this point that the teacher's profile has an impact on the available resources, filters and their relationships. The Ecology of Resources for CAS teachers is further mapped according to user profiles in Chapter 8.

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[35] Note that these were common interview responses – teachers were not given list of responses from which to choose.

## Conclusion

This chapter described in detail the data analysis process for the quantitative and qualitative data in this study. In the mixed-methods strands of the study, the survey and interview data were used together to begin to provide answers to some of the research questions posed by this dissertation. Data from these quantitative and qualitative datasets were also analysed together with data from the qualitative content analysis of the CAS community, to begin to create a map of the Zone of Available Assistance of a general CAS user. These analyses provide a picture of the kinds of resources that are available to CAS teachers, as well as the filters that can help or hinder their access to these resources.

The analysis of the survey and interview data also enabled the development of three profiles of CAS teachers based on their past professional experience. These profiles are described in detail in Chapter 8. The findings that result from analyses of each of the user profiles, as well as a more developed Ecology of Resources map for each profile, are discussed in the next chapter.

Finally, this chapter discussed the development of codes used in data analyses to determine whether the CAS community exhibited characteristics of a community of practice. These codes were adapted from Wenger's community of practice framework and learnings from the work of other researchers who have put Wenger's theories into practice. Chapter 8 begins by addressing one element of the central research question for this study: What is the relationships between participation in an online community of practice and the development of a teacher's practice? The chapter starts by presenting results of analyses to determine whether the CAS online community can be considered a community of practice at all.

# Chapter 8 – Discussion of Findings

## Overview

This chapter presents the main findings of this study relating to whether the Computing at School (CAS) community can indeed be considered a community of practice (COP), and what might influence a computing teacher's access to the resources on CAS and other resources that might aid in their learning and development. The chapter begins by describing the results of the analyses of CAS as a community of practice and whether it meets the criteria set forth by Wenger and by other researchers who have subsequently used his framework to classify online communities as COPs.

The discussion continues with an in-depth examination of the members of CAS who form part of the sample for this study, looking at what these teachers have in common and what factors might influence their use of CAS. The CAS teachers interviewed for this study are separated into profiles based on their previous work experience, and variations between the profiles are examined in terms of the Ecology of Resources framework. The remaining phases of the EOR framework are studied to discover how the resources in a teacher's Zone of Available Assistance (ZAA) interact with filters that enable or prevent them from becoming part of a teacher's Zone of Proximal Adjustment (ZPA). Finally, this chapter addresses what might seem to be the end goal of all of the Computing at School work: the changes teachers report making to their teaching practice as a result of participation in the community.

## Is Computing at School a community of practice?

The central research question for this study is:

**What is the relationship between participation in online communities of practice and the development of a teacher's practice?**

Supporting research questions pursue data about a teacher's context and her practice, as well as her usage of the CS community itself. Chapter 6 described in detail the environment of the CAS community, including its history, its membership over time and the resources and features that are available to teachers who are members of CAS. Chapter 3 discussed the positions of other researchers as to the suitability of online communities in providing professional development or support networks for teachers. It also asked the question – and provided evidence from the literature – of whether an online

community for teachers can be considered a community of practice at all. Therefore, in order to address the main research question for this study, it must be determined whether the online community in this study, the Computing at School community, is indeed a community of practice.

As discussed in Chapters 6 and 7, data were collected from CAS discussions and the comments on CAS resources, as well as during the researcher's attendance at in-person CAS events. These data, along with the teacher interviews, were coded in order to uncover evidence of the three main characteristics of a community or practice according to Wenger et al (2002): Domain, Community and Practice. Figure 8.1 shows the codes originating from Wenger's 14 characteristics of a community of practice (Wenger, 1998) that were used to find data that might imply the formation of a community of practice. (The selection of these codes is explained in detail in Chapter 7.)

**Figure 8.1 Community of practice codes used in this study.**

| Domain | Common goal: Indicates evidence of members sharing a common goal. | |
| | Common vocabulary: Instances of speech that are common amongst CAS members. | |
| Community | Developing relationships: Discussion of interpersonal relationships that have developed between CAS members. | Sustained relationships: Relationships that members say have developed on CAS and continued over a sustained period of time. |
| | Progression from novice to master: Evidence of a teacher learning from another member's contribution to CAS. | |
| Practice | Shared ways of engaging in practice: Evidence of members collaborating on the development of practice. | |

The sections that follow discuss the findings from the content analysis that was conducted on aspects of the CAS online community using the codes shown in Figure 8.1 underlying the three main characteristics of a community of practice. (The content analysis and the data to which it pertains is discussed in Chapter 7.) This section closes with a summary on whether the CAS community can be considered a community of practice.

CAS members work toward a common goal

The CAS data examined in this study was collected, for the most part, from teachers of computing in the United Kingdom. These teachers are all working toward implementing the national computing curriculum in their schools, to the best of their ability. It could be assumed that they are members of the CAS community in order to help them achieve this objective. In this respect, the teachers who are members of CAS could, by default, be considered to be working toward a common goal.

This assumption is not without exception however, and this study did not sample every teacher who is a member of CAS to prove or disprove this theory. However, the idea that members of CAS share a common goal or objective towards which they are working is expressed in many different ways in the teacher interviews and in the CAS discussions that were analysed for this study. The CAS creators themselves believed the goal of CAS was to create a community in which members could share practice around the teaching of computing, thus engaging in a "shared endeavour".[36] Comments from the discussions such as "I was in the same boat" and "Your post resonated loudly with me" provide indications of commonalities amongst members. Interview respondents were not asked directly whether they believed that members of CAS shared a common goal, but many of them mentioned this as one of the points they found most useful about CAS.

Some teachers referenced the common vocation and subject area focus of CAS members. For example, Harry remarked:

> *Everybody on CAS – or at least everybody who's vocal on CAS – is at least into teaching computing or the possibility of teaching computing… There is a sense of real community, um, because it's a lot of people discussing and focusing on this one thing.*

Stuart mentioned something similar, saying about the CAS community:

> *It's predominantly computing teachers… CAS is all computer science. So you know it's people with a similar interest.*

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[36] From CAS home page: https://www.computingatschool.org.uk/, accessed 28 August, 2016.

Teacher participation in online communities of practice

Ian also mentioned the focus on the new computing curriculum when he said:

> *It's also people with an interest in teaching computing and ICT – an interest in the curriculum and making sure things fit best for the objective… The CAS website seems to have a proper focus, um, on teaching to hit the main objectives that are needed in the new curriculum.*

David, however, found the focus on computer science to be problematic for his needs at times, and turns to other communities for issues that fall outside of the computer science realm. He noted:

> *I often find that sometimes on the forums, especially, it – it can be – it's quite focused in on computer science, um… and computing, whereas sometimes you just want to know about GCSE ICT or something like that, do you know what I mean? So that's when the Facebook GCSE ICT group become a lot more sort of knowledgeable.*

However, it is not just content knowledge or a common vocation that most interviewees appreciate. Mark and Henry both mention that CAS members are "like-minded" people, who share similar values. This feeling of being amongst others like themselves seems to make teachers more comfortable asking questions and participating in the CAS community. Steve's comments seemed to explain this when he noted:

> *You can post a question and get a polite reply from someone that understands that you're, you know, reaching out because you're wanting to do better, sort of thing, not sort of telling you off for not knowing more computing stuff.*

Sarah added that the commonalities that exist between members of CAS also influence how much she trusts what she finds on the CAS community. She said:

> *I'm more likely to trust CAS just knowing the kind of – the kind of people that are involved, you just, um, what's the word, they're kind of bona fide, they're computer science teachers, you know they're not – not a general teacher just sort of covering lessons and that kind of thing.*

Interviewees also mention CAS members sharing a common attitude, willingness to share and help their fellow CAS members. Ian spoke about:

> *…the way that everyone's trying to help everyone else. There's no, sort of, financial incentive for anyone. It – in a way it sort of almost follows a sort of open source software paradigm… The idea that you share your ideas and everyone can kind of share as well, really appealed to me.*

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Likewise, Jenn said of her experiences of first starting to use the online community:

> *Everyone was in the same boat and everyone was helping each other and there was lots of resources coming out and lots of ideas.*

Tim echoed this sentiment in more detail, saying:

> *You need to be able to talk to somebody, either pick the phone up, Skype them, or email them, what-have-you, and say, I've got a problem, how do I get out of this? And CAS does that… So you're building up this network, and you need that. IT teachers and computer teachers work better as a little group – a little community. That's what it's doing and it's the only thing that does it properly.*

Finally, John expressed the idea that members of the CAS community are all working together toward something that is bigger than themselves when he said:

> *You do get that sense on CAS of that being a bit of a sort of missionary experience and you get wrapped up in that, actually, it's bizarre, but you do get wrapped up in in the whole sense that you know, you're doing something important.*

*Summary*

The comments from interviewees represent a general agreement that CAS members do share a common goal in their work as computing teachers. In addition to their focus on implementing the computing curriculum in ways that provide success for their students, they are committed to helping other CAS members meet these same objectives. David's comment that he found that CAS is less useful at providing resources for the GCSE in ICT makes sense, because the objective of the CAS community and its members is to support the study of computing and computer science – and not ICT.

Harry's comments about CAS members sharing a common goal are equally significant. He began by saying "everybody on CAS" and corrected himself to say "at least everybody who is vocal on CAS". This is an important distinction because it is impossible to ascertain whether the members who do not participate in either the online or in-person interactions of the CAS community share the same goal, and thus whether they can be considered to be part of the community of practice – if one exists.

## CAS members share a common vocabulary

One possible corollary of a community sharing a common profession, content interest and overall objectives is that the members also share a common vocabulary. Members do not need to include explanatory text to introduce their comments or explain what they are talking about. They might use

jargon, abbreviations, technical terminology or inside jokes, all of which are understood by their fellow members. All of this was evident in the discussions, comments on resources and in interview transcripts conducted for this study. This was also noted by the researcher in field notes from attendance at the community's in-person events.

The data from CAS discussions provided the most evidence of a common vocabulary. During the interviews, there was some assumption on the part of the teacher that this researcher was familiar enough with CAS to understand what the teachers were talking about. However, teachers also often explained terminology or programming concepts and verified that the researcher understood what they were saying. In other words, the interviewees understood that this researcher was not a member of their community of practice, therefore they needed to clarify their comments at times.

By contrast, discussions on the CAS online community could be observed and studied by the researcher without any knowledge of her presence by the discussion participants. As far as the participants were aware, they were discussing issues relevant to their domain with fellow members of their CAS community. Thus, the vocabulary, terminology and speech were not tempered or explained. Some discussion posts included lines of code, which it was assumed would be understood by other participants. No preambles were needed to clarify statements such as the following:

- *Materials for the new specification AS Paper 1 (AQA Warships) can be found under "Computer Science (new specification)".*
- *Not a question about the code, but the environment. Where does AQA specify the IDE requirements? Do we have to use IDLE or do we have freedom to use another IDE?*
- *I decided on this CA for my students. I have a solution using a simple IF structure for the first task.*
- *This should be fine using vnc, so run xtightvncserver on the pi then connect from a desktop, I think you still need to initially connect to a monitor so that you can get everything set up.*
- *Once the mock etc…have died down?*
- *I almost introduced Ruby, but decided on GNU C++ for the class instead.*

In addition, pronouns such as "they" were used without modification, with the understanding that fellow members would understand who was being discussed. Some users were more specific than simply using pronouns, saying things like "the new coursework", but still provided little description as to

which new coursework they were talking about. Teachers assumed that the extra explanation simply was not necessary when discussing the coursework in this community.

Humour was employed during the in-person meetings and in discussion posts and resource comments. One CAS member's comment on a resource noted: "My focus is just on getting it out there, as a free (as in beer and speech) model for primary's to use/adapt." Another user added in his post to a CAS discussion, which contained multiple questions: "Yes, I'm that annoying guy in the meeting".

*Summary*

This evidence suggests that CAS members not only share a common language, but that they are able to differentiate between members and non-members of the community with whom they need to employ the language norms and vocabulary common to members of the community. The extra explanations offered to the researcher during the interviews demonstrate that CAS teachers recognise the researcher as not belonging to the community. Data from the communications online and during in-person events indicate what the language of the CAS community looks like when members are speaking to each other.

## CAS members develop relationships with one another

The idea of mutual engagement amongst members of a community of practice involves the development of relationships between members of the community (Wenger, 1998). The degree to which a community's members are connected differentiates a community of practice from other learning communities (Hoadley, 2000). Thus it is important to examine whether the interactions on the CAS community exhibit any evidence of relationships developing amongst members, which might indicate that a community of practice has formed.

*Correlation between attendance at in-person meetings and relationship development*

Across the CAS discussions, interview transcripts and field notes from in-person events, there were over 50 indications of members forming relationships with others on CAS. The most obvious of these originated from the CAS primary Hub meeting in Reading, where attendees took time from their busy schedules to attend an in-person event, one of the objectives of which was to connect CAS members with each other. It is perhaps not surprising, then, that CAS members at this event were observed to be eager to meet the other primary teachers in attendance, learn from them and continue contact after

the event. Of the seven attendees present (not including the volunteer coordinator and this researcher), only two people had met each other prior to the meeting. The conversation throughout the meeting was lively, with members asking questions of one another and sharing their experiences. The tone of the meeting was positive and collegial, with little to no negativity or complaining. Attendees shared contact details with each other and the volunteer coordinator has maintained an email list in the year since the meeting, emailing the group with relevant information and future meeting topics and dates.

Of the 20 interview respondents, 15 had attended some form of CAS in-person event, whether it was a hub meeting, the national conference or a training event. When asked specifically about their local hub meetings, 14 teachers reported that they had attended at least one of their local hub meetings.  Only three of these teachers, when asked, felt that these meetings had not been useful for their teaching. For two of these teachers, this was because the skill level of the other attendees was too far below their own. One, Harry, found the infrequency of hub meetings to be a problem:

> *I think if you were running something once a month or once every two months, you'd start to get to know people and it would become a – a bit more of a community that way? But the hubs I've been around have had kind of… one event in six months or something like that.*

Of the teachers who found the hub meetings useful, four of them responded that the hub meetings helped them develop networks or make contacts with other teachers in CAS. Kati, for example, organises her local hub meetings and said:

> *They're very, very good. They're excellent for networking with other teachers.*

Stuart agreed, saying:

> *The hub meetings are very good. The main benefit of them is being able to talk to other teachers from other schools. Especially when I started off I was the only teacher in school teaching computing. So there wasn't really anyone I could go to, to kind of ask for advice or help.*

Sarah commented on the importance of these face-to-face interactions by saying:

> *Really you need human interaction – you need to bounce ideas off of people and see what's going to work for your – your environment. And to be honest, the reason I chose the exam board I did for Key Stage 4 was because of CAS meetings and just saying to people you know, What are you doing? Are you already doing it? How are you finding it?*

Matt also valued the in-person meetings in terms of combatting the isolation that lone computing teachers report feeling within their schools. At his hub meetings:

> *We share ideas – we had, uh, a marking meeting in June, for example. One of the difficulties when you're, uh, we tend to be isolated teachers. Most schools have either got one computing teacher or perhaps they've got a whole team, but very few have two or three. So, uh, actually getting internal moderation of your work is difficult. So, uh, we organised a, um, a group hug on that.*

Thus, for the 11 teachers who attended hub meetings and found them useful, the face-to-face interactions were important to build ties between members, develop trust and help build relationships with others whom they might call on for assistance in the future.

*Relationships developed through online interactions*

The data exhibit evidence of relationships developing through online interactions as well. In discussions, teachers frequently suggest continuing contact with other CAS members outside of the CAS discussion space, offering to meet in person, have telephone calls to discuss issues or even continue a conversation via email. For example, one CAS teacher responded to another teacher's question with the following:

> *I am delivering the transition course in London next Wednesday and there might be space? Then both courses in Bristol in January. If you want any more info or are interested in my own training then contact me directly. Hope this helps.*

The teacher with the original question responded thus:

> *Very helpful, thanks. Some free training would be brilliant and I'd be more than happy to host. There's a few schools in town who I'm sure would be interested in coming. I'll contact you via Twitter to set up a date if that's ok?*

Although the ensuing conversation between the two teachers is not available to the researcher and thus it is impossible to ascertain whether a relationship between members actually developed as a result of this interaction, the data indicate that the development of personal relationships between members is possible in this online community.

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In this same discussion, the original teacher received many offers of further contact from other

members, including the following:

- *If you want to come over and spend a day at our school you would be welcome we have been teaching GCSE Computing since it started in 2010, it is good that you have put this post up, shows the real spirit of our community.*
- *If you'd prefer to talk to a human about this rather than try to digest all the information, you can just give me a call. Email or DM me for my number and to agree a time that suits you.*
- *I've got over 200 pieces of assessed/moderated GCSE Computing coursework. Let me know specifically what you want and I can direct you to the ones that will help you the most. Honestly I'd prefer to share them face to face to help you understand subtle differences - but if we can't manage a face-to-face I'll still be happy to send them.*
- *There is a CAS Hub for [Name of Place]. Hopefully there will be a meeting just before or after Christmas. You should come along and meet people in the same situation. Perhaps we could look at the new syllabus. I think it was you who spoke to my colleague last week [Name of Person] … although I could be wrong.*

These kinds of comments were common across many of the discussions observed, and indicate a

cultural acceptance within the community to the development of these kinds of relationships, as well as

a willingness or desire amongst members to use the CAS community for more than just a resource bank.

Interview respondents echoed these sentiments and many agreed that they, too, had formed

relationships with other CAS members that originated with online interactions. Simon said:

> *And you'll find other people in the same boat and then can contact them, um, privately to discuss things. And it just aids networking so much.*

Harry noted the connection between increased familiarity with other members and trust, saying:

> *You get to know people through their posts and it does - that – that does sort of have an impact that you kind of, uh (pause) trust that some people are going to be able to answer some of your questions, and, yeah, it does have that kind of feel of somewhere you can get answers.*

Anthony mentioned the importance of the in person contact in building an online relationship, which is a common theme in the literature as well (Chapman et al., 2005; Sheehy, 2008). He said:

> *Doing a bit of networking is always a good thing, 'cause you get to put faces to names. Um… I'm quite old school, I like meeting people face-to-face and then you actually know who you're talk – and then you can build an online relationship and it works really well. I think having met some people, and got a name to them, I run the school Twitter feed as well, so I've now, these people with strange esoteric Twitter handles, I've now got a face and I can picture, I know which school they work at, and what kind of age range they teach. And I – there are times when I've been able to think, well actually I'll email X, Y or Z on this topic, because when I met them in, you know, last October, they said they'd done it or they were doing it or they were working on it. Um… and I think having – for me, having met somebody at an event and actually sat and talked with them and discussed things, I feel more comfortable then, you know, asking for a favour or saying what do you know about…*

*Not everyone forms relationships on CAS*

However, not all teachers develop relationships through their online interactions on CAS. Many of the interviewed teachers commented on the casual nature of the contacts they have with other teachers on CAS. Simon, for example, noted:

> *We've passed some resources between different members of staff in different schools across the country, but that hasn't led to any further interaction. It's just been a quick share of something or I-I've got something which will help, oh, thanks very much, here's something I've got in exchange and then, you know, you move on to other things.*

Pippa differentiated between communication with CAS members online and developing a relationship with them, saying:

> *I mean, I've commented on their posts and things like that, but I wouldn't say that we have a professional relationship.*

Henry also noted the strength of the ties with other CAS members, saying that although he did have some relationships with other CAS members, "we're not going to each other's weddings yet."

*Sustaining relationships with other CAS members*

Further to the development of relationships is sustaining them, and one of Wenger's original 14 characteristics of a community of practice is the evidence of relationships that are sustained over time – whether they are positive or negative (Wenger, 1998). Due to the nature of the data collected, it was difficult to determine whether any of the relationships that participants developed on CAS had endured,

and this question was not asked of interviewees or survey respondents. However, there were some indications of possible long-term relationships in the data. Harry, who is a new teacher coming to the profession from industry, mentioned that he uses CAS for networking. As such, he maintains relationships with people he has met through CAS and is able to call on those relationships – or be called on himself – when the need arises. He said:

> I've set up a good – a few good relationships with people in local schools and actually, when I was looking to take on a department, um (pause) I had, uh…a couple of people contact me saying – I'd already got a job by then, but – saying, oh well actually something's coming up at our school and what we think is, you know, would you be at all interested? So, it does have that kind of career development angle as well.

The other teachers who mention sustained relationships (Simon, Kati, Ian and Matt) referenced them in connection with their local hub. This makes sense if the hub works as intended whereby a group of local teachers come together multiple times a year. In Simon's case, the teachers from his hub plan the professional development that the hub will provide that year:

> We're quite lucky cause our CAS group, say, we meet and we say, well, what do we want to cover this year? Is there anything specific? Do we want more training on this? Anyone got any ideas? Can anyone deliver? And that – that kind of forms how the – the CAS hub will develop over the year.

Simon went so far as to attribute the success of his students in computing to the quality of his CAS hub:

> Yeah, we're very lucky. If I hadn't had as good as hub as this, A) our exam results wouldn't have been as good and B) we would be – we'd be swimming at sea. We would not know really what we were doing.

For some CAS teachers, therefore, the relationships they develop over CAS, whether they originated in-person or online, have indeed endured over time.

*Summary*

In general, the CAS community, both culturally and structurally, allows for the development and continuation of relationships over time. These relationships might develop through in-person events and continue online or in person, or the opposite might be true with relationships originating through online contact before teachers meet in person. There are some indications of relationships being sustained over time. Once again, however, not all members are using the CAS community in this

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manner. Some teachers simply contact other members when needed and do not seek out more

sustained professional relationships with other CAS members.

## CAS members share ways of engaging in practice

One of the three tenets of a community of practice, the practice itself, is the focus of the work of the

community and the development of its members (Wenger, 1998, among others). The practice for CAS

members is the act of teaching computing and everything that this activity entails, as discussed in

Chapter 3. The data collected provide copious examples of CAS members collaborating on practice.

Evidence of CAS members jointly engaging in practice can be observed in the comments that teachers

make on resources after they have downloaded and used another teacher's resource in their own

classes. Some teachers suggest changes that might be made to the resource, based on their experience,

or post a new, edited version of the resource for anyone to use. In this way, quite literally, teachers are

both sharing practice and engaging in shared practice. In the example of one resource analysed, a

scheme of work for primary schools, the original author of the resource posted the following comment

after reviewing updates that another teacher made to his resource:

> *Thanks for uploading the update. I'm sure other CAS members will appreciate how the SoW links to the progression documents and digital badges. I'll start to look at detailed lesson plans and will upload as soon as done.*

*Engaging in joint practice through CAS discussions*

Members sharing ways of engaging in practice can also be seen when discussion participants join in

extended conversations that have the objective of helping one teacher, yet also aid in the development

and understanding of the other teachers participating in the discussion. This was observed in many of

the discussions analysed, but was particularly evident in the discussion summarised below.

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**AQA Population Model 2017 - (Secondary Education)**

A teacher ("Kate") begins this discussion because she is working on a task for the A-level exam and, although she has completed it, she is questioning her work. She asks what other teachers thought of the task, as in her view it was rather complex. Nearly an hour after the original post, no teachers had yet replied when Kate adds another comment to the discussion saying she has figured out a better solution to the task that "seems to work ok."

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One teacher responds saying she is also working on this task and although it seems complex at first, once the individual components are broken down, it does not seem so difficult. Kate responds to this teacher, agreeing with her viewpoint.

The next teacher to post in the discussion ("Ed") is also working on this task but has not completed it. Ed asks Kate if he can send her privately the work that he has done thus far to see if he is on the right track. Kate sends Ed her email address for him to do that.

Another teacher enters the discussion with her thoughts on how to accomplish this task. A second teacher ("Alistair") asks someone to review his work, saying that he is stuck on the fourth component of this task. This time, Ed jumps in, giving his thoughts on how to work on the fourth problem in this task and offering to send Alistair his solution. Kate posts, contradicting Ed slightly and says that she has sent him a private email. Alistair then joins the discussion, responding directly to Ed and Kate's comments in his next post and elaborating on his concerns. He reiterates that he would appreciate help on this task and that he, like Ed, is happy to send someone the work he has done so far for review. Kate responds to Alistair's comment by posting some code for him to try, with explanations, and offering to help him via email if he has further questions.

This discussion continues in the same vein for nine months, with new teachers asking new questions, offering solutions, and helping each other along the way. One teacher posts saying he thinks he has completed the task but would like someone to check his solution. He describes what he has done and Kate responds, asking a question and saying she will review his solution. Many of the same teachers who started the discussion also persevere for months, directing comments to each other and each participating multiple times. Kate actively participates in the discussion for nearly six months, sharing her own code and answering many questions. The discussion is inactive for three months, until a new teacher posts a comment that starts the thread again with new issues.

Before she discontinues her participation in this discussion, Kate posts the following:

> *This has been a really useful exercise, looking at my solution again I realised that I have over-complicated it. I need to think about what my lower ability students would be able to do.*

Ed responds, thanking Kate for all of her help throughout this process.

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This discussion provides a good example of a group of CAS members engaging in practice together. They are collaborating both towards their own development and towards building a better shared understanding of the material their students need to master. In this way, the participation of members leads to reification through the creation of artefacts used in the practice of teaching computing.

*Shared practice versus sharing ideas*

Some interview respondents also mention instances in which they have collaborated with other CAS member teachers in activities related to their practice, but their actual joint work on practice cannot be observed through the interview data. What the interview data do provide is a distinction between simply sharing or getting inspiration from other community members' ideas, and working with other

members to reify participation in the community. Many interviewees discussed downloading resources from other teachers, editing them to fit their own specific school and pupil needs and then using these resources in teaching. Some teachers then posted these edited resources back to the CAS community, and some did not. While this is not the same as teachers working together on practice, in some instances it might provide teachers with resources that can aid in their own development. Sophie explained it like this:

> *I don't use [resources] as they are; I have to change them to make them suitable for me and the students. But it's a good, you know, building block for me, and I understand it better. And I've got a starting point whereas otherwise you're just thinking, oh god, how do I even start this? What do I do? It's nice to see what other teachers are doing.*

Teachers who download resources and edit them for their own classroom use might develop in their own understanding of a subject area or even use those resources to make changes in their teaching. If they post edited resources back to CAS, they are sharing practice; if they add comments to the original resource telling the community how they have changed it and what worked well or what did not, they are beginning to collaborate on shared practice. But simply downloading a resource and using it in class could be achieved using any online resource bank or content repository, and does not indicate that a community of practice has formed.

## CAS members negotiate new identities
Another of the key components of a community of practice is the idea that members can participate in the authentic activities of a community, regardless of their status or ability and, in so doing, can develop their own skills. Members of a community of practice begin their journey as novices, but through interaction with other COP members and through jointly sharing practice, they can become full-fledged members of the community and indeed, can become masters themselves (Lave & Wenger, 1991).

In addition to providing evidence of joint practice among CAS members, the AQA Population Model discussion described in the previous section also shows how CAS teacher Kate advanced in her own understanding of how to accomplish the specific task on which she was working. Through own

reflection on her practice, her work helping others and learning from others' comments, experience and expertise, she was able to grow and develop her own skills as a teacher of computing.

In two of the other discussions analysed, teachers who are new to teaching a particular course (GCSE computing and primary computing) start threads in their respective discussion areas asking for help as they plan their classes. They each receive many suggestions, ideas, possible resources and links to further information and training from fellow CAS members joining the discussions. Both teachers then add posts further in the discussion threads thanking the CAS teachers for their help, saying that this has helped their understanding and ability to achieve the task at hand. Throughout both discussions, other teachers also chime in, adding that the discussions have been helpful to them as well. In both instances, novice teachers are appealing to the higher level of expertise available in the community so that they might learn enough to accomplish a task that is new to them.

Interviewees provided more nuanced views as to how their own development has progressed through their participation in the CAS community. Harry mentioned the usefulness of participating in CAS discussions in relation to his own understanding of what it means to teach computing (as opposed to merely being an expert in computing). He noted:

> *By hearing the questions that other people have, I learn about – a lot about the kind of questions that sometimes I should have been asking and I just had completely, uh, sort of passed me by. Particularly about things like assessments when people say, look, is it gonna be this or do we have to do that and I think, look, I never thought of that, and then you look at the assessment and I think, no, actually you can't do it that way, or actually, that's not a bad idea. And then by weighing in on it, it does... you kind of see where that discussion goes and that's really helpful.*

Some of the teachers interviewed described how their knowledge has progressed since they have been on CAS, to the point that they do not need to use CAS in the same way or with the frequency that they once did. Matt noted:

*I suppose I'm having to find resources less often now than maybe I was having to three years ago when we were developing computing. We were one of the, um, OCR pilot schools for computing. So at that point, there was an awful lot of scrambling around for resources, but things are a bit more established now and I've got a – a good local collection of resources that I know work. … I'm mostly sort of following, um, threads of conversation about new ideas… and perhaps occasionally chipping in to help people who are looking for answers to questions.*

In this comment, Matt was outlining his own development from "novice" teacher of the new computing curriculum to one who has an established course with content and resources that he is confident are successful for his students. As such, his role – and his use of CAS – has changed and he no longer needs to search for resources or help in developing his course. Rather, he has become a "master" in his own right and is able to provide the same support he once received to other CAS members.

*Some CAS members look for the easy answer*

As seen in the AQA Population Model discussion in the previous section, many CAS teachers who were having difficulty with the particular task in this controlled assessment (CA) asked for help from other teachers and offered to provide the work they had done for review. This was a common occurrence in discussions. Perhaps more common, however, were teachers who did not offer to provide any of the work they had completed (possibly because they had not yet attempted the controlled assessment tasks themselves) and requested that other CAS members simply send them the answer. Discussion posts like the following, accompanied by the CAS member's email address, were quite common:

*Hi would anyone share what they have done for task 1 and task 2 please? Thanks.*

Discussion posts such as this might perhaps indicate that the CAS teacher is not actually interested in learning how to accomplish the task, but merely wants to know the answer. Furthermore, providing these teachers with the answer does not aid in their own cognitive development or understanding of the subject area. A teacher in one of the analysed discussions responded to one such request for a task solution in this manner:

Teacher participation in online communities of practice

> *I deliver training that help develop the skills to complete this CA. I also provide delegates with practice tasks and solutions which I explain on the day. This explanation is essential as there are many ways of solving these problems and mine is only one way and probably (definitely!) not the best but they work and I am able to explain them to my Year 10 pupils. Please don't contact me for copies of the solutions as I don't want them out there circulating on the ether without my explanations. Contact me with questions or if you are interested in some excellent training.*

This example indicates that not all CAS members engage in the legitimate peripheral participation that is central to learning in a community of practice, and allows the negotiation of members' identities as they advance in their own learning.

## Community of practice conclusion

The data analysed for this study suggest that the CAS community (including both the online and in-person elements) exhibits characteristics of a community of practice. Indeed, some members who belong to CAS might, according to Wenger's definition of a community of practice, correctly claim that by being part of CAS, they belong to a community of practice. Evidence from the data collected and analysed indicate that some CAS members share a common objective, use common vocabulary, develop and sustain relationships with other CAS members and engage in a shared practice.

Evidence from the same analyses also shows that not all of the members of CAS interact with CAS as a community of practice. Some CAS members use CAS as more of a resource bank or content repository, and do not engage in deeper activities such as developing relationships or engaging in shared practice; others (not included in the samples for this study) are lurkers, and may not interact with other CAS members at all. The question then develops from one of whether CAS is a community of practice at all, to why CAS serves as a community of practice for some users but not others. This question will be discussed as the results are presented in the following sections.

### Profiles of CAS member teachers

Midway through the transcription process, certain patterns in the interview data became apparent. Teachers who shared similarities in their past professional experience seemed also to share certain other characteristics and behaviours. This hypothesis was noted for future examination after all interviews were transcribed and coded.

As the coding process progressed, it became evident that three separate profiles of teachers existed based on teachers' work experience to date. After examining all 20 interview transcripts, the sample was divided between the three profiles as evenly as possible. "Sets" were created in nVivo as a way to classify data into these categories. Sets are static groups within nVivo that allow similar data to be grouped together. The Sets were labelled with the names of the profiles: Industry Profile, Computer Science Teaching and Neither. The interview transcripts for each interviewee were placed into the Set that corresponded to the profile to which they belonged. In addition, each interviewee's node was opened and the name of the profile to which they belonged was added as an "Attribute", so that the profile label was always associated with each interviewee.[37] The three profiles of teachers are as follows:

- **Industry Profile:** Teachers belonging to this profile include those who reported working in the computing industry in some way before coming into teaching. Seven of the 20 teachers fitted this profile: Mark, Jenn, Matt, Sophie, Stuart, Harry and Sarah.

- **Computer Science Teaching Profile:** Teachers belonging to this profile include those who have taught computing or computer science (not ICT or IT) for more than five years. These teachers were teaching the subject before it changed to ICT and then back to computing. Seven of the 20 teachers fit this profile: Anthony, Simon, Henry, Kati, Tim, Pippa and Emma.

- **Neither Profile:** Teachers belonging to this profile have no experience working in the computing industry and have not taught computer science for more than five years. All of these teachers started teaching computing with the switch to the new curriculum, and may have taught ICT, IT or other subjects prior to that. Six of the 20 teachers fitted this profile: Steve, David, Ian, Pat, Nicola and John.

Once the profiles were established and teachers were assigned to one of the three profiles, further analyses were done using both the survey and interview data for the 20 teachers to identify characteristics of each of the profiles.[38]

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[37] The creation of Sets and Attributes allowed multiple kinds of searches and queries to be run in nVivo.

[38] The question about previous experience was not asked of survey respondents, so it is not possible to separate the 920 survey respondents' data into profiles. Thus the profiles are based on the sample of the 20 interviewed teachers. Because this is such a small sample, the profiles developed here should be considered theories based on the available evidence. A larger sample of CAS teachers would be required to confirm that there exist three profiles of teachers on CAS.

Teacher participation in online communities of practice

*Variations amongst CAS profiles*

Teachers' survey data was examined to identify any variation in the background characteristics of

teachers in each profile. Table 8.1 shows the similarities and differences in background characteristics

between the profiles.

**Table 8.1 Background characteristics of interviewed teachers, by profile.**

| | Industry Profile | CS Teaching Profile | Neither Profile |
|---|---|---|---|
| **Gender** | 4 male/3 female | 4 male/3 female | 4 male/2 female |
| **Average Age** | 39 years | 49 years | 37 years[39] |
| **Average yrs teaching experience** | 7 years | 23 years | 11 years[40] |
| **Highest degree earned** | 4 Bachelor's, 2 Master's, 1 HNC, HND, NVQ at level 4+, Foundation Degree or equivalent | 5 Bachelor's, 2 Master's | 4 Bachelor's, 2 Master's |
| **Frequency of using CAS** | Most frequent users of CAS; 2 access 1x/day or more; 4 access 1x/week or more; 1 accesses 1x/month or more | Slightly less frequent users of CAS: 2 access 1x/day or more; 2 access 1x/week or more; 3 access 1x/month or more | Less frequent users of CAS: 1 access 1x/day or more; 3 access 1x/week or more; 1 accesses 1x/month or more; 1 accesses less than 1x/month |
| **Personal learning network?** | 5/7 say they are part of a PLN | 4/7 say they are part of a PLN | 3/6 say they are part of a PLN |

Teachers belonging to the CS Teaching profile are the oldest at an average age of 49 years and have

substantially more teaching experience (average 23 years). Teachers belonging to the Industry profile

have the lowest average years of teaching experience (7 years) but are not young (average age 39

years), due to the time they have spent working in industry before becoming a teacher. One teacher in

the Neither profile is 54 years old and has 30 years of teaching experience, most of it teaching history. If

he is removed from the average, the average age of teachers in the Neither profile is 34 and their

average years of teaching is seven, meaning they are likely to have started teaching right out of

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[39] One teacher in this category is an outlier in terms of age. When he is removed from the average, the average age of teachers in this category is 34.

[40] One teacher in this category is an outlier in terms of experience. When he is removed from the average, the average years of experience of teachers in this category is seven.

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university. The formal education experience of teachers in all three profiles is similar, and mirrors the

data that emerged from the larger survey, in which 2/3 (67%) teachers report that a Bachelor's Degree

is the highest level of formal education they have achieved, while a quarter report the highest level as

being a Master's Degree.

*Usage of the CAS online community*
Although there was a slight difference in the frequency with which teachers access CAS according to the

profile with which they are associated, there does not seem to be a difference across profiles between

what prompts teachers to access CAS or how, when, and where they access the site. For example, fairly

even numbers of teachers in each profile report accessing the site at home, at school, from both home

and school or elsewhere (via a mobile phone, for example). As with the survey respondents, the

majority of interviewed teachers responded that the email notification prompts them to access CAS

more than anything else. Also in line with survey responses, the majority of teachers across all three

profiles (13/20) report that the first thing they look for after logging in to CAS is a resource posted by

another teacher. The remaining seven teachers report that they usually look at discussions first.

When asked in the interviews to elaborate on other things that might prompt or motivate them to

access the CAS site, the 15 of the 20 teachers (evenly distributed across profiles) again mentioned the

email notifications as being what prompts them to look at the site. Five teachers in each profile

mentioned that they go to CAS when they have a specific question or learning need, and a slightly

smaller number of teachers from each profile (three or four) reported that they consult CAS when they

are planning.

*Participation in CAS in-person events*
There was not much variation across profiles as to teachers' participation in CAS in-person events,

which could include hub meetings, the national conference or CAS training. As mentioned previously,

only five teachers of the 20 interviewed reported never having attended an in-person event. Of the 15

teachers who have attended in-person events, 12 reported that their experience at one or more of

these events has prompted a change in their teaching practice.

Teacher participation in online communities of practice

Interviewees were also asked about their attendance at their local hub meetings and, again, there was little variation between profiles as to whether teachers attended hub meetings or not. The attendance at hub meetings seemed to be more closely related to the timing of the meetings (whether they were on dates and times convenient for the teachers) and the proximity of the meetings to the teachers.

*Attitudes toward the computing curriculum*

During the interviews, teachers were asked questions about the new computing curriculum, in order to get an idea of their levels of preparedness for the curriculum and perhaps discover why, in addition to how, they might use the CAS community for their own support and development. They were also asked how they felt about the change from ICT to the new computing curriculum, whether they felt happy about it or whether they personally wanted to teach it. Here again some differences between the profiles emerged. The most negative attitudes toward the curriculum came from teachers in the Neither profile, which makes sense since all but one had previously been ICT or IT teachers and had limited to no experience teaching computing before the new curriculum was launched. Only three of these teachers reported feeling positive about the curriculum change. Similarly, only two of the six teachers said they felt prepared to teach the content of the new curriculum and of those two, one (Ian) reported that he didn't feel prepared with the pedagogy of the curriculum. Four of the Neither profile teachers said that they weren't prepared for the content of the new curriculum at all.

Teachers in the other two profiles (CS teachers and Industry teachers) felt nearly unanimously positive about the change to the new curriculum. In the Industry profile, six of the seven teachers reported feeling very positive about the change to the new curriculum.[41] Five of the seven CS teachers reported being very positive about the new curriculum, and the remaining two were not negative. Emma expressed "mixed feelings" about the new curriculum but was not clear why she felt this way. Anthony didn't explicitly answer the question but later in the interview mentioned that he was happy to be teaching computing again as it "used to be my department."

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[41] The seventh teacher was not asked the question, as he only became a teacher after the new curriculum was already in place.

Feelings of preparedness for teaching computing

Perhaps predictably, teachers in these two profiles also reported feeling more prepared for teaching the new curriculum than those in the Neither profile. The majority of Industry teachers, having just recently come into teaching from industry, reported that they felt prepared to teach the content of the subject, although Matt and Sophie mentioned that their skills were a bit rusty since they hadn't been in industry for a while. Harry and Jenn, although prepared for the content, said that they did not feel prepared for the pedagogy of teaching computing, mentioning specifically that they needed to build skills to help them learn how to teach computing, how topics progress, how to build schemes of work and so forth.

Similarly, the majority of the long-term teachers who had previously taught computer science also expressed that content-wise, they felt prepared for the new curriculum. However, all of them proceeded to say that there were, of course, skills on which they needed to 'brush up', because they hadn't taught certain topics in a while. Only one of these teachers (Simon) reported feeling unprepared and, unlike the other two profiles, none of the CS teachers mentioned feeling that the pedagogy of teaching computing might be an issue.

Feelings of confidence toward teaching computing

While coding the interview data, teachers expressing confidence (or a lack thereof) in themselves and their abilities were coded under the Confidence code. Teachers across all profiles mentioned confidence, but in different ways. Five of the six teachers in the Neither profile made comments about confidence, specifically speaking about a lack of confidence in their own abilities. However, several mentioned they were building confidence through the experience of teaching computing. Two teachers in the CS teaching profile made statements about their confidence. Both Emma and Kati expressed a lack in the confidence needed to be able to share their own resources with the CAS online community. In the Industry profile, only two teachers made statements about their confidence, which were mostly positive. One said that she felt confident in her abilities in general, while the other felt more confident participating in the community on Facebook than she did on CAS.

Teacher participation in online communities of practice

*Professional Development and motivations to seek support*

Teachers were asked several questions about the professional development (PD) or training that they seek out or receive for their teaching, whether it be inside or outside of their schools. Again, no significant differences between the profiles were revealed in teacher reports. Overall the support teachers report receiving from their schools includes releasing them (by providing supply cover) so that they might attend PD and providing necessary funding. The PD that is offered within a school tends to have a general focus on general teaching and learning, rather than any subject-specific focus. According to the data, if teachers of computing need PD specific for their subject area, they must seek it out themselves from sources outside of school.

There was no profile-specific pattern to the motivations teachers have for seeking out PD or support for their teaching. Teachers across profiles expressed that they seek out PD or support for their teaching if they see gaps in their knowledge (9/20 teachers), or have areas they need to strengthen in their teaching (7/20 teachers). This aligns with the literature on what motivates teachers to change their practice (see Chapter 3). If teachers are motivated to change by the impact of their actions on their students, their culture or the culture of their school, these are not related to their past work experience and thus variation between profiles would not be observed (See Guskey, 1986; Shulman 1987; Hargreaves et al., 2001, among others). However, if teachers' motivations for change are based on their own practical knowledge of teaching (Richardson, 1994), their past experience could be influential. (The profile variations in teachers' knowledge and skills are discussed later in this chapter.) More research with larger sample sizes is required to discover whether teachers' profiles are a source of motivation for them to seek out further development for their teaching.

## Ecology of Resources for CAS teachers, by profile

In Chapter 7, steps 1 to 5 of the Ecology of Resources framework provided a view of the available resources (people, tools, knowledge, skills and environment) that were available to CAS teachers overall, as well as the filters that might encourage, slow or prevent teachers' access to these resources. However, differences in CAS teachers that can be attributed to the profiles discussed in this chapter also influence some of the resources available to these teachers. The interview data enabled continued

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mapping of the Ecology of Resources for CAS teachers. The sections that follow continue the mapping of

the zone of available assistance (ZAA) for CAS teachers according to their profile. The objective of this

analysis is to understand how a computing teacher's work experience might be related to the resources

that are a part of their zone of proximal assistance (ZPA).

### Phase 1, Step 5, continued: Identify the learner's resources

It is important to highlight at the outset that the learner in the example of this thesis research is the

teacher. A learner's own resources can be classified as the knowledge and skills they bring with them

when they approach an area of new learning. Learners' resources also include their history of past

experiences, such as work experiences, which will be further examined as the data are divided into the

Industry, Computer Science (CS) teaching and Neither profiles in the sections that follow. Finally, the

motivation to learn and attitudes towards learning (some of which are discussed in the previous

sections) also form part of the resources that a learner brings with him or her (Luckin, 2010) to any new

learning experience.

The sections that follow examine the comments that interview respondents made about their own

knowledge and skills in relation to their role as teachers of computing. Comments that teachers made in

their interviews about the knowledge or skills they possess or lack in a particular area were coded as

such in nVivo. Differences that were noted between teacher profiles are explained below.

#### *The Industry profile*

In terms of knowledge and skills, the teachers with industry background reinforced their content

knowledge and their need for pedagogical knowledge. Some mentioned that their skills had become a

little 'rusty' since they left industry, and they had to brush up a bit. Some spoke of not "knowing what to

teach" or, in other words, lacking the knowledge to develop a scheme of work or understand the

progression of topics necessary to teach computing. Once these teachers understood what they needed

to teach, they could work on refreshing any skills or seeking out the tools and resources they needed.

Some teachers who had more recently made the transition from industry were less familiar with

educational software and the use of education-specific tools. These teachers might have gone about

solving a problem in a different way when they were working in their previous roles in computing (using

a text editor for coding, for example). In addition, there are several topics such as "computational thinking" or the "Little Man Computer" that figure heavily in the computing curriculum but never appear in industry.

Harry was one of the teachers with the fewest years of experience in teaching. At the time of the interview, he had two full years of teaching under his belt. However, as he said:

> *I've got a degree in computer science, I've been programming for about 26 years.*

Even though he was very confident in his skills and content knowledge in computing, he had a lot to learn in terms of pedagogy.

> *My… challenge was more in terms of learning how to do the… teaching bit. Rather than having to do the… um… uh… the technical bit. But I think the problem that also caused me was… because I didn't have to learn the technical bit, because I was… kind of… all over that, it meant that… uh… breaking down what I knew suddenly became, you know, that was quite a challenge. To break it down so that a… year 7 pupil at sort of 11 years old could understand all this complicated technical stuff… My mentor was sitting in lessons keeping a list of words that had come out of my mouth that no child in the world would understand.*

He also had to learn about technologies that were used in education, to teach programming, but not in industry.

> *I have to learn all sorts of strange educational technologies. That I wouldn't usually use – you know, I'd usually just fire up a text editor and get coding.*

Harry was not the only teacher with substantial industry experience to discuss his lack of knowledge of computing concepts or technologies that were only used in education and were not found in industry. Sarah expressed something similar when she looked at her specification and realised she had to teach something called 'Little Man Computer', which she had never heard of.

> *And in all my years, I've never come across it, I'd never heard of it, um, it was all the way through the spec. It seemed to be this very important thing that clearly everybody would know about – it was so basic. And I felt probably for the first time since I started teaching, or actually since I entered the industry, you know, what is this thing? I could Google it. I could see what it was and I was really baffled as to why it's in the spec. Because as I say, I've been in industry, I've been teaching a while and I've never heard of it.*

Stuart discussed the key difference between teachers with industry experience and those in the other two identified profiles when he said:

> *So whilst they started teaching computing, they're kind of a lot further behind knowledge-wise than I am. I don't necessarily need the knowledge; I need ways of implementing that in my classroom. And a lot of the training I've seen is all about improving teachers' knowledge.*

Therefore, although teachers in the industry profile may have been confident in most of the content they had to teach, their knowledge and skills around pedagogy were lacking at times. These teachers expressed needs for more information as to how to develop a scheme of work, how to use specific educational tools that were not present in industry and how to present topics in ways that their young learners would understand.

*The Computer science teaching profile*

Since most of the teachers in this profile teach the A-level, their subject knowledge should be more advanced than teachers only teaching to the GCSE. Teachers in this profile made the fewest number of comments about their own knowledge and skills, but they did speak about "brushing up a bit", as now they were teaching new programming languages that they had not previously learned. One teacher also mentioned attending training simply to increase her confidence level. In other words, as she says, she is not learning anything new, she is just strengthening her beliefs that she knows what she is doing. None of these teachers mentioned in their interviews anything, either positive or negative, about the pedagogy of what they teach. This could be a simple omission, since pedagogy was not asked about directly. Or it could be because they were experienced teachers who were comfortable with the pedagogy of teaching computing already, and it was not something that they consciously consider.

Pippa spoke about the negatives of being an experienced teacher, in terms of being able to relate to her students learning something new.

> *You need to remain – understand that awareness of how difficult learning something new is. And particularly when you're teaching kids programming. You need to have struggled with something. You really need that awareness of finding something difficult. And as teachers, we've gotten to the point where most of the time, we don't.*

Teacher participation in online communities of practice

Pippa was not the only teacher to mention this. Others spoke of the benefit of having to learn a new programming language, for example, because the content covered by the new computing curriculum had changed as technology itself had advanced over the years. As they struggled to learn something new, the teachers gained a valuable understanding of their students' own challenges in grappling with a new topic, which they believed helped them to improve their teaching of computing.

*The Neither teaching profile*

There was no clear pattern to the comments made about knowledge and skills amongst the teachers in the Neither profile. Two teachers expressed confidence to teach computing in the content knowledge they already possessed. One of those two expressed a need for pedagogical knowledge to teach the subject. The other, who expressed unwavering confidence in her preparedness and abilities to teach computing, was also the youngest teacher interviewed, at age 28. She mentioned that she had covered the curriculum in her first year of teaching as a newly qualified teacher (NQT) and that she knew what she was doing.

Three teachers said that they had trained in ICT and/or didn't have a computing-based degree and thus lacked the content knowledge necessary to teach computing. Pat, for example, noted:

> *I don't have a computing-based degree. So I've been kind of learning it a bit quicker than the kids have.*

David said of his entire staff, including himself:

> *We had to base, um…effectively retrain as staff, um, and you know effectively, complete – totally reskill ourselves… So my skills, I needed – well, I'd never – I'd never done any programming.*

Steve also discussed his retraining, saying:

> *I've been, um, sort of brushing up computing. I'm not formally trained in computing at all, um, but I've taught ICT for about four years and then it started to turn into computing so I started retraining, basically.*

The final teacher expressed he had some of the skills necessary to teach to the new curriculum, but not all, in terms of content and pedagogy.

Because there is not a pattern to the responses from the small sample of teachers who belong to the

Neither profile, more research needs to be done with a larger sample of teachers who fit this profile.

Based on the comments of Neither teachers regarding knowledge and skills, it might actually be possible

to break this profile down further into two profiles as follows:

- Teachers who have received formal education in computer science and have been trained to be computing teachers but have fewer than five years teaching experience. These teachers might be confident in the content necessary to teach computing but less confident in the pedagogical aspects of teaching computing or teaching in general, as they have not been teaching long.

- Teachers who have taught ICT, IT or another subject and might have extensive teaching experience but for different subjects. These teachers might have knowledge and skills around general pedagogy but would be lacking in the content and pedagogical skills necessary to teach computing.

At present, the teachers in the Neither profile could be divided into these two categories, but the

sample sizes are too small to determine whether there are actually four profiles of teachers using CAS.

Further research with larger sample sizes is necessary.

### Phase 1, Step 6: Identify potential more able partners

According to Vygotsky, learning takes place in a zone of proximal development, in which learners'

capacity for development is extended when they collaborate with others who are more capable than

them (Vygotsky, 1978; Cole, 1985). These more able partners (MAPs) can be human, but they can also

be physical resources, digital resources or elements of the learner's environment (Luckin, 2010). In the

Ecology of Resources model, a MAP helps the learner negotiate the development of his or her ZPA, and

thus influences the resources to which he or she has access.

The other area in which teachers' reports differed according to profile concerned the people resources

they had access to, whether these were CAS members or not. In addition, teachers were asked if they

were part of a personal learning network. For the purposes of the interviews, a PLN was described as a

network of people, inside or outside of school (and inside or outside of CAS), that the teacher could call

on if he or she needed help (and these people might call on the teacher in return as well) (McElvaney &

Berge, 2009; Kop & Hill, 2008). The responses to these questions varied by profile as well and are

described below.

Teacher participation in online communities of practice

However just because some teachers might not have the same access to people who could act as more able partners, this does not mean that they do not have access to any more able partners. The CAS online community itself could act as a more able partner. Teachers could be lurking without posting to the community and reading discussions, which could provide them with information that influences what resources they select for their learning. Teachers could find training on CAS, whether online or in person, which could also act as MAPs. Family members, colleagues at school and others not mentioned could also fill this role. Therefore, just because some teachers, according to profiles, might have less access to some kinds of MAPs, this does not mean they do not have any MAPs aiding in their learning.

*The Industry profile*

The Industry teachers reported a wide variety of contacts outside of their schools on whom they can draw if they need help and support. Only one (Sophie) reported being largely alone, with the exception of people on courses she attends – when she is actually on those courses. Harry, Sarah and Matt have industry colleagues they contact. Jenn and Mark still contact people from their universities and training. Stuart reported having others in his academy chain and on Twitter. Jenn has friends and colleagues from other schools. Mark also relies heavily on the Raspberry Pi community and his family as well as those in his department. Matt calls on the expertise of the Oxford science, technology, engineering and mathematics (STEM) team, and Sarah has contacts at the local university. In terms of relationships with other CAS members, 5/7 report having developed ongoing relationships with other members.

The Industry profile contained the highest number of teachers who said that they consider themselves as being part of a personal learning network (PLN). Matt was not asked this question, but he has strong relationships with industry colleagues whom he contacts regularly. Of the remaining teachers, all said that they were part of a PLN with the exception of Sophie, who also was one of the only people in this profile who also has no ongoing relationships with other members of CAS. Sophie appears to work completely alone and is the outlier in this profile.

*The Computer Science teaching profile*

The CS teachers, who have been teachers in this field for more than five years and have, on average, the most teaching experience of all three profiles, have had the time to develop relationships with

colleagues in other schools, to whom they continue to turn for support. Six of the seven CS teachers report having relationships with people in other schools. One of these also has a friend in industry. The remaining teacher (Emma) reports having no relationships with anyone outside of her own school. In terms of relationships with other CAS members, 5/7 report having ongoing relationships with other CAS members.

There was a nearly even split amongst teachers in this profile about whether they would consider themselves part of a PLN. Four teachers (Pippa, Simon, Tim and Henry) felt that they are part of a PLN, while three (Kati, Anthony and Emma) did not. However, two of these three teachers reported having ongoing relationships with people in nearby schools, which seems sensible since they have been teaching for some time and have had time to build these relationships.

*The Neither teaching profile*
In something of a surprise, the six teachers in this profile reported having very few relationships with others outside their own schools from whom they can get support for their teaching. Pat still communicates with some colleagues from her training and John occasionally communicates with colleagues from neighbouring schools but reported that most of his support came from online interactions. In terms of CAS relationships, only three of the six (Ian, Pat and Steve) reported having developed any relationships with other CAS members.

Only three teachers in this profile (Pat, Steve and John) felt that they were part of a PLN. The other three (Ian, David and Nicola) felt they are not. This aligns with evidence in their profiles. David and Nicola were two of the youngest teachers surveyed, both very confident and reliant on online resources. Ian spent his career teaching at special schools at the primary level, and has only just moved on to secondary computing. He would not have the appropriate past relationships to draw on for his new work.

Phase 2, Identify relationships within and between the resources and filters
What the analyses of teacher profiles demonstrate is the role that a teacher's background work experience can act as a filter that influences which resources can be found in the teacher's ZPA. Figure

Teacher participation in online communities of practice

8.2 shows how the filter of the teacher profiles, as explained in the previous sections, interacts with

resources available to the CAS teacher, as well as how those resources might interact with each other.

**Figure 8.2 Relationships between resources and filters for CAS teachers.**

| Resource Element | | Filter Element |
|---|---|---|
| Knowledge and skills<br><br>Knowledge of pedagogy to teach computing<br>Knowledge of general pedagogy<br>Content knowledge needed to teach computing (eg. programming skills) | *Influences* | Teachers' past work experience (profile)<br>Teachers' knowledge or understanding of computing topics<br>Teachers' confidence to teach computing<br>Teachers' attitude or motivation to learn computing<br>Teachers' formal education and/or PD |
| *Influences* | | *Influences* |
| Tools and People<br><br>Computing at School community<br><br>Other online communities or websites<br>CAS members<br><br>Teachers' own PLN<br><br>*CAS hub or other CAS in-person events*<br><br><br>Training and other CPD<br>Classroom resources, lesson plans, schemes of work, programming languages, technology | *Influences* | Teachers' past work experience (profile)<br>Teachers' confidence with subject and online communities<br>Search capabilities and user interface of online communities, internet speed<br>Teachers' willingness to participate/share<br>Backgrounds and attitudes of other CAS members<br>*Proximity of hub, frequency of meetings, time, family commitments, supply cover*<br>Cost, support and knowledge of school leadership, availability of appropriate training<br><br>Teachers' knowledge of content and pedagogy to teach computing<br>National curriculum in computing, exams for GCSE/A-level in computing |
| *Influences* | | *Influences* |
| Environment<br><br>Classroom, computer lab, training rooms<br>Online environment of CAS, user interface, search capability, discussion forums<br>Email, Skype, mobile phone and other technology-based communication devices<br>Hub or national conference meeting location | *Influences* | Teachers' past work experience (profile)<br>School leadership support for computing and in general<br>Available technology, devices, programming languages, bandwidth, firewall<br>Teachers' knowledge of content and pedagogy to teach computing<br>Proximity of hub, frequency of meetings, time, family commitments, supply cover |

Previous sections in this chapter have discussed how teachers' knowledge and skills might be influenced

by their past work experience and the profiles proposed by this research. CAS teachers' current

knowledge base for their work might also be shaped by their own formal educational background,

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whether through higher education or continuing professional development, as well as their attitudes toward the subject they are teaching. Teachers who are passionate about the subject might be driven to learn more than is necessary for the lessons simply because they are interested in the subject matter. Conversely, several teachers interviewed mentioned learning just enough to keep them "one day ahead of the students".

Interviews and previous discussions indicate the relationships between teachers' profiles and the tools and people to which computing teachers have access. The literature also indicates that a teacher's propensity for sharing or their familiarity and confidence with using online communities might influence their use of the community (Chen & Chen, 2009), and in turn the resources within that community that are available to them.

*The computing curricula and exams as filters*
One filter uncovered by the interviews and not previously discussed is the impact of national exams and the national curriculum on the tools and people to which teachers have access. The curricula and accompanying exams require certain skills to be mastered by students and, as such, teachers also need to possess those skills in order to adequately teach them. Teachers that were interviewed tended to look to the curriculum and exams to assess what knowledge they themselves are lacking before searching out resources that could help them build their competency in that area. As these teachers also had time and funding as filters to available resources, they might be less likely look for resources or training in areas that they do not have an immediate need to teach. Some teachers mentioned bookmarking resources like this for possible future use.

*The school environment as filters*
Once again a teacher's profile can act as a filter to some of the environmental resources available to him or her. If teachers have experience using a particular device or programming language, for example, they might have access to more information to help them decide whether to use that in their teaching. Interviews also uncovered the influence of school-level support on how the computing teaching environment is shaped, as well as on the people and tool resources available to teachers. Many teachers spoke about computing, as a subject, being far less of a priority to school leaders than subjects

such as mathematics or English. As such their computing department received less budget and attention from leadership than other subject departments might. This influences the tools, classroom setup and computer lab facilities that are possible at the school. It also affects the professional development support available to the teacher, in terms of the funding and supply cover that is provided for the teacher to attend training.

In addition, multiple teachers also mentioned that their school leadership had varying degrees of knowledge about computing as a subject. As a result, school leaders were unable to provide guidance to computing teachers, who often felt that they were completely alone. This acted as a catalyst to teachers' access to CAS, as they often turned to CAS for support or guidance in developing the curriculum for their school or college.

## Do teachers' profiles relate to whether they use CAS as a community of practice?

The results presented and discussed at the beginning of this chapter suggest that, while the CAS community exhibits characteristics of a community of practice, not all CAS teachers use the community in that manner. Some come to CAS solely to download resources or "lurk" without participating. For these users, CAS is no more than a resource bank. Other teachers engage more fully with CAS, they begin to develop and sustain relationships with other members of the community, collaborate on shared practice and gain expertise that allows them to make the transition from novice towards master. These teachers share a common objective and common language and can be said to be part of a community of practice.

While data also indicate that certain of teachers' background characteristics might be related to the resources available for learning in their ZPA, it is unclear whether the teachers' profile is connected to their use of CAS as a community of practice or simply as a resource bank. All teachers interviewed share a common objective and appear (in interview transcripts) to use a lexicon common to other members of the CAS community. However, once interviewees' data were separated by profile and a query was run to see which COP codes had been applied, no patterns emerged according to profile (See Figure 8.3).

Once again, a larger sample of CAS teachers along with additional questions that probe into teachers' use of CAS, is required to answer this question.

**Figure 8.3 Community of practice codes applied to teachers' interview data, by profile.**

| | Developing Relationships | Sustaining relationships | Sharing practice | Novice to master |
|---|---|---|---|---|
| **Industry** | | | | |
| Harry | ▓ | ▓ | ▓ | ▓ |
| Stuart | ▓ | | ▓ | |
| Jenn | ▓ | | ▓ | ▓ |
| Sophie | | | ▓ | |
| Sarah | ▓ | | ▓ | |
| Mark | | | ▓ | |
| Matt | ▓ | ▓ | ▓ | ▓ |
| **CS Teacher** | | | | |
| Pippa | ▓ | | ▓ | ▓ |
| Simon | ▓ | ▓ | ▓ | ▓ |
| Tim | ▓ | | ▓ | ▓ |
| Kati | ▓ | ▓ | ▓ | ▓ |
| Henry | ▓ | ▓ | | |
| Anthony | ▓ | ▓ | ▓ | ▓ |
| Emma | ▓ | | ▓ | ▓ |
| **Neither** | | | | |
| Ian | ▓ | ▓ | ▓ | ▓ |
| Pat | ▓ | | ▓ | ▓ |
| David | | | ▓ | ▓ |
| Steve | ▓ | | | |
| Nicola | ▓ | | ▓ | |
| John | ▓ | | ▓ | ▓ |

| | |
|---|---|
| ▓ | Denotes these characteristics of COPs were coded for in this teacher's interview |

## The relationship between participation in an online community and teaching

As described in Chapter 6, CAS began as a grass roots organisation committed to the development of a computing curriculum in the United Kingdom. Stakeholders in industry, academia, schools and the government had recognised a need for more students studying computer science in university, and the agreed solution was to re-introduce computing curricula and exams in schools and further education (Brown et al., 2013). CAS as a community developed to support the teaching of computing in schools and further education to this end. In other words, the job of CAS is to help teachers be successful in

teaching the new computing curriculum so that students can be successful. For students, success means

not only high attainment in class and on exams, but also the development of a genuine interest in

computing, a motivation to continue studying computing at university and, ultimately, a desire to work

in the computing industry.

This study did not look at student achievement data for CAS teachers and a control group, in order to

attempt to understand whether teachers' use of CAS might be related to student achievement. Rather,

this research focused on teachers' reports of changes to their own development, as discussed in the

previous sections, as well as reports of CAS resources that teachers felt made important changes in their

teaching. The next sections discuss findings from these data and what relationship participation in CAS

might have with a teacher's practice.

## Changes teachers are making to practice

The majority of teachers sampled, including both the CAS teachers who responded to the survey and

those who took part in the interviews, claim that they have made changes to their teaching practice as a

result of something they learned on CAS. Without student achievement data, it is impossible to claim

that the changes teachers are making are positive or negative in terms of improving student

performance or motivation to study computing. Instead, this section characterises the changes teachers

report making to their practice as a result of their participation in CAS.

Only 11% of CAS teachers who responded to the survey said that nothing with which they have

interacted as a result of their CAS membership has prompted a change in their teaching. The majority of

survey respondents responded positively to this question. Amongst them:

- 72% of teachers said that a CAS resource prompted a change in their teaching practice;
- 50% reported that a discussion did;
- 37% said they made a change based on their attendance at a CAS event; and
- 17% said a change was precipitated by their contact with another CAS member.

The survey asked CAS teachers to name a specific CAS resource that they felt had been the most useful

and to describe why that resource had been helpful to their classroom teaching. Following the analysis

procedure described in Chapter 5, the types of changes that CAS members reported making to their

practice can be categorised as follows:

- 19% reported that a CAS resource helped them with planning or assessment;
- 18% said that CAS has provided them with a new activity or idea to use in class;
- 10% of teachers said a CAS resource taught them something new; and
- 7% of teachers said the CAS resource they used helped their students in some way, provided a new approach to teaching a topic or helped their own understanding of a topic.

Again, following the procedure set forth in Chapter 5, the resources mentioned by teachers were analysed in terms of their type in an effort to understand what kinds of resources CAS teachers are finding the most useful for their teaching. The top ten types of resources, in descending order from most reported by teachers to least reported, were:

- Python resources
- Progression pathways document
- Discussions
- Scratch resources
- CAS conference
- Contact with a named person
- Training
- Other CAS event
- Scheme of work
- GCSE resources

From these data alone, one could assume that CAS is quite useful in developing the teaching of computing, as the majority of teachers report that they have made changes in their practice as a result of CAS, and the kinds of changes being made can be identified. Analyses of the interview data began to show that the survey data alone did not provide the entire story.

### Is all change really change?

In the interviews, teachers were prompted with their survey responses to the questions about the CAS resource that was most useful to them. They were asked to describe in more detail the specific resource and why it was useful. Teachers were also prompted with their responses to the survey questions asking what other CAS resources had incited a change in their teaching and were asked to provide an example of one of these (resources, events, discussions or contact with another CAS member).

All interviewed teachers reported that they had made a change in their teaching as a result of their interaction with or use of a CAS resource. As teachers began to describe these resources in more detail

however, it became apparent that the changes being made in their teaching varied in terms of their significance. In other words, some teachers were effecting or experiencing greater change than others.

When the interview responses were reviewed, the impact of a CAS resource on a teacher's teaching was assessed as having genuinely made a change in their teaching if teachers reported the following:

- The resource had impacted their understanding of a particular topic or taught them something they did not previously know. (For example, the resource changed the teacher's point of view or taught them a programming language.)
- The resource had changed how the teachers run their classroom or the way they teach a particular topic.
- The resource had influenced how they plan their courses or how they assess students' abilities.

Resources were not considered to have made a significant impact on teachers' teaching if they were simply a downloaded lesson plan, worksheet, quiz, homework activity or lesson starter that was used for the first time. In the survey data, this was categorised as New idea/Activity, and constituted nearly one fifth of the changes that CAS teachers reported making in their teaching. The interview data revealed that these types of resources most likely did not enhance a teacher's development or change the way she taught; rather, the "change" was in the introduction of a new activity that might have been used once or more than once by the teacher.

*Teachers' descriptions of the changes they are making*
Some teachers described significant changes to their teaching practice, their own professional development or their knowledge or understanding as a result of their interaction with CAS resources. The specific resources they mention as being responsible for these changes were both online and in-person resources. Harry, for example, spoke of how discussions influenced his teaching. He said:

> *By hearing the questions that other people have, I learn about – a lot about the kind of questions that sometimes I should have been asking and I just had completely, uh, sort of passed me by... I think, look, I never thought of that, and then you look at the assessment and I think, no, actually you can't do it that way, or actually, that's not a bad idea. And then by weighing in on it, it does... you kind of see where that discussion goes and that's really helpful.*

Harry was describing an advancement in his own learning and understanding as a result of participating in CAS discussions. This new knowledge influenced how he thought about his teaching and changed how he approached teaching computing as a result.

Sarah came to teaching from the computing industry and spoke about a topic she discovered in the computing curriculum that was completely unfamiliar to her: Little Man Computer. In her words:

> *There's a lot of focus on this thing called Little Man Computer. And in all my years, I've never come across it, I'd never heard of it, um, it was all the way through the spec. It seemed to be this very important thing that clearly everybody would know about – it was so basic. And I felt probably for the first time since I started teaching, or actually since I entered the industry, you know, what is this thing? Um, so you know, I could Google it, I could see what it was and I was really baffled as to why it's in the spec. Because as I say, I've been in industry, I've been teaching a while and I've never heard of it. So I really looked to CAS for some guidance. I could see things on YouTube and I'm thinking, it's a nice position to be in because I'm thinking, I'm like my students, what is it? what's the point of it, where's this going, how's it work, what does it relate to, and so I was able to, myself, learn about the LMC um, from CAS and I was quite stressed, thinking oh my god, am I going to have to get them through this? And how am I going to get these girls looking at me with these blank faces when I say "motherboard" to understand how it works. And from the resources on CAS I was able to devise, um, a nice kinaesthetic lesson… And it did work, and the girls understood at least, you know, equally to me, um, and it, you know, those sort of resources, gave me, conf - yeah, well, taught me Little Man Computer to the point that I was then able to teach it myself. And so that was really important."*

Sarah's example provides an excellent illustration of how CAS resources provided multiple positive benefits for her teaching. The resources she found on CAS taught her about Little Man Computer and prepared her to teach the concept effectively to her students. She advanced her own skills enough to develop and implement a successful lesson, and in learning about the new topic herself she became empathetic to her students' struggles comprehending new topics in computing.

Pippa found a resource online upon which she was able to expand in order to change the way her classroom functions. As she described:

> *Because when you're teaching programming, there's an awful lot of… kids who go, I can't, and it's about increasing resilience and also to get them to think more positively rather than just doing it for them. They now have to keep a record of the help they've been given, so they get a log of the help they have…it has made such a difference to the way my classroom runs. I am not running around ragged trying to help 50 people at once. Because everybody else – the kids, other kids – just go, well*

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> *I've just done that so I can help you with that. Can you sign my form?...They've also got this kind of log sheet in their own folders. So if they give somebody else help they'd record it and the other people would sign it to say, they helped me… They get really into helping each other and the explanation part of it is really good for building their understanding.*

The CAS resource Pippa mentions (called "SNOT"), provides a new system of classroom management, whereby students must first ask each other for help before asking the teacher and are then rewarded for helping their peers. Pippa noted that her computing classes run more smoothly and work progresses more quickly than before she implemented this new system, when students who experienced problems had to wait for one person (the teacher) to help them before they could move forward.

Anthony provided a summary of the impact that CAS resources have had on his teaching when he said:

> *Yes it does have an impact, but it's quite ephemeral, it's difficult to pin down. Whereas resources, um or even if it's a commentary…um, a discussion in a forum about a resource, um, that I think does directly map into what I do in the classroom, and what my students use, and the results that they get.*

In other words, everything Anthony accessed through CAS contributes to improving his teaching and, he believed, the results his students are able to achieve. He did not identify one single resource, but the people, events, discussions and activities he is able to access as a result of his membership in CAS.

*Is change related to a teacher's profile?*

In an effort to understand why some teachers reported CAS resources as having more of an impact on their teaching or personal development than others, the teacher profiles were again examined. As mentioned previously, while survey data from all interviewed teachers indicated that they had made a change to their teaching as a result of one or more CAS resources, the interview data showed that the changes mentioned by some teachers were mere implementations of a new idea or activity. When examining whether teachers reported a so-called "significant impact" to their teaching, according to the aforementioned criteria, it became clear that the profile of the teacher might be related to the changes they are reporting to their teaching as a result of their participation in CAS. In the Neither profile, when teachers were asked to discuss the CAS resource they had noted in the survey as having the most impact on their teaching (as well as any other types of CAS resources that had an impact), only two of the six teachers spoke about resources that changed their teaching, rather than simply providing them

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with a new idea or activity to use. The remaining Neither profile teachers seemed to use CAS as a resource bank and did not discuss the community as one that impacted their own development or practice. In contrast, more teachers from the other two profiles (6/7 teachers in the Industry profile and 5/7 teachers in the Computer Science teaching profile) self-selected and reported on resources that had impacted their teaching or development in a more substantial way.

Due to the small sample sizes in each of the profiles, it remains a theory that a computing teacher's background work experience might be related to the influence of CAS resources on a teacher's classroom practice. This is an area for further research, as discussed in Chapter 9.

## Conclusion

The findings presented in this chapter indicate that the CAS community can be considered a community of practice for some of its users, but not all of them. Perhaps CAS could be described as a virtual community, which has organic communities of practice that emerge from within it (Johnson, 2001).

While all CAS member teachers could be said to share a common goal (and even a common vocabulary), not all of them build or sustain relationships with other members or collaborate on shared practice. While evidence indicates that some computing teachers do develop their own knowledge past what they have been individually capable through their interactions with other members and participation in the activities of the community, some computing teachers seem to use CAS as no more than a resource bank from which they can download lesson plans or training. However, with the current sample of teachers and available data, it is impossible to ascertain whether those teachers who simply "lurk" on the site and whose participation cannot be observed are receiving any benefit to their own development from their membership in CAS. A larger or different sample is needed to ascertain this.

The CAS member teachers who participated in the interview were divided into three profiles based on their past work experience: specifically, whether they had worked in the computing industry, had taught computer science for more than five years or whether they had had neither of these experiences. When the Ecology of Resources framework was mapped for each of the three teacher profiles, it became apparent that the interviewed teachers' profile acted as a filter that influenced their use of CAS and

their access to certain resources outside of CAS. However, it remains unclear from the data whether a teacher's profile impacts whether he or she interacts with the CAS community as a community of practice or simply a resource bank. Again, more data are needed to determine this.

The profile of computing teachers, as discovered through these analyses, acts as more than just a filter on their access to resources, however. Data indicate that a teacher's profile is related to the knowledge and skills that a teacher brings to their learning and practice. It also seems to be related to their attitudes toward the computing curriculum, but not to their motivations for seeking out professional development of support for their teaching practice. Because the sample size of 20 teachers is small, a larger sample is required to test the initial findings presented regarding the teacher profiles.

Finally, while the majority of teachers sampled did assert that their participation in CAS does influence their teaching practice, the extent of that influence varies. Some teachers report real change occurring in terms of how they manage their classroom, their approach to teaching a subject, or in their own learning or understanding of a topic. Others claim that CAS has changed their teaching but when probed further it becomes apparent that their use of CAS has provided a new activity or lesson for classroom use, but has not changed their teaching or development. More research is needed to understand whether the relationship between teachers' use of CAS and its impact on their teaching is related to the teacher profiles described in this chapter.

The findings in this chapter have addressed many of the components of the research questions posed by this study. The final chapter will summarise all findings in this study in relation to the original research questions and will explore the implications they might have for the future development of online communities for teachers and research in this area.

# Chapter 9 – Conclusions and Implications

## Overview

The final chapter of this dissertation revisits the study's research questions and explains how the findings presented in previous chapters provide possible answers, while at the same time raising new questions for future research. The discussion begins by examining the data around how the Computing at School (CAS) community becomes a part of a computing teacher's context, providing resources to address the teacher's learning need at that time. Data on the characteristics of CAS that teachers find most useful for the practice of teaching the computing curriculum is presented in an effort to understand how this might influence teachers' motivation for choosing CAS as a resource to help with their learning. The main findings from earlier chapters are also reiterated in relation to the research questions.

This chapter elaborates on the findings regarding the characteristics of the changes teachers are making to their practice, as evidenced in the survey data and teacher self-reports, and the implications of these findings for the teaching of computing and for further research. Learnings from the data in this study are presented in relation to the literature on online communities from Chapter 3 to form guidelines for developers of current and future online communities for teachers. Finally, outstanding and new questions emerging from this research are presented along with topics for future academic study.

## Revisiting the objectives of this research

The main objective of this dissertation has been *to understand what is the relationship, if any, between a teacher's participation in an online community of practice and the development of his or her teaching practice.* To answer this main research question, the following areas also need to be understood:

- How does an online community of practice fit into a teacher's context?
- What are the characteristics of the community that teachers are actively using to develop their practice?
- What are the characteristics of the changes teachers are making to their practice as a result of their participation in online communities?

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In asking these questions, this study has tried to understand why, with all the other resources available to the sampled teachers, they chose an online community (specifically the Computing at School community) to fill their learning need(s). To do this, the research has tried to provide a picture of the teachers who do use the CAS community, in an effort to understand the characteristics of teachers who might turn to online communities in general, and to this community in particular. It is also important to recognise the specific features of this online community that make it useful for teachers, such that the community is active, growing and self-sustaining. Finally, the research needs to understand the ramifications in terms of a teacher's teaching. What kinds of changes are being made to teaching practice, if any? In other words, is all the work that is involved in planning, developing, populating and sustaining an online community – along with the efforts to recruit teachers and encourage them to participate – really worthwhile? The sections that follow use data from this study to provide answers to these questions.

## Outlining the context of a CAS teacher

To understand how the Computing at School community becomes part of a teacher's context, it is first necessary to define a CAS teacher's context. Data from the survey of 920 CAS teachers indicate that all CAS teachers surveyed teach computing at either a primary or secondary level. The sample is somewhat equally split between men (53%) and women (47%) who have an average age of 41 and have been teaching, on average, for 13 years.

The teachers sampled for this study are frequent users of the CAS community, with 49% of them saying that they visit it once a week or more. Interviewed teachers confirmed that they access the community via their computer or their mobile phone, from home and from school. Teachers look at the site when they have a specific need or question, when they are planning, habitually (when they arrive at school each morning) or when they are simply bored or have a few spare minutes. According to the survey, the number one reason that teachers said they are motivated to log in to CAS is because they have seen something in the regular notification email and want more information. In fact, 63% of teachers said that they navigate directly to CAS by clicking a link in this notification email.

### CAS teachers' access to external resources for teaching computing

CAS teachers, in general, have access to similar resources in terms of the hardware and software necessary to teach computing, as well as resources for their own development. All interviewees reported that their schools provide a certain level of professional development during the school year for all staff, most often in the form of inset days or "twilight" sessions after school. The content of this professional development is not subject-specific, however. Training is usually devoted to general pedagogy, school improvement, safeguarding and care issues.

The variation in teachers' access to resources can be seen when Ecology of Resources filters are considered. For example, school leadership support for computing and the school budget can be powerful filters that prohibit or allow the purchasing of equipment or licensing of software needed to teach computing. Some teachers interviewed worked at schools with robust computing labs and more equipment than their colleagues at other schools, some of whom reported installing software on only a few PCs which students shared, due to a lack of funding. Leadership support and budget were also relevant factors in the decision as to whether teachers had access to certain professional development offerings. Some teachers spoke of not being "let out" often, meaning their leadership would not provide supply cover for them to attend off-site professional development. Others mentioned a lack of budget or prioritisation for computing as a subject in school. Some interviewees, however, spoke of their school leadership being quite supportive in terms of trusting the computing teacher's judgement to make purchasing and development decisions for himself or for his department.

### The "learner resources" available to CAS teachers

The resources that CAS teachers bring with them to a learning situation include things like their past education, knowledge of and skills in the subject area, their motivation, attitudes and beliefs. The majority (2/3) of CAS teachers surveyed report that a Bachelor's degree is the highest level of formal education they have achieved, although the subject in which they earned the degree is not known. Interviewed teachers also reported similar motivations for seeking out development to improve their teaching, including having:

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- a passion for learning or the love of a challenge,
- an immediate need for their teaching or curriculum development,
- a gap in their own understanding or knowledge or
- an identified need from their students.

Beyond these parallels, the learner resources that CAS teachers possess seem to be related to the

profile to which they can be assigned based on their previous work experience. The profiles that were

developed based on the interview data and their relation to learner resources are described below.

- Teachers belonging to the **Industry profile** have worked in the computing or computer science industry prior to entering the teaching workforce. All but one report having a positive attitude towards the revision of the computing curriculum and that they were comfortable that they had the content knowledge necessary to teach the subject (although two admitted being a bit "rusty" in some areas). They report more of a need around learning the pedagogy of teaching computing. Teachers in the industry profile have access to a wide range of people to whom they can call on for advice or support, including colleagues from industry and other CAS members.

- Teachers who are part of the **Computer Science teaching profile** have taught computer science as a subject for longer than five years. Again, the majority of these teachers felt the change to the computing curriculum was positive, although one teacher had mixed feelings. In terms of content, most CS teachers reported that although they needed to refresh their content knowledge, they were prepared to teach the content of the computing curriculum. No teachers in this profile mentioned anything about the pedagogy of teaching the subject. Like their Industry colleagues, CS teachers have a broad network of others on whom they can call when needed, including teachers from local schools with whom they have developed relationships over time.

- Teachers in the **Neither profile** did not work in industry and have not taught computing or computer science for more than five years. They may be new teachers, or they may just be new to computing, having come to the subject from any number of other areas, including ICT. Only half of the six teachers in this profile believed the switch to the computing curriculum was a good idea, and only two felt they were prepared for this change. Also, unlike their colleagues in the other two profiles, these teachers were less likely to report having colleagues outside their schools – either inside or outside of the CAS community – on whom they could call if they needed support.

It should be noted that these profiles are unique to teachers of computing and might not be applicable

or relevant to teachers of other subject areas. Individual subject areas and their corresponding online

communities should be examined separately. In terms of computing, a teacher who had previously been

in industry would have built and applied valuable skills over time that they could use directly in their

teaching. In other fields, such as history for example, there might not be an easily-identifiable

corresponding professional field. The unique qualities of CAS teachers, their subject area and the CAS

community that supports them are discussed in the following sections.

## How does CAS become part of a teacher's context?

The data summarised thus far provide a picture of the context of a CAS member, the resources to which

he or she already has access and the relationship of some of those resources to a teacher's profile. To

understand how CAS becomes part of a teacher's Zone of Proximal Adjustment as a resource that is

used to fill a learning need, it is also necessary to examine those characteristics that make CAS teachers

different from teachers of other subjects – those teachers who might not turn to CAS for help with their

teaching. The data revealed information about the computing curriculum and its teachers that might

influence the likelihood that a computing teacher would become a member of CAS.

### CAS teachers share an urgent need for computing support

First, CAS teachers all teach computing, and CAS as a community was designed with the objective of

supporting the teaching of computing across the United Kingdom. The change to the computing

curriculum was new for all teachers in 2012, and many teachers interviewed reported having very little

time to prepare for implementing the curriculum. Teachers described preparation as involving the

following tasks, amongst others:

- Familiarising oneself with the computing curriculum, how it differed from what was currently being taught and the outcomes on which students would be assessed.
- Developing a plan for the computing classes to be offered at one's school or college.
- Creating a scheme of work, lesson plans and the necessary resources (in terms of homework or classroom activities) for these classes.
- Purchasing or licensing the necessary resources for students to use in class.
- Assessing skills, identifying gaps, and finding resources for training or skill development for themselves and/or their departments.

Some teachers reported that they started to introduce elements of the new curriculum into their

existing classes prior to launch in order to develop and present the new course modules little by little

over a period of time. These teachers were in the minority, however. Most teachers had a few months

or even weeks to prepare, and no advice from a teacher or leader with computing expertise within the

school. Thus CAS, with its promise of free resources, training and access to other teachers around the

United Kingdom who were "in the same boat" became an appealing option for support for computing teachers.

## The field of computing – and the curriculum – are constantly changing

The CAS community has continued to grow and thrive partly due to this urgent need from its members, and partly because, as Harry, one of the interviewed teachers in the Industry profile, said: "Where everybody goes is the place that everybody goes. Because everybody goes there, it's the place that everybody goes." In other words, computing teachers join CAS because they know that most other computing teachers are members of CAS. The community and its content are also trusted by CAS members; an overwhelming majority (89% or more) of surveyed teachers agree that they trust the resources and discussions that are on the CAS community.

Would an online community for teachers of subjects like English or mathematics have the same success? Data from CAS teachers, at least, indicate that part of the success of CAS is due to the subject area it supports. The computing curriculum is not only new, it is constantly changing due to the continually evolving nature of the field of computing itself. New technologies are being developed every year, along with new languages to program them, and students need to know how to use them. At the same time, other technologies and programming languages are becoming obsolete. The content of mathematics education or English literature, by comparison, does not change as frequently. Due to the persistent development of the computing field and the curriculum, CAS teachers return to the site for new resources, training or information about the changing exams for their students.

Teachers observed that the fact that CAS is online allows it to keep up with the developments in the computing curriculum and the larger field of computing. The resources available on CAS can change in reaction to changes in the computing curriculum. In addition, if the computing curriculum changes, CAS members will be experiencing these changes together, at the same time. John, one of the interviewed teachers in the Neither profile, noted the usefulness of an online site in comparison to a more traditional training resource, saying:

> *I suppose the fact that it's online rather than a book, you know, it's relatively current and its scope is much bigger.*

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Therefore, since CAS is an online community that is continually updated by its members, its resources can change from day-to-day and stay current with the changes in the field or in these teachers' practice.

## CAS teachers are familiar with technology

In addition, one of the challenges facing online communities for professional development could be the user's confidence level with interacting in an online forum (Chen & Chen, 2009; Carr & Chambers, 2006). As discussed in Chapter 8, some interviewed teachers mentioned that their lack of confidence in the subject area discouraged them from posting resources of their own creation or adding to a discussion on CAS. Yet these teachers continue to log in to CAS frequently, read discussions, search for events and download and use resources in their classrooms. Therefore, even though they may not participate, they are still visiting and using CAS for their own learning needs. In addition, many of the teachers who do not participate online, report being active with in-person events. Kati, for example, reported never posting to the online community due to her lack of confidence. However, she manages her region's CAS hub, communicating with teachers in the area, organising the hub meetings and their agendas.

Although all CAS teachers might not be computer programmers, all are currently using technology in their work as computing teachers. It can be assumed that some, who have been computer science, ICT or IT teachers in the past, have been using ICT in their teaching for some time. It is difficult to generalise about the primary teachers on CAS, as they were not part of the interview sample, but those who attended the CAS hub meeting for primary teachers, in Reading, all proclaimed themselves to be the teachers at their schools with the most interest in and aptitude for the use of technology in teaching. Thus these teachers might have a familiarity with the use of digital resources, such as online communities, that teachers of other subjects might not have. As Steve said:

> *I think the subject lends itself – it's quite handy having basically a web-based community – it seems to work quite well. And there's lot of people that are obviously used to working like that.*

Even those who expressed that the content on CAS did not always meet their needs often mentioned other online communities (such as Facebook, Teach-ICT or Twitter) as alternative resources to which

they turned when they needed help. Hence computing teachers in particular have a level of comfort with online resources that could add to their motivation for using an online community like CAS for their learning needs.

## Summary

Therefore, the CAS community becomes a part of a computing teachers' context because the teachers have an urgent need for the kind of resources that are a part of the community. In addition, there is an awareness on the part of computing teachers that CAS is the community to which their peers belong. CAS teachers, as teachers of computing, might be more naturally inclined to look to an online community for support and, due to their skills using technology in their work, might be more comfortable participating in an online forum than teachers of other subjects.

## What do we know about the Computing at School community?

The CAS community, its origins and the online and in-person elements were described in detail in Chapter 6. The data collected for this dissertation reveal an online community of 23,597 members (as of 19th July, 2016) that is continually growing. The online community is designed with spaces for discussions grouped by topic and audience, an area to advertise upcoming events hosted by CAS and others for computing teachers, as well as an area for resources uploaded by other teachers. The resource area is the most popular with CAS members, with 62% of surveyed teachers saying that the area of the site they visit first is the resource area. Furthermore, 72% of teachers responding to the survey noted that a CAS resource uploaded by another teacher has prompted them to make a change in their classroom teaching.

Yet the CAS community, as its organisers take pains to point out, is not simply an online resource. CAS provides ample in-person resources for teachers, in the form of regional hubs, an annual conference, training and the Master Teacher programme. Many interviewed teachers who attend these events report finding them useful for their teaching, but the main emphasis of the CAS community still seems to be the online presence. Only 37% of CAS teachers surveyed report that attending a CAS event has prompted a change in their teaching. Nearly half of the interviewed teachers had never attended or had only attended one of their regional hub meetings. For many of these teachers, the barriers to attending

their local hub meetings were the proximity of the meetings to their schools and the frequency or

conflict in their timing. Furthermore, all of the interviewed teachers who attended hub meetings said

that there was, at the time of the interviews, little to no connection between the hub meetings and the

online community.

## Characteristics of CAS that teachers find useful

Nonetheless, there is much about CAS that teachers find useful for their work teaching computing. First,

CAS is free to use. Many of the other online communities or websites with resources for teachers are

now charging for membership or to download resources. More than one interviewed teacher

mentioned the benefit of CAS being free of charge. Furthermore, not only are CAS resources free to use,

but in most cases they are also devoid of the bureaucracy that is currently associated with many

professional development resources in schools. Sarah noted that, for an urgent gap in her knowledge or

skills, she turns first to CAS as she does not have to endure the time-consuming administrative

paperwork that is required by her school, in order to get approval to take in-person training. In fact, six

of the interviewed teachers identified CAS as the first place they look when they need help or have a

question about their work.

Many teachers also mentioned the fact that most of the resources on CAS are created by teachers and

have already been tested in the classroom. This appeared to contribute to the feeling of trust that

teachers have in the quality of the resources on CAS. As Stuart said:

> *[The resources] are created by teachers. I think that's a lot more useful. Because
> there are resources out there you can go and get, kind of professional resources, but
> very rarely are they kind of written or created by teachers. They look very pretty, but
> they're not really practical. Um, for CAS I like it because all the resources are created
> by teachers. You know they've been used and they're effective.*

CAS is not necessarily better organised than other online communities, as just as many teachers report

that the site is easy to navigate as those that say that it is especially difficult. However, the regular email

digests, whose frequency can be set by users, have proven extremely useful in both getting teachers to

the site, as mentioned previously, and in maintaining their interest. Many CAS teachers mentioned their

disdain for large companies offering training and inundating them with advertising emails or flyers. CAS,

along with being a grass roots organisation of like-minded individuals, rarely sends communication

directly to its members and allows them to determine how frequently they would like to receive

automatic notifications from the site.

## Characteristics of CAS that resemble a community of practice

As discussed in detail in Chapter 8, it can be said that CAS is a community of practice. Members of the

CAS community are working towards a shared goal: to improve the teaching of computing for learners

in this country. As such, they are all individually working to improve their own practice and collaborating

on shared practice. On the community, their interactions show evidence of a shared vocabulary and

understanding, meaning that explanations and introductions to their topics or questions are not

necessary. Interview and discussion transcripts provide an indication of relationships developing

between other members. It is somewhat more difficult to determine whether these relationships are

sustained over time, but the conditions on the site and the shared culture of the members certainly

make possible the building and ongoing nurturing of relationships amongst members. Finally, some

interviewed teachers exhibit evidence of transforming from novice to master through their interactions

as part of the CAS community.

However, data also indicate that CAS does not act as a community of practice for all its member

teachers. Even though the interviewed teachers and, to a lesser extent, the surveyed teachers are fairly

frequent users of CAS, not all of them actively participate. Few of the interviewed teachers classified

themselves as being both active contributors to and consumers of the online community. Some of these

teachers participate in in-person events rather than online, but others use CAS simply as a content

repository, from which they can download resources for classroom use. Wenger's three components of

a community of practice are Domain, Community and Practice. CAS teachers may receive training or

read discussions that provide them with new knowledge or a different understanding of a topic, but if

they are not contributing to shared practice and interacting with other community members, it cannot

be said that they are part of a community of practice.

Summary
Thus, while only a percentage of CAS teachers use CAS as a community of practice, there are other

features of CAS that form part of its appeal to teachers. CAS provides push notification to teachers

which remind them of the community to which they belong and signal new resources, discussions or

events in which they might be interested. Teachers can set the frequency of these email notifications

and can click hyperlinks directly in the emails to navigate to the particular topic in which they are

interested. The resources and fellow members of CAS are trusted by CAS teachers and are available free

of charge. Teachers know that when they download a resource they are not only saving themselves

time, but they are also getting a resource that has been created, tried and tested by a fellow computing

teacher.

## What is the relationship between teacher participation in an online community of practice and the development of a teacher's practice?

The Computing at School online community and, indeed, the overall initiative around the computing

curriculum have as their objectives to support and improve the teaching of computing in schools.

Therefore to measure the success of the online community, it is necessary to measure success against

this objective (Avis & Fisher, 2006) and understand the impact that teachers' participation in this

community has on their teaching. As Chapter 8 notes, the data collected in this dissertation do not

include student data; hence no comments can be made on whether participation in CAS promotes high

quality teaching in terms of improving student achievement. What the data from this study do

demonstrate is that, for a percentage of the computing teachers who are CAS members, the CAS

community does play a role in the development of these teachers' knowledge, skills and practice. But

the answers to these research questions described in detail in Chapter 8 indicate that not all CAS

teachers are interacting with the community in the same manner. For some, CAS is a community of

practice in which teachers can collaborate on practice that contributes toward a common goal shared

by the other members. In so doing, these teachers can develop their own skills and competencies and

may be able to mature from a novice to an expert in certain areas. Meanwhile, other teachers see CAS

as simply a content repository for high quality, free resources that have been developed and tested for

other teachers and are ready for classroom use. Still other teachers, of course, use CAS for both

purposes.

Does it matter if teachers use CAS as a community of practice or a resource bank? To answer the

research questions in this study: yes, it does. The central research question asks for an identification of

the relationship between a teacher's participation in an online community of practice and the

development of a teacher's practice. The word "development" is very important. If this study only

sought to understand the relationship between teacher participation in an online community of practice

and his or her teaching practice, then whether teachers use the community as only a site from which

they download resources would be irrelevant. Both the teachers who actively participate in CAS as if it is

a community of practice and those who simply visit the site to obtain resources could be considered to

be interacting with the site in a way that impacts their teaching. However, as discussed in the previous

section, only some teachers are using CAS in a way that impacts their own development as teachers of

computing. To examine this further, it is necessary to revisit the theories upon which this research is

based:

- The zone of proximal development (ZPD) is the difference between a learner's capacity for development, and the level of development he or she can reach with the help of a more able other (Cole, 1985).
- The zone of available assistance (ZAA) is the collection of resources that could be available to a learner to fill his or her learning need, and the zone of proximal adjustment is the subset of the resources in the ZAA that suit the learner's needs at that time (Luckin, 2010).

CAS teachers who are responsible for implementing the new computing curriculum have many needs

that are vital to their teaching practice. These could include actual learning needs, such as learning a

new programming language or an understanding of the sequence in which topics need to be presented

to students. Many teachers are turning to CAS for these learning needs and, as such, CAS becomes a

part of the teachers' ZPA and the resources, training and people the teacher finds on CAS act as a more

able other, increasing the development potential of the CAS teacher beyond that of which they are

inherently capable.

Other teachers are using CAS to fill a need that is not necessarily a learning need. These teachers might be searching for a lesson activity that they can use in class or they could be looking for a quick answer to a problem that they can provide to students without fully understanding it themselves. CAS also fills this need for these learners, but not as a part of their ZPA. In acting as a resource bank, for example, CAS is not aiding in the development of these teachers and does not represent a more able other.

### Explaining the differences in usage of CAS

The reasons for these differences in use can be partially attributed to the role that filters play in allowing or preventing a teacher's access to CAS resources. Filters, such as teacher content knowledge, self-efficacy or confidence, influence whether teachers feel comfortable participating in the CAS community and whether they turn to other sources for the development of their practice. For in-person events, such as hub meetings or training, proximity or frequency of the events, cost, support of the school leader and the relevance of the event for the teacher's individual need are all filters that could impact on participation.

In an effort to understand the variation in teachers' usage of CAS, data were examined to understand whether a correlation existed between a teacher's profile or background work experience, and whether he or she used CAS as a community of practice. Data from Chapter 8 show a possible connection between teacher profile and some of the filters mentioned earlier, such as teacher's knowledge and skills. Unfortunately, the data were insufficient and the sample too small to allow any conclusions to be made. This could be a topic for future research.

### Summary

This research provides an understanding of the context of the teachers who actively participate in an online community of practice, the Computing at School (CAS) community. The community participation includes the resources that exist as a part of the teacher's Zone of Available Assistance, their own personal learner resources and the filters that might influence whether CAS and its resources become a part of the teacher's Zone of Proximal Adjustment. The study considers the features of a community of practice that are exhibited by the CAS community, as well as the special characteristics and needs of teachers of computing and how an online community in general, and CAS specifically, is able to meet

those needs. It examines the specific features of CAS – online, in person, free of charge, trusted and teacher-created – which teachers report being the most valuable to their teaching. Finally, it looks at the self-reported impact that CAS resources have on teachers' classroom practice and their own personal and professional development as teachers of computing.

The research finds that there is a relationship between teachers' use of the CAS community and their own development, if the community becomes part of a teacher's ZPA. It is important to note that this does not occur for all teachers who were part of the sample, and whether CAS and its resources enhance a teacher's skills or simply provide an activity for tomorrow's lesson is influenced by a number of filters, which could include a computing teacher's previous work experience. Data indicate that the profile to which a computing teacher belongs, according to their previous work experience, shapes other resources to which they have access for their development. These resources include the network of people on whom they might call for assistance, the teachers' own knowledge and skills in computing and their attitudes towards the computing curriculum. Finally, the study finds that CAS does act as a community of practice for some of its members, enabling them to engage in shared practice with others who have a common goal.

In short, the founders of CAS are meeting their objectives in supporting computing teachers in their implementation of the computing curriculum, regardless of whether these teachers use CAS as a community of practice. The function of CAS as both a COP for those teachers who want that kind of interaction, and as a resource bank for those who are only comfortable with that level of participation, makes CAS more appealing to a wider base of teachers. This ensures that more computing teachers have access to the high-quality resources within CAS to help their teaching.

## Contributions to the field

Elements of the research in this doctoral dissertation can be said to have made contributions both to the development of the theoretical frameworks employed and to the body of literature on online communities in general and those used as professional development for teacher in particular. The following sections discuss these contributions.

## Contribution to literature

After years of conducting research to determine whether online communities could be an effective

vehicle for delivering professional development (PD) to teachers, today researchers tend to agree that

online communities do prove beneficial in providing PD to teachers, some even going so far as to claim

that teacher participation in online communities can even raise student achievement (Tseng & Kuo,

2014).

The research on online communities reviewed for this dissertation spans the first 15 years of this

century. As mentioned in Chapter 3, the terminology used to label online communities varies greatly,

and the research swings widely between networks (Jones & Esnault, 2004), communities of interest

(Holmes, 2013), computer-supported collaborative learning (Falk & Drayton, 2015) and virtual

communities (Baek & Schwen, 2006), among others. Some research labels online communities as

communities of practice without any evidence of how they adhere to Wenger's principles (Duncan-

Howell, 2007; Wang & Lu, 2012). Studies look at limited groups of teachers, such as those new to the

profession (Kelly et al, 2014), or those still in training (Kim & Cavas, 2013) or specific aspects of the

technology, such as Twitter (Kim & Cavas, 2013), wikis (Sheehy, 2008) or blogs (Liu, 2012). Research

often focuses on a certain aspect of an online community, such as its sustainability (Bruckman & Jenson,

2002; Hanewald & Gesthuizen, 2009), the strength of the ties between members (Jones & Esnault,

2004; Schlager et al, 2009; Thorpe, 2009) or how the online interactions compare with those of an in-

person community (Kelly et al, 2014).

This dissertation is a broad piece of research that learns from many of these topics and others from the

literature on online communities in order to discover how teachers' participation in an online

community of practice is related to the development of his or her teaching practice. Because the

development of teachers' practice is key, the work begins in a manner that is different from many of the

aforementioned studies by selecting a community that teachers had already reported as being one that

was influential in developing their practice. The study then endeavours to understand and describe the

characteristics of the community that make it useful for teachers, as well as those that might act as

barriers to teachers' access to the resources within the community. In so doing, the data and analyses

are able to answer whether the CAS online community can be considered a community of practice, and if so, what impact does that has on teachers' development.

Using the ecology of resources (EOR) framework and mapping out all of the resources available to the learner reveals how the CAS community becomes part of a teacher's Zone of Proximal Adjustment, and as such, how it might act as a more able partner in supporting the teachers' development beyond that of which they might be capable on their own. The EOR mapping exercise also reveals the connection between the teacher's background characteristics and his or her access to support resources inside and outside of CAS. Examining the EOR map for CAS teachers exposed the intersection between the offerings in the CAS community and its members' learning needs. It is this point of intersection that provides data on what makes CAS useful to so many teachers. Uncovering these data then enables the creation of guidance for developers of online communities on what specific features are and are not useful for teachers as well as the identification of topics for further research.

This research also considers the self-reported changes that teachers are making to their practice at a variety of levels. Data indicate that the kinds of changes teachers are making as a result of their participation in CAS could be something as simple as trying out a new activity in a lesson. Other teachers who are using this online community of practice to fill a learning need might interact with a resource in a way that changes their understanding of a certain topic or significantly alters the way they might have otherwise taught it.

## Contribution to theory

The two theoretical frameworks used in this dissertation, the community of practice framework (Wenger, 1998) and the ecology of resources framework (Luckin, 2010) were both adapted before being applied to the analyses conducted for this research. As mentioned in Chapter 6, Wenger's own thinking around what constitutes a community of practice (COP) has evolved over time as his work began to cross professional boundaries and move from academia to industry. Research on COPs since 1998 were used as a guide to developing a system for identifying whether the CAS community exhibited such

characteristics. Wenger's earlier works (Wenger, 1998; Wenger et al, 2002) informed the creation of the COP codes that were used to analyse the CAS community.

In this regard, although the COP framework was adapted slightly for this study, there were decades of research from which to learn and the framework itself was not altered upon application. Rather, Wenger's own criteria for classifying COPs from his earlier work were applied to help identify and describe the elements of domain, community and practice in the CAS community.

The ecology of resources framework is a much newer theoretical framework, as discussed in Chapter 3. As such, there are fewer examples of its use in research studies, and many of those that do exist involve the development of learning technologies rather than the review of technologies currently in use. The EOR framework was thus more significantly adapted for use in this study, and some suggestions could be made to improve its applicability in future studies.

In this study, the EOR framework was used to create a map of the learner's resources to ultimately reveal how the CAS community became part of the learner's Zone of Proximal Adjustment, and the filters that acted as barriers or catalysts for CAS acting as a more able partner in supporting the learner. This required adaptation from its original intended use in three distinct ways. First, several steps in the EOR framework were omitted from this study, as described in Chapters 6 and 7, because they were more relevant to the development of a technology application than the review of one. For example, Phase 3, which involved developing scaffolds and adjustments, was not used as it involves assessing the quantity and quality of interactions between the learner and possible more able partners, as well as the level of scaffolding that was taking place. These data were not only unavailable, but they were unnecessary to answer the research questions.

Another change involved categorising or grouping the filters that were observed. Such categorisation can be observed in Table 7.7 in Chapter 7. Some filters influencing teachers' access to any support resources, regardless of the teachers. Examples of these filters might be the time the teacher has available or the cost of the resources. Others might be specific to the resources, such as the physical location, timing or frequency of an in-person training or event, or the ability of the teacher to get supply

cover for his or her time out of school. Still others relate to the learner him or herself. In this study, it was determined that a teacher's background work experience acted as a filter to his or her access to specific support resources. A teacher's own knowledge and skills, beliefs, confidence or learning needs are other examples of this kind of filter.

Finally, the ability to emphasise certain filters is important and is not available in the current EOR framework. Some filters, such as a teacher's access to computing equipment (software or hardware) resources at his or her school, does not seem to act as a barrier or a catalyst to his or her own development or influence their teaching practice. Conversely, the computing exams are an important filter. According to interview data, teachers shape their schemes of work and development of the computing curriculum on the content that will be on their students' exams. Those teachers who reported limited school budgets still had to teach the same topics and programming languages as their more fortunate colleagues. One teacher reported buying as many software licenses as she could and shaping her teaching so that her student shared the few computers that had the software installed. In other words, the lack of software was a less influential filter than the content of the computing exam in terms of shaping the teacher's practice and her need for support in teaching the topic.

The EOR framework proved valuable in identifying how and why the CAS community addressed the learning needs of some teachers while proving less useful for others. It might be that two versions of the EOR framework could be produced in the future: one for the development of new technology for learning and a second for the review of existing applications.

## What this research says about developing online communities of practice for teachers

As the literature discussed in Chapter 3 suggests, learning communities for teachers – including online communities – could be beneficial professional development venues for teachers, in terms of allowing them to share with and learn from the everyday experiences of their peers (Vescio et al., 2008; Darling-Hammond et al., 2009). Online communities and online communities of practice use technology to link members without requiring them to meet face-to-face (Hoadley, 2000), which is useful for teachers who have trouble taking time away from their classroom for professional development. The asynchronous

nature of technology allows teachers to participate when they have free time, to edit their contribution so that they feel confident about it and to participate at a level with which they feel comfortable (Chapman et al., 2005; Carr & Chambers, 2006). Membership in an online community can also alleviate the sense of isolation that many in the teaching profession experience (Chapman et al., 2005).

## What can CAS tell us?

In these ways, the Computing at School online community should be beneficial for teachers' professional development. The design of the CAS community also presents several other advantages for teachers, according to previous studies of online communities. For example, one of the most significant challenges of online communities in general is one of trusting the other members and resources that are part of an online community (see, for example, Thorpe, 2009; Wenger et al., 2002; Kirkup, 2002). As data from this study indicates, CAS members have a <u>high level of trust</u> in their fellow members, the responses they provide to questions and the resources they post to the community. This could be because CAS teachers form part of the same domain and as such are under the same pressures to succeed at similar work. Teachers on CAS are "in the same boat" as more than one interviewee noted.

However, there are certain aspects inherent in the design of the CAS community that also influence the level of trust members have for each other in CAS. First, the CAS leadership has made a concerted effort to <u>incorporate in-person events</u> into the CAS community. The literature notes that combining in-person and online interactions can aid in the knowledge exchange that is possible between members (Sheehy, 2008; Dubé et al., 2006). As several interviewed teachers noted, when they are able to meet other teachers face-to-face, it becomes easier to build and sustain an online relationship.

Wenger et al (2009) note that one of the pitfalls of online communities of practice is that members might become distant or forget that the community even exists. This is combatted by CAS with the <u>regular notification emails</u>, which the majority of teachers say is the number one reason motivator to access CAS. <u>CAS hub meetings</u> also connect a group of teachers in close proximity to each other, who then receive update emails from Hub leaders on topics of interest or future hub meetings.

Teacher participation in online communities of practice

The <u>technology platform</u> itself is paramount to the success of the online community. Wenger et al (2009) recommend online communities have a "digital steward" who intimately understands the needs of the members of the community and can shape the platform of the community to meet those needs. Even though the development of the CAS site is done by volunteers, the online community platform has evolved to address the growing community. Features to aid in the tagging and organisation of resources and to encourage participation in discussions have been added along with others that were directly suggested by CAS members. In this way, the CAS online community also differentiates itself from the failed Microsoft teacher community discussed in Chapter 2.

## Limitations of this research – and of the Computing at School community

This research only provides data on those CAS members who participate in the research, either by responding to the survey or participating in interviews. Although these teachers report frequently visiting the CAS community, the CAS leadership team reported that only a "very small proportion of CAS members access the online community on any given day".[42] This would suggest that the majority of CAS teachers are likely not to be represented by this study's sample. As such, this research does not provide data on teachers who are not active participants in CAS in terms of their context, the resources available to them, and whether they find CAS useful in the development of their teaching practice. Conducting a similar study with a random sample of CAS member teachers could be a topic for further research, as discussed later in this chapter.

In addition, once the interviewees are separated into profiles, the sample sizes are too small to make any definitive statements as to the relationship between these teachers' participation in CAS and their prior work experience. As stated several times in this thesis, the impact of a computing teacher's background on the resources available to him or her is a theory that needs further research with a larger sample to verify.

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[42] See Question 17 in the survey questionnaire, which can be found in Appendix A.

Issues with CAS

While this study shows that participation in CAS does appear to have a relationship with the development of *some* of its member teachers, the data in this study is unable to quantify what percentage of CAS members experience this benefit. As a result, this finding cannot be used to measure the success of the CAS community. Although this study reveals that it is possible for teacher participation in an online community to influence their teaching practice and the development of their practice, it is still unclear whether CAS, as an online community, can be deemed a success.

To measure the success of an online community, one must consider whether it is meeting its original objectives rather than simply reporting on growth in membership over time (Avis & Fisher, 2006; Falk & Drayton, 2015). When the original grant was given to CAS by the Department for Education in 2012, the objective they assigned for CAS was to create "a network of excellence" around the teaching of computing. In 2016, the CAS website listed the purpose and mission of CAS as being "to provide leadership and strategic guidance to all those involved in Computing education". It is not clear how success is measured against these two objectives and, at first glance, data from the CAS National Survey, whose results were reported in Chapter 6, do not appear to address this.[43]

The issue of whether CAS can and does provide support for all of its members is one that neither this study nor the CAS national research addresses. The teachers who are not part of this sample - teachers who are new to computing, who have moved from teaching ICT or another subject area, who are not confident in their abilities and who do not actively participate in CAS - are not studied here. It is not evident that CAS meets the needs of these teachers or that the community becomes a part of their ZPA. Indeed, some of the teachers interviewed in this study and classified as belonging to the Neither profile, expressed negative attitudes towards the computing curriculum, confessed to only using CAS as a resource bank and tended to go to other communities (such as those on Facebook) for support. It would seem that CAS is not meeting the needs of these teachers. It would be interesting to understand first

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[43] The CAS National Survey data available for this research dates from 2015. It is possible that the 2016 survey addressed success measures, but these data were unavailable to the researcher.

Teacher participation in online communities of practice

what percentage of the CAS user base these teachers constitute and second, what CAS could do to be

more welcoming and useful for these teachers.

## Next steps for further research

The findings from this research pose many new questions and offer suggestions for further research

into online communities for teachers and the CAS community itself.

*Increase sample size*

In terms of research on the CAS community, it would be interesting to launch a second survey, similar to

the one used in this study, that also includes a question about teachers' previous work experience.

Having data from a larger sample size on whether teachers came to teaching computing from industry,

with previous experience teaching computer science or with neither of these profiles would enable

further development of the teacher profiles suggested by this research, to determine whether they are

indeed valid and, if so, what CAS can do to address the diverse backgrounds of its users. This revised

survey, coupled with further interview questions probing into whether teachers use CAS as a

community or practice, could also determine whether a correlation existed between a teacher's profile,

or background work experience, and whether he or she used CAS as a community of practice.

*Draw from a different sample of CAS teachers*

As mentioned, the sample for this study consisted of those teachers who are relatively active

participants in the CAS community already. Many of these teachers have been long-term members of

CAS who were also early adopters of the computing curriculum in their schools. Thus they might be

more comfortable with the content, setup and culture of CAS. For the success of the computing

curriculum in the United Kingdom, it is vital to study those teachers who did not respond to this survey

or the CAS National Survey and who are not active participants in CAS. To better support these teachers

and improve the teaching of computing across the country, it would be important to understand the

Ecology of Resources of these teachers, in terms of their knowledge and skills, learner resources,

resources in their ZAA and ZPA, and what filters are preventing CAS from being part of their ZPA.

*Look at changes to CAS since the data were collected*

Since the data for this study was collected, the regional hub programme and the Master Teacher programme have developed and become more robust parts of the CAS community. Although hubs were discussed in this research, the Master Teacher programme was not. No interviewed teachers provided more than a passing mention of a Master Teacher, thus it was not explored in more detail for this research. As development of a Master Teacher programme was also one of the original objectives of the CAS community, an analysis of this programme and how it contributes to teacher development and teacher participation in CAS would also be interesting.

*Examine student achievement data*

Student achievement data were not collected as a part of this study. If creators of the CAS community want to understand whether CAS is truly impacting the teaching of computing, research needs to be conducted that includes student data. There are many different ways in which such a study could be designed, and many teacher and school variables would need to be considered. However, such a study could provide a more definitive picture of the success – or not – of the CAS community.

*Study online communities for teachers of other subjects*

In terms of the findings about online communities for teachers in general, it would be interesting to conduct a similar study with teachers from other subject areas different to computing. This would help understand whether computing teachers are more likely to turn to online communities for professional development than teachers in other subject areas. It would also help to understand how professional development providers or subject associations might provide online support at scale for teachers of different content areas.

*Examine data from this study regarding the UK computing curriculum*

Finally, there was a substantial amount of data from this study that provided a picture of the naissance of the implementation of the computing curriculum. These data should be examined in order to learn from the successes and failures of the introduction of the curricula into England's schools in particular. CAS leadership, the Department for Education, schools and teachers could learn from the successes and failures of their colleagues with this experience.

## Conclusions for this researcher

If we return to Chapter 2 and the description of the teacher network that served as the inspiration for this research, the findings discussed in Chapters 8 and 9 reveal why the Partners in Learning Network (PiLN) had no chance of success. The "community" of teachers was created to fit a software solution, rather than the other way around. It did not arise organically and teachers from around the world did not have a common goal, a common language or a shared practice. The technology solution itself did not aid in connecting teachers to each other and to resources; rather, the log-in and inefficient search capabilities made these processes more difficult. Most importantly, the teachers had no real need for the PiLN. The objective for creating the community was entirely on the part of Microsoft, who wanted more teachers to use their software. With such an artificial objective, there was no chance for success.

Those of us working on the PiLN suspected that it would never be successful but, at the time, we could not say why. I began this doctoral research while I was still an employee at Microsoft and, as I started reading the literature and planning my research, I began to believe that developing an online community of practice for teachers was an impossibility. This research, and the time I spent with teachers over the years of conducting it, taught me that teachers can and will participate in and benefit from an online community of practice for professional learning, if that community has been developed with their needs in mind.

The aims of well-intentioned individuals or organisations are not necessarily the same as those of the classroom teacher. Organisations creating online spaces for teachers need to be more honest about what they are willing and able to provide to teachers, and how it helps teachers achieve their objectives, if at all.

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## Appendix A: Data Collection

Contents:

A.1: Context Survey from preliminary research phase

A.2: Data for selecting online community for this study

A.3: Survey of Computing at School member teachers

A.4: Teacher consent form and emails for teacher interviews

A.5: Interview schedule

**Online Communities of Practice: Exploring the Relationship between Teacher Participation and Classroom Practice**

*A doctoral research project 2010 - 2016*

**Introduction and Definitions**

This research aims to study whether there is any relationship between teachers' participation in an online community of practice and any changes made to their teaching as a result. As such, I would like to as you about an **online community** that you visit on a regular basis. When identifying this community before our interview, think of one whose primary audience or membership is teachers, and where members actively interact with other members of the community. **Interacting**, in this case, may include discussions between community members and/or the sharing of resources and ideas.

This survey also contains a number of questions about your background and the context, or environment, in which you teach. The survey will also be given to a larger group of teachers within the online community that is selected for the study, and responses to these questions will allow me to look at the specific characteristics of teachers who are participants in this community.

If you have any questions as you are completing this survey, please feel free to contact me: kweatherby@ioe.ac.uk or kriwea@gmail.com.

Thank you for your time.

Kristen Weatherby

**Please answer the questions below in the manner indicated.**

*Please type/write the answer to the following question in the space provided.*

1. Given the definition of an online community to be used in this study, what is the **name** and **address** (URL/Twitter hashtag) of the online community you will discuss in the interview?

---

*Click here to enter text*

---

**Teacher Background Characteristics**

*These questions are about you, your education and professional development and the time you have spent in teaching. In responding to the questions, please mark the appropriate choice(s) or provide written responses where necessary.*

2. Are you female or male?

   ☐     Male

   ☐     Female

3. How old are you?

   *Please write a number.*

   | *Click here to enter text* |
   |---|

   Years

4. How many years of experience do you have working as a teacher?

   *Please round up to whole years.*

   | *Click here to enter text* |
   |---|

   Year(s) working as a teacher in total

5. What is the highest level of formal education you have completed?

*Please mark one choice.*

☐　　　A-level

☐　　　Diploma

☐　　　Bachelor's degree

☐　　　Master's degree

☐　　　Doctoral degree

6. Were you awarded either of the following teacher certificates?
    *Please mark all that apply.*

☐　　　Qualified Teacher Status (QTS)

☐　　　Postgraduate Certificate in Education (PGCE)

7. During this school year, what subjects do you teach?
    *Write in the name of all of the subjects that you teach in the space below.*

Click here to enter text

8. What year(s) are the students that you teach?
    *Please mark all that apply.*

☐　　　Year 7　　　　　　　　☐　　　Year 10

☐　　　Year 8　　　　　　　　☐　　　Year 11

☐　　　Year 9　　　　　　　　☐　　　Sixth Form

9. At what kind of school do you teach?
    *Please mark one option from column A and one option from column B*

| Column A | Column B |
|---|---|

| ☐ State funded | ☐ Comprehensive/community school |
| --- | --- |
| ☐ Independent (public) school | ☐ Academy |
| | ☐ Free school |
| | ☐ Foundation school |
| | ☐ Grammar school |
| | ☐ Sixth form college |
| | ☐ Other |

10. On average, how many students do you have in one class?

    *Please write the average number of students per class.*

*Click here to enter text*

Students

11. Approximately what percentage of the students you teach qualify for free or school meals?

    *Please estimate the percentage of students overall.*

*Click here to enter text*

Percent

12. In the last 12 months, did you participate in any of the following professional development activities?

    *Please mark all that apply.*

☐ Courses/workshops (e.g. on subject matter or methods and/or other education-related topics)

☐ Education conferences or seminars (where teachers and/or researchers present their research results and discuss educational issues)

☐ Observation visits to other schools

☐ Qualification programme (e.g. a degree programme)

☐ Participation in a network of teachers formed specifically for the professional development of teachers.

☐ Individual or collaborative research on a topic of interest to you professionally

☐ Mentoring and/or peer observation and coaching, as part of a formal school arrangement

# Appendix A.2: Data for selecting online community for this study

This appendix contains the complete version of Table 4.2.

| Criteria | #UKEDchat | #MFLTwitterati | Computing at School http://www.computingatschool.org.uk/ |
|---|---|---|---|
| **Main target of community should be primary or secondary school teachers in the UK** | Yes: subject specialisation for topic of Thursday conversation each week | Yes: Focused on teachers of MFL | Yes: focused on teachers of computing in schools |
| | Yes | Yes | Yes/No: Aims to promote the teaching of computing in schools. However, different spaces on the site for teachers, IT professionals and parents, and site advertises that their members include "teachers, academics, industry professionals, school governors, parents, etc. |
| **Community has been active for more than one year.** | Yes: Teacher 1 reports using the community since 2010. | Believe so, but can't verify: Teacher 3 reports using this community for a "long time" | Yes: Teacher 2 reports using this community for about 5 years. |
| | Yes: First weekly Twitter-based discussion was 24 June 2010 | Unable to verify existence. | Yes: White paper forming the Computing at Schools working group was published in August 2010. Unclear exactly when the online community started. |
| **Participation for teachers in this community should be voluntary** | Yes | Yes | Yes |
| | Yes | Yes | Yes |
| **Community should have more than 1000 members** | Depends on the topic that is discussed each week. Could be 50, could be much larger. However, small percentage of teachers are actually on Twitter | Small percentage of MFL teachers are actually on Twitter | "A few thousand, I think" |
| | Anyone can use or follow the hashtag, so it is impossible to verify unless you count the unique tweets each week. As an example, during a 2 hour period on 13/01/15, there were 50 tweets to the hashtag from 39 unique contributors | Anyone can use or follow the hashtag, so it is impossible to verify unless you count the unique tweets each week. As an example, during a 14 hour period on 13/01/15 there were 50 tweets to the hashtag from 31 unique contributors. | 16,922 are in the community as of 13 January 2015 http://community.computingatschool.org.uk/door |
| **Community should be web-based, and may be a "traditional" online space or may be via social media.** | Yes | Yes | Yes |
| | Yes | Yes | Yes |
| **Interviewed teachers should report having used something from the community to change their classroom teaching behaviour. In other words, teacher(s) report doing something different in their teaching as a result of something they learned on the site.** | YES. 1. Attended discussion on feedback and marking as he was responsible for developing whole-school policy in this area. He answered a few questions and asked specific questions about a particular type of marking (1,2,3 RAG - Red Amber Green). Specifically, he wanted to know the proof (evidence of success) from people who had used this. He looked for resources in this specific area because he needed to make a change and wanted to widen his evidence base and add a new perspective to his thinking on whole school policy in this area. 2. He has also gone to Twitter to geography teachers in particular to ask them to review something that he has developed. | YES 1. MFL teachers on #MFLTwitterati "talk about things that work" especially relating to problems or issues they have in common, such as controlled assessment. This teacher uses the site mainly for resources and ideas about classroom practice "how to employ certain things". All of the individual tools that he has found for students to use and posted to his Pinterest board were found here. 2. He has also used a resource from the community to change the way he has teaches vocabulary. He is now using an API feed provided by SAP to draw a Twitter feed into a PowerPoint slide. As he teaches vocabulary, the children can have their phones out and they can write to a particular hashtag and their comments will appear in real time on the class PowerPoint. | YES 1. Issue in teaching computing is that students are continually asking the teacher for help. Students may be working on a complex task and if they can't get something to work they go directly to the teacher, which is difficult when teachers have classes of 25-30 students. This teacher wanted to help make students more independent. On the community she found a poster of a "green cartoon bogey" with the acronym S.N.O.T. This stands for Self, Neighbour, Other, Teacher and is the order in which students should ask for help. These posters are now hung in every (computing) class and students are directed to consult others first when they have a problem during class. |
| | N/A | N/A | N/A |
| **Elements of Wenger's community of practice framework should be observed or reported on.** | YES. Connections made to people or material resources through the hashtag have certainly provided a lot of personal and professional development to Teacher 1, although it's not clear whether a community of practice is evident within the hashtag "community" itself or whether the hashtag is a catalyst for communities forming organically. "...it's certainly sparked other things in my professional development...and I certainly don't think I'd be where I am today without some of the things and some of the people I've met through UKEDchat." Teacher 1 gives an example of a community of some sort forming as a result of a Twitter dialogue. "I guess a good example would be a couple of weeks ago, which was about geography, and kind of I said something...that turned into kind of a direct message kind of conversation for a little while. ...Then I was like...just email me at my work address...and I'll get back to you with some examples. And that kind of set up like a little informal support network." Teacher 1 speaks of another in-person meeting with colleagues initially contacted through Twitter and says "I found a few people – one local and then someone in [City name] and someone else fairly local. And we got talking about feedback and we were all in the same boat of like, right, we're all here, and the guy, [Name of Person], he's just up the road and he said, look, why don't we just get together in the pub and ...I'll bring along what I've done and we'll just have a chat. And that's kind of what happened, and that was really great. I left that meeting kind of knowing a little bit more and now I'd be confident in defending the policy I've written, and in fact, I've spoken at conference this year about it." Teacher 1 speaks further about being an expert in certain areas himself, saying "I've learned a lot, but also I know I've been in contact with other people through tweeting and into email and into kind of sharing conferences or talks or whatever that I know have impacted on other people as well." | Unclear. Teacher 2 says "I've got no problem with the master and apprentice" but the examples he gives do not actually indicate that he has observed or experience this phenomenon on the hashtag community. | Unclear. Teacher 3 discusses the "badge" system on the site that allows users to get badges for sharing resources or joining in discussions. She seems to imply that more badges = more expertise. However, from her description it seems that these are just indicators of the level of participation and do not really indicate any increase in skill level for teachers. |
| | Need thorough review of hashtag | Need thorough review of hashtag. Although initial review doesn't show much interaction... | Accessed the community on 2 February 2015 and reviewed two sample discussions to see whether something like a CoP might be possible. In these discussions, teachers are able to ask questions in a "safe" environment and get advice from other teachers or others in the field that could influence what they do in the classroom and could further their own development. |
| **Researcher should be able to research the community** | Teacher 1: "I think that would be quite interesting to people to start with." "There'd be quite a few people that I know that would be willing to kind of contribute to it mainly because they are big advocates of Twitter." "I have a feeling the community would be quite supportive of that, yeah." | "Yeah...as I say, the half dozen that I talk to definitely would, and I'm sure that others would as well. Um we could encourage people to blog about it and get the link out there and get it...going, I'm sure." | Teacher 2: "As far as I know you could just sign up, and I think they just verify you who are." "I think it's fine. I think you'll be able to." "I would've thought so. ...some people though when they've got time and joining in discussions and would probably be willing to do a survey I would have thought, yeah." |
| | By design, anyone can look at the conversations occurring by the community members on the hashtag. There is also a website that aggregates the Thursday night conversations, posts other resources, compiles an e-newsletter, etc., and there is an "owner" of UKEDchat who assigns the weekly topic and does some moderation, summarising, etc. It might be necessary to contact this person for permission to look at the site. | By design, anyone can look at the conversations occurring by the community members on the hashtag. | Anyone can look at the website for Computing at Schools, but to actually join the community, you have to apply for membership and be approved. I applied for membership on 12 January 2015 stating my status as an education researcher with the IOE and have been granted access to the community. I communicated with the community owners on 10 February 2015 about my plans for phases two and three of my research. They approved my use of the CAS site on the same date. |

## Appendix A.3 Survey of Computing at School member teachers
**INTRODUCTION and INSTRUCTIONS**

**CAS Teacher Survey 2015**

Introduction

This survey is part of the doctoral research for Kristen Weatherby, a research student at the Institute of Education, University College London. The research aims to study whether there is a relationship between teachers' participation in an online community of practice and any changes made to their teaching. As such, I would like to ask you about your participation in the Computing at School community.
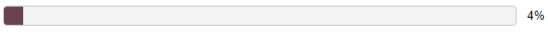
This survey contains a number of questions about your background and your use of the Computing at School (CAS) community. The survey data will be used to inform my doctoral research and will be shared with the Computing at School team so that they might make improvements to the online community. Because this research aims to study teachers' use of the online community, the survey is designed for teachers who are currently teaching and who are members of CAS.

Please answer the survey questions as thoughtfully and candidly as possible. If you have any questions as you are completing this survey, please feel free to contact me at kweatherby@ioe.ac.uk.

This survey will be open for 4 weeks. At the end of each week, all respondents who have fully completed the survey that week will be eligible to win a £25 Amazon.co.uk voucher. If you do not wish to be entered into the drawing for the voucher, you can indicate this in the survey.

Thank you for your time.

Kristen Weatherby

4%

Next

**QUESTION 1**

Response options: Yes; No

**CAS Teacher Survey 2015**

\* Are you currently working as a teacher?

7%

Prev    Next

If respondents answer no, the following text appears: We thank you for your interest but you do not need to continue this questionnaire. This research is studying the participation in the CAS site of current classroom teachers only.

## QUESTION 2

Response options: Yes, I agree; No, I do not agree



**CAS Teacher Survey 2015**

\* The results of this survey will be presented as a whole as part of a doctoral dissertation or academic journal articles. The data will also be shared with the Computing at School management team. Only references to the full set of respondents will be made and it will not be possible to identify you in any way, unless you choose to volunteer for a follow up interview at the end of this survey. Should you choose to volunteer we will anonymise any responses you provide during the interview.

Based on this information, I agree that my survey response can be used by Kristen Weatherby in (and only in) the ways indicated above.

11%

Prev    Next

If respondents answer no, I do not agree, they are taken to the end of the survey: Thank you for taking the time to complete this questionnaire. Should you have any questions, please contact Kristen Weatherby at kweatherby@ioe.ac.uk.
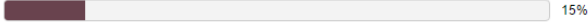
## QUESTION 3

Response options: Female; Male



**CAS Teacher Survey 2015**

About you

**Are you female or male?**

15%
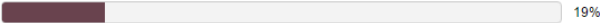
Prev    Next

## QUESTION 4

**CAS Teacher Survey 2015**

About you

**How old are you?**

*Please write a number.*

19%

Prev   Next

## QUESTION 5
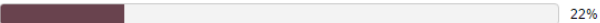
Response options: GCE A levels or below, or equivalent; HNC, HND, NVQ at level 4+, Foundation Degree or equivalent; Bachelor's Degree; Master's Degree; Doctorate

**CAS Teacher Survey 2015**

About you

**What is the highest level of formal education you have completed?**

*Please select one choice.*

22%

Prev   Next
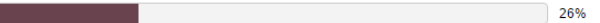
## QUESTION 6

**CAS Teacher Survey 2015**

About you

**How many years of experience do you have working as a teacher?**

*Please round up to whole years.*

26%

Prev   Next

## QUESTION 7

**CAS Teacher Survey 2015**

About your current teaching

**During this school year, what subjects do you teach?**

*Please select all that apply.*

- [ ] I teach primary school
- [ ] Computing (Secondary)
- [ ] Design and Technology (Secondary)
- [ ] Sciences (Secondary)
- [ ] History (Secondary)
- [ ] Maths (Secondary)
- [ ] English language/literacy/literature (Secondary)

- [ ] Art and Design (Secondary)
- [ ] Geography (Secondary)
- [ ] Music (Secondary)
- [ ] Physical Education (Secondary)
- [ ] Religious Education (Secondary)
- [ ] Modern Foreign Language (Secondary)
- [ ] Citizenship (Secondary)

Other (please explain)

[                                        ]

30%
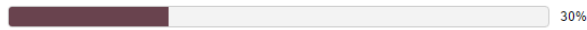
Prev     Next

---

**QUESTION 8**

**CAS Teacher Survey 2015**

About your current teaching

**What level(s) are the students that you teach?**

*Please mark all that apply.*

- [ ] Primary
- [ ] Secondary
- [ ] Middle
- [ ] Further education
- [ ] Sixth form college

33%
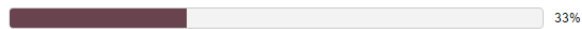
Prev     Next

**QUESTION 9**

Response options: Once a day or more; once a week or more; once a month or more; less than once a month.

**CAS Teacher Survey 2015**

About your use of the CAS online community

**How often do you access the CAS site?**

**Please select one choice.**

[ dropdown ]

37%

Prev    Next

**QUESTION 10**

**CAS Teacher Survey 2015**

About your use of the CAS online community

The following list includes things that might motivate you to log in to the CAS community. Please rank these in terms of what is most and least likely to motivate you to log in to the CAS community, with 1 being most likely and 5 being least likely.

[ ] Saw something in the regular notification email and want more information
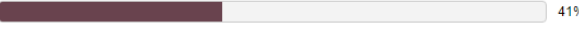
[ ] Want to contact another member of the community

[ ] Need information or have a question or problem regarding a certain topic

[ ] Want to upload a resource or event

[ ] Need to download a resource for classroom use

[ ] Want to respond to a discussion

41%

Prev    Next

**QUESTION 11**

Response options: By clicking a hyperlink in the notification email; By navigating to the URL http://community.computingatschool.org.uk/ in my internet browser; Via a link that appears in social media (Twitter, Facebook, other); Other.

**CAS Teacher Survey 2015**

About your use of the CAS online community

**When you access the CAS community, how do you get there most often?**

*Please select one choice.*

44%

Prev    Next

If other is selected, participant gets this message, with a text box: If you selected Other in the previous question, please explain.

**QUESTION 12**

Response options: Classroom resources that other teachers have uploaded; Discussions about approaches to teaching; Contact with a specific person (local master teachers, hub leaders, another teacher, another CAS member); Information about upcoming events

**CAS Teacher Survey 2015**

About your use of the CAS online community

**When you log in to the CAS community, what do you most often look for first?**

*Please select one choice.*

52%

Prev    Next

**QUESTION 13**

**CAS Teacher Survey 2015**

About the influence of CAS on your teaching

**Has anything you have learned from the CAS community prompted you to make a change in your classroom teaching?**

*Please mark all that apply.*

☐ Yes, a classroom resource uploaded by another teacher

☐ Yes, information from a discussion

☐ Yes, virtual or in-person contact with another member of the community

☐ Yes, attending an in-person CAS event

☐ No

56%

Prev    Next

**QUESTION 14**

**CAS Teacher Survey 2015**

About the influence of CAS on your teaching

**What single CAS resource (discussion, uploaded resource, event, training, contact with another member, etc) has had the most impact on your classroom teaching?**

*Please write the name of this resource below.*

59%

Prev    Next

**QUESTION 15**

### CAS Teacher Survey 2015

About the influence of CAS on your teaching

**Briefly describe why this resource has been helpful to your classroom teaching.**
*(For example: Did this resource teach you something new, answer a question you had or provide a new activity for classroom use, etc?)*

**Please write your response below.**

[                              ]

63%

Prev    Next

**QUESTION 16**

### CAS Teacher Survey 2015

About improving CAS

**How strongly do you agree or disagree with the following statements about the quality of resources or information from the CAS online community?**

|  | Strongly disagree | Disagree | Agree | Strongly agree |
|---|---|---|---|---|
| In general, I trust that if I ask a question in a discussion on CAS, a fellow CAS member will provide me with an answer, idea, or suggestion that is helpful. | ○ | ○ | ○ | ○ |
| Overall, I find the resources I have downloaded and used from CAS to be high quality. | ○ | ○ | ○ | ○ |
| I often use resources I have downloaded from CAS in my classroom teaching. | ○ | ○ | ○ | ○ |
| When I read discussions on the CAS community, I know that I will be getting accurate information. | ○ | ○ | ○ | ○ |

67%

Prev    Next

**QUESTION 17**

Response options: I don't have enough time; My peer group or my area of interest aren't represented in the community; I do not feel comfortable speaking as I am not an expert in this topic; I don't have fast enough internet access, or the site is too slow; Other members of the site are rude, disrespectful or dismissive; Other: (If you selected Other, please explain.)

**CAS Teacher Survey 2015**

About improving CAS

Only a very small proportion of CAS members access the online community site on any day. From the list below, please select the primary obstacle to your own active participation in the online community.

[dropdown] ⬍

70%

Prev    Next

If other is selected, participant gets this message, with a text box: If you selected Other in the previous question, please explain.

**QUESTION 18:**

**CAS Teacher Survey 2015**

About improving CAS

What one change could be made to the online to community to make you feel able to participate more actively?

*Please write your response below.*

[text box]

78%

Prev    Next

**QUESTION 19:**

Response options: Yes; No

**CAS Teacher Survey 2015**

Follow up

We are looking for a small number of teachers to be interviewed about the impact their participation in CAS has had on their teaching. Would you be willing to be contacted for a longer Skype or telephone interview?

[ ▲▼ ]

81%

Prev | Next

**QUESTION 20:**

**CAS Teacher Survey 2015**

If you responded Yes in the previous question, please provide your email address or another method by which you can be contacted to schedule an interview.

*We will not use your contact details for any purpose other than contacting you for an interview.

*Please write your response below.*

[ ]

85%

Prev | Next

# Teacher participation in online communities of practice: a mixed-methods study of community, context and practice

*A doctoral research project 2010 - 2016*

<u>Information for participants</u>

My name is Kristen Weatherby. I am a doctoral student at the London Knowledge Lab, which is part of the Institute of Education. This leaflet tells you about my research. I would be pleased to answer any questions you have.

## Why is this research being done?

My overall purpose is to learn why teachers choose to participate in online communities of practice, amongst all of the other resources available to them, and when they do, what impact that participation has on their teaching practice.

## Who will be in the project?

For this part of my research, I will interview approximately 25 secondary school teachers in the United Kingdom to learn more about their participation in the Computing at School online community and how any resources or learnings from that community might have influenced their classroom teaching.

## What will happen during the research?

During the interview, I will ask your permission to make an audio recording of our conversation. If you agree, I will record our interview. Our conversation should last about an hour depending on your available time and the amount you have to say. During this time I would like to learn more about your use of the Computing at School online community and its resources, your participation in this community, and the changes it has provoked to your teaching.

## What questions will be asked?

During the interview, I will ask you more detailed questions about your use of the CAS community, to build on the data that was already collected through the survey you completed in June 2015. We will discuss the other learning resources you have available to develop your teaching of Computing as well any changes you have made to your teaching as a result of your participating in CAS. I would also like to discuss your participation in any of the in-person events associated with CAS.

**Possible outcomes of the research**

The research aims to look at the relationship between a teacher's participation in an online community of practice and the development of that teacher's practice. In order to do that, I need to study the characteristics of an online community that has already had an impact on teachers' practice. In my research, I hope to look at the characteristics of teachers using this community, the kinds of resources available, and the types of changes that are being made to teaching as a result of interactions in the community.

If you have any problems with the project, please tell me or my supervisor Rose Luckin at rose.luckin@gmail.com

**Who will know that you have been in the research?**

I will keep recordings and notes in a safe place, and will change all the names in my reports so that all identities are kept completely confidential.

**Do you have to take part?**

You decide if you want to take part and, even if you say 'Yes', you can drop out at any time or say that you don't want to answer some questions.

You can tell me that you will take part by signing the consent form, found at the end of this leaflet.

**Will you know about the research results?**

If you want I will endeavour to keep you informed of any publications or reports I produce related to this research.

The project has been reviewed by the Faculty Research Ethics Committee, and was approved in July 2015.

<div align="center">

**Thank you for reading this leaflet.**

</div>

**Researcher's name and contact details**

Kristen Weatherby

Tel: 07889252100          Email: kweatherby@ioe.ac.uk or kriwea@gmail.com

# Teacher participation in online communities of practice: a mixed-methods study of community, context and practice

**Voluntary Nature of the Study/Confidentiality:**
Participation in this study is entirely voluntary and at any point you may ask the researcher any questions and/or refuse to continue. Your name will not be connected to the research results or released to anyone outside the project; a pseudonym will be used for identification purposes. Information that would facilitate the identification of any participant will not be included in any sort of report, or disclosed outside the project, unless you explicitly request to be identified and acknowledged.

Name: _____

**Please complete all statements below and circle your choice.**

a) I have read and understood the accompanying    yes    no
   information sheet and consent to take part in the
   described activity.

b) I consent to audio recordings being used by the named    yes    no
   researcher (Kristen Weatherby) for research purposes

c) I consent to information produced as a result of my    yes    no
   participation in the research activities (interview) being
   used for research purposes

Signature: _____

Date: _____

Email Address*: _____

Telephone*: _____

Thank you

* (Optional)

# Email communications with teachers to set up interviews in main study

**EMAIL FOR FIRST 60**

Dear TEACHER –

You recently completed a survey on the Computing at Schools website regarding your experiences with the online community. In your responses to this survey, you very kindly agreed to participate in a follow-up interview for my doctoral research.

I am writing now to inform you that you have been selected for a possible interview. Interviews will take place in September and I will be contacting you again in August to schedule the interview and send you a permission form that needs your signature in order for me to use your data.

Interviews will last no longer than one hour and will be conducted via phone or skype as you prefer, at a time convenient to you. I will send you the interview questions in advance.

Could you please respond to this email with the following information:
- Given this information, are you still willing to participate in an interview?
- Is this email address the best one to use if I am contacting you in August?
  - (If not, can you provide another one?)

Thanks in advance for your time, and please let me know if you have any questions or need further information.

Best,
Kristen Weatherby
Doctoral student
Institute of Education, University College London

**EMAIL FOR REMAINING TEACHERS**

Follow-up to CAS teachers survey: possibility of interview?

Dear TEACHER -

In June, you completed a survey on the Computing at Schools website regarding your experiences with the online community. In your responses to this survey, you very kindly agreed to participate in a follow-up interview for my doctoral research.

I am writing now to inform you that you have been selected for a possible interview. Interviews can take place at a date and time that is convenient for you. They will last between 30 minutes and one hour and will be conducted via phone or skype as you prefer. I will send you the interview questions in advance.

Given this information, are you still willing to participate in an interview? If so, could you please suggest some dates and times that might be convenient for you? I am available during day between 9:15 and 3pm and any time after 4:30pm most evenings, as well as on weekends.

I have also attached an information sheet explaining my research and a consent form for you to sign should you agree to participate in an interview.

Thanks in advance for your time, and please let me know if you have any questions or need further information.

Best,
Kristen Weatherby
Doctoral student
Institute of Education, University College London

**EMAIL TO SET UP INTERVIEWS**

Dear TEACHER,

I hope you're having a good summer. I wanted to get back in touch to see if we could schedule your interview for a time convenient for you in September.  I know the beginning of the school year is crazy, so I'm happy to schedule this in the evenings or on the weekend or even to move it into October if that's better for you. If you are available during the day, I can do between 9am - 2:30pm. Otherwise, evenings or weekends are generally good.

Can you send me some days/times that might work for you?  The interview should take about an hour. I'm trying to schedule 25 of these interviews, so although I'll do my best to accommodate your first choice of interview slot, it may not always be possible.

I have attached two documents for you. One is an information sheet with consent form. The info sheet tells you about the purpose of the interview and describes how it fits into the rest of my research. It includes a place for you to sign, agreeing to let me use your interview data in my research. If you could sign this (electronically is fine) and email it back to me before the interview, that would be great.

The second document contains the interview questions. If you have a chance to look at this before the interview, fantastic, but don't worry if you don't. Many of the interview questions build on your survey responses, so they shouldn't be coming at you out of nowhere. (And don't worry if you don't remember your survey responses; I have them and will remind you during the interview.)

Do let me know if you have any questions, and I look forward to speaking to you further during the interview.

Best,
Kristen

## Appendix A.5: Interview Schedule

**Background**:
1. Tell me a bit about your teaching career. In your survey responses, you said you've been teaching for ==XX== years. Did you start teaching right after you finished your degree or did you have another job first?
2. What subjects/age levels did have you taught?
3. In your survey results, you mention you currently teach Computing and ==XX==. How is that divided (i.e. how many classes/levels of each do you have each week)?
4. Have you always been at the same school or have you changed schools?
5. Tell me a bit about your school – in terms of the teaching of computing. Are you the only teacher of computing? What technology (software/hardware) do you use?

**Computing Curriculum Change**
6. When the new computing curriculum was launched, what had you been teaching?
7. Did you feel prepared for the new curriculum? Did you have any experience with the kind of computing/programming skills that the new computing curriculum required?
8. How did you feel about the change to the new curriculum?
9. You said you started teaching computing in ==XX==, how far in advance of that did you learn you would be teaching computing? In other words, how much time did you have to prepare?
10. What support were you given in terms of preparing you to teach computing at that time? (From your school, from the DfE or other organisations? What did you seek out yourself?)

**CAS Use**
11. At what point in your journey as a computing teacher did you learn about CAS; How did you hear about it?
12. What is it about the community or the site itself that makes it useful for your work teaching computing or teaching in general?
13. In your survey responses, you said that you use CAS (==frequency==) and that ==XX== prompts you to access the site. When do you tend to consult CAS (what day/time)? Does anything else prompt you to check CAS other than ==XX==?
14. Would you say that you are primarily a consumer of the CAS online community, or do you also upload things – resources, comments to discussions, answers to questions?
15. What is your involvement in CAS in-person events such as the National Conference, hub or regional meetings or any trainings? What did you think of these?
16. Do you think the in-person events you've attended have any relationship with your use of the online community? In other words, after you've attended an in-person event, have you searched for different types of resources, discussions or specific people?
17. Do you participate in any other online communities for teachers or teachers of computing? How does your experience with those communities differ from CAS?

**Relationship between CAS and classroom teaching**
18. In your survey responses, you mentioned a specific resource as having the most impact on your teaching ==name the resource==. How did you find this resource (what were you looking for originally)? Can you describe the resource and how/why you used it? Have you used it again?
19. In the survey responses, you also mentioned that you have made a change in your classroom teaching based on ==X, Y or Z==. Can you give an example of one of these?
20. Is there a particular part of the computing curriculum that you find CAS especially useful for?
21. Have you met any people on CAS (other CAS members) that you didn't know before and with whom you have a professional relationship now?

**Other available resources**

22. What other kinds of professional development have you taken part in over the last couple of years, for computing or otherwise, that is not related to CAS?
23. How do you hear about these kinds of offerings?
24. What was it about these offerings that made you decide to go? What makes you say NO, I can't go?
25. Are you part of a "personal learning network" or a community of teachers at or outside your school with whom you collaborate and to whom you can go if you have a question or need help?
26. What kind of support does your school have if you need help, are having an issue with your teaching or just generally wants to bounce ideas around? Inset days, cross-curricular groups?
27. Is there anything that you haven't mentioned that you do when you want an idea, inspiration, need help?
28. In general, what motivates you to seek out professional development or support for your teaching?

# Appendix B: Data Analysis

Contents:

B.1: Codebook for this study

B.2: Section of coded transcription

Appendix B.1: Codebook

| Code | Definition | Use when… | Don't use when… | Example |
|---|---|---|---|---|
| Questions 1-28 | Autocoded based on my review of the questions in the transcripts. | Hand code when rereading the transcripts and find text in other places that refers to another question | N/A | N/A |
| People case nodes | Autocoded according to the unique identifiers of each of the interviewees/survey respondents | N/A | N/A | N/A |
| *Social Media User* | A person who says that they personally use a social media application for teaching purposes, such as Twitter, Facebook, or Pinterest | The interviewee mentions using the application him or herself | The interviewee mentions the application in conversation | N/A |
| Facebook group (nested) | A person who is part of a Facebook group for teaching purposes | The interviewee is commenting on his or her personal use of a Facebook group for teaching purposes. | The interviewee is not a Facebook user for teaching but makes comments anyway or uses FB but not for teaching. | "There was a Facebook group on OCR, EDEXCEL ICT, and there's an OCR – I think there's an OCR computing one as well" |
| Twitter (nested) | A person who is part of Twitter for teaching purposes | The interviewee is commenting on his or her personal use of Twitter for teaching purposes | The person is not a Twitter user for teaching but makes comments anyway, or uses Twitter | "on Twitter, people are usually just showing off about new things they're doing and ideas of what they've got whereas I'd use |

| | | | but not for teaching. | CAS sometimes for discussion" |
|---|---|---|---|---|
| Confidence | Evidence of a teacher speaking about their level of confidence with something relating to his or her teaching. | The teacher expresses confidence in himself, his abilities, his resources, speaks about his work being high quality or not, etc. | Do not use if a teacher is speaking about other teachers and not himself. | "if I'm not confident about teaching it, you know, I just need to make sure I'm skilled up before that, so the drive is I just have to get on with it and do it" |
| *Ecology of Resources codes* | Available resources: Heading for codes that fall under this category. | Parent node for all EOR resources nodes that follow | N/A | N/A |
| Environ-ment (nested) | Location and other things around the learner that he or she might interact with | Use for technology situation at school, classroom, other elements of the learner's environment to supplement initial EOR analysis | Might overlap with People and Tools categories - need to be clear. | "we also have our own TV studio" |
| People (nested) | People that the learner access to help him or her | A teacher speaks about people they turn to when they need help or support. Also use when a teacher says they do NOT have people they can access for help or support. | Do not use for just social situations. People node does not aggregate from child nodes so it should NOT include CAS members - only discussion of people the teacher interacts with who are not CAS members. | "also a lot of people within my academy chain, there's kind of we have a specialist I can go to if I need to" |

| CAS member (nested) | Another member of the CAS community that the teacher has interacted with, either online or in person | A teacher speaks about another CAS member or members of CAS in general with whom they have interacted in the past. | Do not confuse with non-CAS members | "we have like a you know, a group of people, you know, that are regular attenders and we've got a mailing list that I sent – you know, it's usually ends up me organising it and I'm not quite sure why." |
|---|---|---|---|---|
| Tools (nested) | Things that the learner accesses to help him or her | Could be any number of tools (including technology) such as books, etc, that the teachers uses when he or she needs help and support. Do use for PD but also code in PD category. | Do not use for a general discussion of resources, as this doesn't talk about what a teacher is using/has access to. | "we've purchased into a number of resources, and companies that offer resources, so one of those is ZigZag" |
| CAS discussion (nested) | Marks mention of a discussion the teacher has participated in or read on CAS in order to further his or her learning | Could be things that are helpful are unhelpful - as the teacher will have used that discussion as a resource regardless. | | "for me the most important think that I liked was that I used the forums a lot to begin with" |
| CAS event (nested) | Marks mention of a CAS event that a teacher has attended | Teacher is referring to hub meetings, trainings or the CAS conference. | Note: If they are trainings or CPD, they need to be coded as such as well. | "I've been to a few of the Sunbury hubs. I first got contacted there to present, um, so I went there and presented last year. And then I've been a few times" |
| CAS resource (nested) | Marks mention of a resource found on CAS that the teacher has used or is talking about using. | Teacher could have used resource in his or her own class or to further his or her own learning or for planning or assessment. Or teacher could be talking about | Do not use for general discussion of CAS resources. Those should be tagged in new category of | "And to start with a lot of resources we kind of used were coming off CAS" |

| | | | | |
|---|---|---|---|---|
| | | searching on CAS for resources or resources he or she has posted to CAS. | General CAS Discussion. This doesn't help me get an idea of what resources learner has access to, but instead is a comment about resources - which is something else. | |
| Knowledge and skills | That which is to be learned. Knowledge = concepts; skills = procedures. | Teacher speaks of his or her own knowledge and skills or lack thereof. | Note that knowledge and skills can be both a resource and a filter. Don't confuse them. Need to make sure to double-code in this instance. | "Because in a way, some of what I learned is just a little bit out of date in terms of what…uh…is going on in certain parts of industry" |
| CPD and training | Any formal training, course, workshop, conference, observation visit, formal education (post the initial degree) that a teacher participates in to give them support in their teaching. | Teacher mentions any of these things. Include formal events inside and outside the school, as well as online. Could be a comment about a lack of available training or a general comment about CPD. | Do not include the initial teacher training in this category. Include CAS trainings and CPD but NOT CAS hub meetings and other events as it's unclear how | "I've done some trainings with the exam board" |

| | | | | much of this is CPD. |
| --- | --- | --- | --- | --- |
| Pedagogy | Knowledge on how to teach a particular subject. | Code when teacher talks about the pedagogy of teaching his or her subject area. Could be general or specific comments. Doesn't have to include the word pedagogy. | | "my…challenge was more in terms of learning how to do the…teaching bit." |
| Industry experience | Teachers with past experience working in the computing industry | Use when a teacher has worked in the computing industry before becoming a teacher. | Don't use if a teacher is commenting on industry experience in general or other teachers with industry experience. Want to capture teacher's own experience. | "I, uh, was working in industry in engineering" |
| *Filter element* | Something that influences the learner's access to an available resource | Use for all filters to categorise them as such - whether they are a barrier or a catalyst to the learner's use. A teacher's own personal motivation counts here. What motivates him or her to access a resource. | | N/A |
| Catalyst (nested) | A filter that speeds up or enhances the learner's access to a resource | Includes motivation to go on PD. | | "Cost, location and whether I need it." |

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| | | | | |
|---|---|---|---|---|
| Barrier (nested) | A filter that slows down or prevents the learner's access to a resource. | Includes barrier for accessing CPD | | "the feedback I've heard from other people that have been on them, says they're not worth the money" |
| Support of school | Used to describe positive support - either in terms of behaviour, time to plan, funding - received by teacher from school to implement computing curriculum | Use when school - or school principal or academy chain - has been supportive | Don't use if it's just one other teacher providing support. | "they were great, I mean I've been on quite a lot of training courses so whatever training I wanted to do. Um, my boss at the time, who has now moved up, he was very supportive and was really helpful" |
| No support from school | Used when a teacher mentions that his or her school has not been supportive in some way. | | | "There was no support whatsoever. " |
| F2F vs online | Used to discuss the relationships between CAS face to face events and any online interaction subsequent to that | Also use when the teachers discuss the relationship with face to face and online at all - regardless of direction (online -> f2f or vice versa) | | "doing a bit of networking is always a good thing, cause you get to put faces to names. Um…I'm quite old school, I like meeting people face to face and then you actually know who you're talk – and then you can build an online relationship and it works really well. " |
| Only computing teacher | If the teacher is the only teacher of computing at his or her current school | Use if this teacher says he or she is the only computing teacher, regardless of whether others in the department teach ICT or other technology-focussed subjects. | | "I'm the only teacher. It's a special school so it's relatively, um, small for a secondary school." |
| Program ming | Use to list the programming | | No commentary on languages - | "Python" |

| | | | | |
|---|---|---|---|---|
| languages taught | languages taught at current school. | | listing languages only. | |
| *Attitude toward the new computing curriculum* | Used to note teachers' attitudes towards the launch of the new computing curriculum | Parent node for next Positive and negative attitude. Use also for attitudes that are neither positive nor negative. | | "I think it's…very 80s, the curriculum." |
| Positive attitude (nested) | When teachers express that they felt positive about the introduction of the new computing curriculum | | | "so it was a very welcome – to me it was a very welcome sort of going back to basics and sort of the more important concepts of teaching computing which I think we lost with teaching strict ICT" |
| Negative attitude (nested) | When teachers express that they felt negative about the introduction of the new computing curriculum | Use also to delineate negative elements of an otherwise positive response. | | "I can't say that I was overly excited by that prospect. I realise that that was going to be a whole load more work for us to sort out. It meant that we had to base, um…effectively retrain as staff, um, and you know effectively, comple – totally reskill ourselves as well as developing brand new now schemes of work" |
| Length of time to prepare for computing curriculum | How long teachers said they had to prepare for the computing curriculum | | | "very little time. It was almost…teaching… – almost just ahead of the pupils as we went" |
| Difference between communities | To note expressed differences in participation or characteristics of the different online | Use when teacher discusses how their use of CAS is different than their use of other | | "it's better organised than the CAS website because there's obviously just a set of resources on there. |

| | | | |
|---|---|---|---|
| | communities in which a teacher participates. | communities. Also use to note teachers' descriptions of how CAS differs from other online communities in which they participate. | But there's nothing terribly useful on there." |
| Teacher solely responsible | When the teacher is the sole person responsible for helping themselves or others with computing curriculum in some way | This could be seeking out their own development, making exam or purchasing decisions for the department, convincing the leadership of something, offering trainings for their colleagues. Developing the curriculum or scheme of work, etc | "I built a lot of resourcing myself, I used CAS a lot, their things, I used a network of friends – in industry and outside of industry. And…um…they gave me ideas, I then put those into practice, I then tried them out, and um, and built the curriculum around that. I mean, it took me 18 months to build the curriculum. " |
| *Preparedness for computing curriculum* | All nodes related to teachers' level of preparedness for the new computing curriculum. Covers teachers who were prepared, were not prepared, or said something else entirely. | Parent node for the next three nodes. | N/A |
| Felt prepared for the new curriculum (nested) | Use for teachers who said they felt prepared to teach the new computing curriculum in terms of their skills or past experience. | | "I was pretty ok, I just had to refocus um, some – some skills." |
| Did not feel prepared for the new | For those teachers who said they did not feel prepared for the new curriculum | | "I don't have – I don't have a computing-based degree. So I've been kind of learning it |

| | | | | a bit quicker than the kids have. " |
|---|---|---|---|---|
| Something else entirely (nested) | Teachers who did not talk about their own personal level of preparedness but maybe spoke about their department or their school's technology situation or something else | | | "I think the technology in schools was the biggest concern, to be honest. " |
| *Usage of CAS* | Used for categories that emerged when coding for Q13 in which teachers described in detail their typical usage of CAS. Supplement this with info from survey question. | Parent node for next 4 nodes | | N/A |
| From home (nested) | Use when teacher discusses accessing CAS from home | Can be used with another category (such as from mobile). If teacher says mostly at home, tag this. | | "Mostly when I'm at home" |
| From school (nested) | Use when teacher discusses accessing CAS while at school | Can be used with another category (such as from mobile) | | "I usually do that first thing when I come in work when I check my email" |
| Anytime (nested) | Use when teacher discusses accessing CAS anytime | Can be used when the teacher isn't being specific about whether they are home or at school or when they say they use it all the time. Can be used with (from mobile) | If it is tagged as anytime, does not need to be tagged as home or school. | "that could be at home, at school or on the bus on the way to work" |
| From mobile (nested) | Use when teacher mentions that they access CAS via their mobile phone | | | "one reason is it just comes through to my phone" |

| | | | | |
|---|---|---|---|---|
| *Motivator to check CAS* | This question was prompted by the teacher's response to the survey question as to what prompts them to access CAS. It's an elaboration of the survey question response and the nested nodes below categorise the responses. | Only use the overall category if there are any mentions of single motivations that don't fit the below categories. | N/A | "I don't want them to ever not have the answer" |
| Email notifica-tion (nested) | Use when a teacher says they go on CAS after seeing something in the email notification | | | "the notification email is actually filtered into a box, and occasionally I'll dip into there and see what the current trending discussion is" |
| When planning (nested) | Use when a teacher says they go on CAS when they are doing their planning for upcoming units or lessons. | Planning could either be for professional development for self or staff or lessons for students. | | "If I'm planning, I'm looking for a new resource. If I'm planning a scheme of work, let's say I'm doing the CPU at the moment, and I have a gap and I need a resource, I'll tend to then go to the CAS resources and then look through." |
| Needs to find out or learn something (nested) | Use when a teacher says they go on CAS when they have a question or a need to learn something they don't already know. | | | "I'll go on if there's something I want to find out" |
| *Impact on teaching* | These codes were created for the analysis of Q18 and 19 only. The nodes under this parent node are the same categories noticed from the overall survey responses. for Q18. These codes will be applied to the | This is the parent node - it is not aggregated to the child nodes because so many teacher responses were tagged to more than one child node. | Do not apply any of these codes to resources the teachers may have talked about in Q18 or 19 but DID NOT actually use (there were | N/A |

| | | | |
|---|---|---|---|
| | interviewee responses for Q19 as well. | a few of these). | |
| Answered teacher's questions (nested) | Any resource or interaction from CAS that answered an outstanding question that the teacher may have posed or may have just wondered about. | | "mean kind of answering questions, by hearing the questions that other people have, I learn about – a lot about the kind of questions that sometimes I should have been asking and I just had completely, uh, sort of passed me by." |
| Connect with other people (nested) | Any resource or interaction from CAS that helped the teacher connect with others in the field of computing teaching that he or she may not have known before. | Could also be others that the teacher did know but that were able to help them with their teaching in some way. | "So it was a discussion with other teachers on how to implement something and how to go about teaching it in the classroom" |
| Helped students (nested) | Any resource or interaction from CAS that after the teacher used it, caused the teacher to express a specific impact that it had on the students | Helped the students' understanding, helped them prepare for exams | "They get really into helping each other and the explanation part of it is really good for building their understanding." |
| Helped teacher's under-standing (nested) | Any resource or interaction from CAS that helped the teacher think about things in a new way. | | "So that makes you rethink how…how I'm going to deal with these, you know, everyday problems in class, for example." |
| Helped with planning or assess-ment (nested) | Any resource or interaction from CAS that helped them with planning lessons or assessment of learners. | | "I've used those progression tables to plan what – well to guide my planning and what the key stage 3 kids should be doing in each year, essentially." |

| | | | |
|---|---|---|---|
| Inspired teacher or built confidence (nested) | Any resource or interaction from CAS that inspired their teaching or build their confidence. | | "So that was nice, that instantly made me feel a little better." |
| New idea/activity/way of teaching (nested) | Any resource or interaction from CAS that provided them with a new idea or activity or a way of teaching to use in their classes. | | "that's definitely something that I've built into my teaching in a big way and whether it's right or not, but it feels right." |
| Saved time (nested) | Any resource or interaction from CAS that saved the teacher time they normally would have spent without this resource or interaction. | | "to have someone do that work for you was just invaluable. I mean, it was something we were going to have to sit down and do ourselves in the department. But someone had done it and shared it and it then got agreed, and it went around hub meetings and it got changed and improved and it was just brilliant" |
| Taught teacher something (nested) | Any resource or interaction from CAS that taught the teacher something new. | | " Also probably teaching me at the same time how to go about setting inputs and outputs for variables if looping, etcetera, like build it in their stages. " |
| General Comment about CAS | Use when teacher makes a comment in general or offers an opinion about CAS or any CAS-related resources, events, people, or discussions | | "everybody on CAS – or at least everybody who's vocal on CAS – is at least into teaching computing or the possibility of teaching computing." |
| Teacher motivation | Something that motivates the teacher to seek out development or | Does not include a motivation just to check the CAS | It's a little bit of self-motivation, wanting to improve the department and |

| | | | | |
|---|---|---|---|---|
| | support for his or her teaching. | website, which is coded separately. | | improve results, so it's, uh, it's a constant wanting to improve what you're doing. |
| Common vocabulary | Instances of speech that are common amongst CAS members and require no preamble or explanation | Use for acronyms, expressions or other speech that is common across CAS members but not part of everyday lexicon | | |
| Progression from novice to master | Evidence of a teacher learning something from another member's contribution to CAS | A teacher expresses that they learned something new from the community that develops their skills or understanding | Do not confuse with other community of practice codes. This one is about an individual developing skills. | "I love the fact that I can go on and get involved in a discussion or go and find a resource that might not be what I want to use but it gets me thinking in a different way." |
| Common goal | Evidence of a common goal shared by members of the CAS community | Use when participants mention the idea of CAS members sharing a common objective. | | "you'll find other people in the same boat" |
| Developing relation-ships | Discussion of interpersonal relationships that have developed between the teacher and other CAS members | Use when CAS teacher discusses interactions with other CAS members that continue beyond just the first interaction. | Do not use with people the CAS teacher is in contact with outside of CAS. Do not use if the CAS teacher has only been in contact with a person once. | "If you want to come over and spend a day at our school you would be welcome we have been teaching GCSE Computing since it started in 2010, it is good that you have put this post up, shows the real spirit of our community" |
| Sustained relation-ships (nested) | Identifies relationships that members say have developed on CAS and have continued over a sustained period of | Use when there is an indication that the relationship with another CAS member, whether in-person or | Do not use with people the CAS teacher is in contact with outside of | "our CAS group, say, we meet and we say, well, what do we want to cover this year? Is there anything specific? Do we want |

| | | | | |
|---|---|---|---|---|
| | time, whether harmonious or conflictual | virtual, has continued for more than several months. | CAS. Do not use if the CAS teacher has only been in contact with a person once. | more training on this? Anyone got any ideas? Can anyone deliver? And that – that kind of forms how the – the CAS hub will develop over the year. " |
| Shared ways of engaging in practice | Evidence of members collaborating on the development of practice relating to the teaching of computing. | Use when members are collaborating to answer a question, to develop a resource, or working toward the same objective. | Do not use when a CAS teacher uses another teacher's resource and says thank you or simply compliments it. | "I had this to do last year and used advice given by a KS2 advisory teacher for the LA to divide it into 3 categories for each year group to ensure coverage of Digital Literacy (relied heavily on SWGfL teaching resources, which were great), Computer Science - Scratch, Kodu, unplugged activities about networks and how the internet works etc and IT (the old software type stuff). Drew it out on a grid for each year group for each term, linked to topics etc where applicable and developed plans from there. Happy to share stuff if it's helpful but I am definitely no expert!" |

Appendix B.2: Section of coded transcription

# Coding Summary By Source

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|

**Internals\\Interview Transcriptions\\Interview QA - 4044763044 - Anthony**

**Nodes\\Broad Topic Codes\\CPD and Training**

| | | | | 1 | W | 01/02/2016 11:51 |
|---|---|---|---|---|---|---|

I did manage to get some inset at Edge Hill. Cause Edge Hill was running – has run a series of sessions for teachers, um, so there's been some sort of free CPD there at weekends

| | | | | 2 | W | 11/02/2016 15:17 |
|---|---|---|---|---|---|---|

the events that I go to…um, which have mostly been, um, a little bit of CPD, some of the Raspberry Pie stuff, they have helped broaden my knowledge, and they do have an impact on, I suppose on, um, the co-curricular things that I can offer.

| | | | | 3 | W | 01/02/2016 12:51 |
|---|---|---|---|---|---|---|

for computing, absolutely none. Um, I've – I'm aware that for example, OCR and AQA run some courses, but the feedback I've heard from other people that have been on them, says they're not worth the money

| | | | | 4 | W | 01/02/2016 12:50 |
|---|---|---|---|---|---|---|

in terms of other CPD, I- I haven't had a huge amount over the past five years because during all of our sort of in-service training time at school, our sort of protected CPD periods, I'm normally delivering it rather than receiving it

| | | | | 5 | W | 01/02/2016 12:51 |
|---|---|---|---|---|---|---|

I've had the normal school-based stuff that one would expect, so some basic health and safety, some first aid, some, um…safeguarding. But beyond that the only other CPD I tend to get is on things like school admin systems

| | | | | 6 | W | 01/02/2016 12:51 |
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I tend to find myself being sent on report writing courses and things like that.

| | | | | 7 | W | 01/02/2016 12:52 |
|---|---|---|---|---|---|---|

so some of the things I go on, um, I go because I'm best placed to then disseminate that knowledge, not because I'm actually going for something that is particularly my job

| | | | | 8 | W | 01/02/2016 12:53 |
|---|---|---|---|---|---|---|

I've had a leadership course as well

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
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### Nodes\\Broad Topic Codes\\F2F vs online

| | | | | 1 | W | 11/02/2016 15:17 |
|---|---|---|---|---|---|---|

do-doing a bit of networking is always a good thing, cause you get to put faces to names. Um...I'm quite old school, I like meeting people face to face and then you actually know who you're talk – and then you can build an online relationship and it works really well.

| | | | | 2 | W | 01/02/2016 12:49 |
|---|---|---|---|---|---|---|

I've now got a face and I can picture, I know which school they work at, and what kind of age range they teach. And I – there are times when I've been able to think, we'll actually I'll email X, Y or Z on this topic, because when I met them in, you know, last October, they said they'd done it or they were doing it or they were working on it. Um...and I think having – for me, having met somebody at an event and actually sat and talked with them and discussed things, I feel more comfortable then, you know, asking for a favour or saying what do you know about...

### Nodes\\Broad Topic Codes\\General comment about CAS

| | | | | 1 | W | 24/02/2016 13:56 |
|---|---|---|---|---|---|---|

It's the resources that people put on there, which obviously all need modification to use (pause), but there's a host of ideas there. So it's well, how do other people deliver this particular topic, you know, have they got a worksheet, it-it's that trawling of information when you're building a-a-a- series of lessons on a particular topic. Um...the other very strong benefit I've got from it is access to experts.

| | | | | 2 | W | 19/08/2016 10:43 |
|---|---|---|---|---|---|---|

It's one of the things I like about CAS It's clean and it does what it says it's going to do, um, and it's not using a platform that's going to try and...pull data on me.

| | | | | 3 | W | 24/02/2016 13:59 |
|---|---|---|---|---|---|---|

there are relatively few CAS members delivering A-level. Equally the people that are delivering A-level tend to have a background. They tend to be...um, fairly expert already. And so they – I've met – maybe I'm exaggerating, but they seem less prone to going, Help, I don't know what to do with X, Y or Z.

| | | | | 4 | W | 24/02/2016 13:59 |
|---|---|---|---|---|---|---|

There's a lot of members that sign up wanting help with GCSE because they're business studies teachers, or they're sort of old school ICT teachers and they've been landed with computing and they're completely out of their depth.

### Nodes\\Broad Topic Codes\\Length of time to prepare for computing curriculum

| | | | | 1 | W | 01/02/2016 11:48 |
|---|---|---|---|---|---|---|

it was sort of at the launch in 2012

| | | | | 2 | W | 01/02/2016 11:48 |
|---|---|---|---|---|---|---|

we were going through a merger at the time. Um, and so we were actually reviewing the entire curriculum as we brought two schools together. So it was the perfect opportunity

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
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| | | | | 3 | W | 01/02/2016 11:49 |

No, you just dive in and do it.

## Nodes\\Broad Topic Codes\\No Support from school

| | | | | 1 | W | 22/02/2016 13:43 |
|---|---|---|---|---|---|---|

in terms of support...not a great deal

## Nodes\\Broad Topic Codes\\Programming languages taught

| | | | | 1 | W | 01/02/2016 11:47 |
|---|---|---|---|---|---|---|

Scratch

| | | | | 2 | W | 01/02/2016 11:47 |
|---|---|---|---|---|---|---|

Kodu

| | | | | 3 | W | 01/02/2016 11:47 |
|---|---|---|---|---|---|---|

Python

## Nodes\\Broad Topic Codes\\Social media user

| | | | | 1 | W | 01/02/2016 12:49 |
|---|---|---|---|---|---|---|

I run the school Twitter feed as well

## Nodes\\Broad Topic Codes\\Social media user\Twitter

| | | | | 1 | W | 01/02/2016 12:49 |
|---|---|---|---|---|---|---|

I run the school Twitter feed as well

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
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### Nodes\\Broad Topic Codes\\Teacher motivation

| | | | | 1 | W | 24/02/2016 14:00 |

it's (stutter) very much, uh, curriculum driven. So it's where there's – um… - if a new spec's come out, I go through it with a fine tooth comb, I say, ok, what's it gonna – do I understand it, do I need to go and learn about X, Y and Z, um, every year I look at the – the whole school program and I go well, you know, do I now need to learn more about, um, you know, generating apps and putting – and getting apps onto mobile devices. Do I need to go and look about – learn about X, Y and Z because it's the thing that's trending. Um…you know, I'm among the many people waiting to get my hands on a- on a - BBC um, you know Code bug and (stutter) see—see what I can do with it. Um…so…yeah, (stutter) it's if I think there's something that's not firing on all cylinders curriculum-wise, that's when I need to go and learn something new.

### Nodes\\Broad Topic Codes\\Teacher solely responsible

| | | | | 1 | W | 01/02/2016 11:49 |

basically I taught myself Python

| | | | | 2 | W | 01/02/2016 11:50 |

I've got three textbooks and the kids have got one, so I've got two reference sources that I can pull on that they don't necessarily have access to. Um…you read up on it, and you go for it.

| | | | | 3 | W | 01/02/2016 11:55 |

I mean to say we're in very dire straits – I co-wrote them. So…if they'll let me do it, they'll let anybody do it

| | | | | 4 | W | 01/02/2016 12:54 |

I'm quite an independent learner, so I – I will use YouTube, I will use Google, I will go out and find a range of stuff, synthesize it and then try to coalesce it

### Nodes\\Community of Practice codes\\Developing relationships

| | | | | 1 | W | 24/02/2016 13:58 |

I think having met some people, and got a name to them, I run the school Twitter feed as well, so I've now, these people with strange esoteric Twitter handles, I've now got a face and I can picture, I know which school they work at, and what kind of age range they teach. And I – there are times when I've been able to think, we'll actually I'll email X, Y or Z on this topic, because when I met them in, you know, last October, they said they'd done it or they were doing it or they were working on it. Um…and I think having – for me, having met somebody at an event and actually sat and talked with them and discussed things, I feel more comfortable then, you know, asking for a favour or saying what do you know about…

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|

## Nodes\\Community of Practice codes\\Progression from novice to master

| | | | | 1 | W | 04/02/2016 15:12 |
|---|---|---|---|---|---|---|

the other very strong benefit I've got from it is access to experts. Um, so for example, for OCR one of the controlled assessments has been um, a study of Little Man Computer, which is all low-level programming. Well, I was able to get in contact with Peter Higginsen, that wrote the most frequently used LMC, um, emulator. Um…and so one of the questions on last year's controlled assessment was to write a comparison between risk and sisk (??) architectures. Um…so obviously I'd done a bit of research and I'd done some things, but I threw a PowerPoint together, um, based on that, um, and I could – I could send it to Peter, who has been a (pause) a processor architect in the past. Um…and he's very knowledgeable on these sorts of things. And so he said, well actually, that's not entirely true, and if you word it like this it's more accurate, and I got some real expert input, um, I – and I've blankly (?) shared that back up onto CAS. So I think version 4 or something is up there now. But that was something that was very, very beneficial for me. Cause it was an area I wasn't familiar with, there isn't a huge amount of literature out there that isn't written in …degree level jargon,

| | | | | 2 | W | 01/02/2016 11:58 |
|---|---|---|---|---|---|---|

 I put a post up, um, saying that if people were struggling with the topic they could contact me. And I've had maybe…16-18 people get in contact and say well, I'm stuck on the Fibinacci sequence, or can you explain what a left shift is, and um, they've sent me their solutions, I've given them some commentary on it and then given them a copy of my model

| | | | | 3 | W | 02/02/2016 10:49 |
|---|---|---|---|---|---|---|

I haven't posted a huge amount, I-I – a lot of people have contacted me just to get a little bit of advice on a problem that I'd already cracked.

| | | | | 4 | W | 01/02/2016 12:45 |
|---|---|---|---|---|---|---|

if I'm going to do a new topic, so if in 2 weeks time I'm about to start teaching the floating point arithmetic, I'll think, well I've got my resources, but I'll just have a quick poll to see if you know somebody's come up with this superb, unique, dynamic way of doing it that suddenly makes it simple. Um, and it's going to stop my sixth form from, you know, crying whenever I talk to them about mantises and exponents. So, yeah, I'll just have a look then

## Nodes\\Community of Practice codes\\Shared ways of engaging in practice

| | | | | 1 | W | 19/08/2016 10:38 |
|---|---|---|---|---|---|---|

It's the resources that people put on there, which obviously all need modification to use (pause), but there's a host of ideas there. So it's well, how do other people deliver this particular topic, you know, have they got a worksheet, it-it's that trawling of information when you're building a-a-a- series of lessons on a particular topic.

| | | | | 2 | W | 19/08/2016 10:39 |
|---|---|---|---|---|---|---|

having done some work on the – on the Little Man topic, um, and kind of developing some resources on there, um, I- I put a post up, um, saying that if people were struggling with the topic they could contact me. And I've had maybe…16-18 people get in contact and say well, I'm stuck on the Fibinacci sequence, or can you explain what a left shift is, and um, they've sent me their solutions, I've given them some commentary on it and then given them a copy of my model

## Nodes\\Ecology of Resources codes\\Available Resources

| | | | | 1 | W | 24/02/2016 13:54 |
|---|---|---|---|---|---|---|

in the senior school, we, um, we've just taken on an NQT. Um, who used to be one of our technicians

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| | | | | 2 | W | 01/02/2016 11:45 |

we've got four suites, the two main computing labs are sort of I5s.

| | | | | 3 | W | 01/02/2016 11:46 |

four suites

| | | | | 4 | W | 01/02/2016 11:46 |

couple of servers

| | | | | 5 | W | 01/02/2016 11:46 |

Raspberry Pis. Um, so we've bought 25 Raspberry Pis, uh, Pi 2s

| | | | | 6 | W | 01/02/2016 11:46 |

HTMI ports, um a lead physically attached – we've taken the power lead out from the back of the PC so you can literally plug the Pi in, press the monitor button, switch inputs and you've switched from your PC to your Pi.

| | | | | 7 | W | 01/02/2016 11:51 |

App Inventor

| | | | | 8 | W | 01/02/2016 11:54 |

at least I've got the contact details of 4 or 5 people that do the same GCSE board as me

| | | | | 9 | W | 01/02/2016 11:56 |

it's access to two things It's the resources that people put on there, which obviously all need modification to use (pause), but there's a host of ideas there. So it's well, how do other people deliver this particular topic, you know, have they got a worksheet, it-it's that trawling of information when you're building a-a-a- series of lessons on a particular topic

| | | | | 10 | W | 11/02/2016 15:12 |

Cause it was an area I wasn't familiar with,

| | | | | 11 | W | 01/02/2016 12:43 |

Raspberry Jams

| | | | | 12 | W | 01/02/2016 12:44 |

Googling it

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| | | | | 14 | W | 11/02/2016 15:17 |

the events that I go to…um, which have mostly been, um, a little bit of CPD, some of the Raspberry Pie stuff, they have helped broaden my knowledge, and they do have an impact on, I suppose on, um, the co-curricular things that I can offer.

| | | | | 15 | W | 01/02/2016 12:48 |

resources, um or even if it's a commentary…um, a discussion in a form about a resource, um, that I think does directly map into what I do in the classroom, and what my students use, and the results that they get.

| | | | | 16 | W | 01/02/2016 12:56 |

there are one or two people that I – that I know externally, um..who – who aren't educators, but are knowl – who have worked in computing for, sort of 20-odd years, and I can – I can ring them and say, I'm really stuck. Can you dig your university notes out and tell me what this means?

| | | | | 17 | W | 01/02/2016 12:57 |

we've got a teaching and learning group, um and we meet, um, about once a month

| | | | | 18 | W | 01/02/2016 12:57 |

TeachMeets

| | | | | 19 | W | 01/02/2016 12:57 |

There are people I can call on, we do have technology advisors, um, who can come and advise us on…future planning or mobile device deployment or whatever particular topic we want to look at

| | | | | 20 | W | 01/02/2016 12:59 |

BBC um, you know Code bug

## Nodes\\Ecology of Resources codes\\Available Resources\Environment

| | | | | 1 | W | 01/02/2016 11:46 |

four suites

## Nodes\\Ecology of Resources codes\\Available Resources\Knowledge and Skills

| | | | | 1 | W | 11/02/2016 15:12 |

Cause it was an area I wasn't familiar with,

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|

### Nodes\\Ecology of Resources codes\\Available Resources\People

| | | | | 1 | W | 24/02/2016 13:54 |

in the senior school, we, um, we've just taken on an NQT. Um, who used to be one of our technicians

| | | | | 2 | W | 01/02/2016 11:54 |

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| | | | | 3 | W | 01/02/2016 12:56 |

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| | | | | 4 | W | 01/02/2016 12:57 |

There are people I can call on, we do have technology advisors, um, who can come and advise us on…future planning or mobile device deployment or whatever particular topic we want to look at

### Nodes\\Ecology of Resources codes\\Available Resources\People\CAS member

| | | | | 1 | W | 01/02/2016 11:55 |

my ex colleague, um, has now got himself the lofty position of being a CAS master teacher

| | | | | 2 | W | 24/02/2016 14:33 |

I was able to get in contact with NAME OF PERSON, that wrote the most frequently used LMC, um, emulator. Um…and so one of the questions on last year's controlled assessment was to write a comparison between risk and sisk (??) architectures. Um…so obviously I'd done a bit of research and I'd done some things, but I threw a PowerPoint together, um, based on that, um, and I could – I could send it to NAME OF PERSON, who has been a (pause) a processor architect in the past. Um…and he's very knowledgeable on these sorts of things. And so he said, well actually, that's not entirely true, and if you word it like this it's more accurate, and I got some real expert input

| | | | | 3 | W | 01/02/2016 12:56 |

when I do hit a problem, there are – there are a couple of  - I may be tempted to post on CAS

### Nodes\\Ecology of Resources codes\\Available Resources\Tools

| | | | | 1 | W | 01/02/2016 11:45 |

we've got four suites, the two main computing labs are sort of I5s.

| | | | | 2 | W | 01/02/2016 11:46 |

couple of servers

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| | | | | 3 | W | 01/02/2016 11:46 |

Raspberry Pis. Um, so we've bought 25 Raspberry Pis, uh, Pi 2s

| | | | | 4 | W | 01/02/2016 11:46 |

HTMI ports, um a lead physically attached – we've taken the power lead out from the back of the PC so you can literally plug the Pi in, press the monitor button, switch inputs and you've switched from your PC to your Pi.

| | | | | 5 | W | 01/02/2016 11:51 |

App Inventor

| | | | | 6 | W | 01/02/2016 11:56 |

it's access to two things It's the resources that people put on there, which obviously all need modification to use (pause), but there's a host of ideas there. So it's well, how do other people deliver this particular topic, you know, have they got a worksheet, it-it's that trawling of information when you're building a-a-a- series of lessons on a particular topic

| | | | | 7 | W | 01/02/2016 12:43 |

Raspberry Jams

| | | | | 8 | W | 01/02/2016 12:44 |

Googling it

| | | | | 9 | W | 01/02/2016 12:46 |

Uh, unfortunately, no

| | | | | 10 | W | 11/02/2016 15:17 |

the events that I go to…um, which have mostly been, um, a little bit of CPD, some of the Raspberry Pie stuff, they have helped broaden my knowledge, and they do have an impact on, I suppose on, um, the co-curricular things that I can offer.

| | | | | 11 | W | 01/02/2016 12:48 |

resources, um or even if it's a commentary…um, a discussion in a form about a resource, um, that I think does directly map into what I do in the classroom, and what my students use, and the results that they get.

| | | | | 12 | W | 01/02/2016 12:57 |

we've got a teaching and learning group, um and we meet, um, about once a month

| | | | | 13 | W | 01/02/2016 12:57 |

TeachMeets

| | | | | 14 | W | 01/02/2016 12:59 |

BBC um, you know Code bug

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|

### Nodes\\Ecology of Resources codes\\Available Resources\Tools\CAS event

| | | | | 1 | W | 01/02/2016 12:46 |

Uh, unfortunately, no

| | | | | 2 | W | 11/02/2016 15:17 |

the events that I go to…um, which have mostly been, um, a little bit of CPD, some of the Raspberry Pie stuff, they have helped broaden my knowledge, and they do have an impact on, I suppose on, um, the co-curricular things that I can offer.

### Nodes\\Ecology of Resources codes\\Available Resources\Tools\CAS resource

| | | | | 1 | W | 01/02/2016 11:56 |

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| | | | | 2 | W | 01/02/2016 12:48 |

resources, um or even if it's a commentary…um, a discussion in a form about a resource, um, that I think does directly map into what I do in the classroom, and what my students use, and the results that they get.

### Nodes\\Ecology of Resources codes\\Filter element

| | | | | 1 | W | 07/03/2016 11:23 |

free CPD there at weekends.

| | | | | 2 | W | 07/03/2016 11:23 |

free CPD there at weekends.

| | | | | 3 | W | 01/02/2016 11:51 |

free CPD there at weekends. Um, and that introduced me to things like App Inventor, um, which I'd hadn't seen before.

| | | | | 4 | W | 07/03/2016 11:24 |

It was straight up on CAS. I just looked for events within 50 miles, um, they came up, and that was it

| | | | | 5 | W | 01/02/2016 11:51 |

It was straight up on CAS. I just looked for events within 50 miles, um, they came up, and that was it

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| | | | | 6 | W | 07/03/2016 11:38 |
| the local hub meetings, um, all conveniently start at 400, which is…when I finish school | | | | | | |
| | | | | 7 | W | 01/02/2016 12:46 |
| the local hub meetings, um, all conveniently start at 400, which is…when I finish school | | | | | | |
| | | | | 8 | W | 07/03/2016 11:38 |
| they're about 25 miles away | | | | | | |
| | | | | 9 | W | 01/02/2016 12:46 |
| they're about 25 miles away | | | | | | |
| | | | | 10 | W | 07/03/2016 11:24 |
| the feedback I've heard from other people that have been on them, says they're not worth the money | | | | | | |
| | | | | 11 | W | 22/02/2016 12:09 |
| the feedback I've heard from other people that have been on them, says they're not worth the money | | | | | | |
| | | | | 12 | W | 01/02/2016 12:50 |
| £120 for a two-hour webinar, doesn't sound like value to money to me | | | | | | |
| | | | | 13 | W | 07/03/2016 11:24 |
| £120 for a two-hour webinar, doesn't sound like value to money to me | | | | | | |
| | | | | 14 | W | 07/03/2016 11:24 |
| I haven't had a huge amount over the past five years because during all of our sort of in-service training time at school, our sort of protected CPD periods, I'm normally delivering it rather than receiving it | | | | | | |
| | | | | 15 | W | 07/03/2016 11:24 |
| I haven't had a huge amount over the past five years because during all of our sort of in-service training time at school, our sort of protected CPD periods, I'm normally delivering it rather than receiving it | | | | | | |
| | | | | 16 | W | 01/02/2016 12:58 |
| complete lack of finance would be a – would be the first one | | | | | | |

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| | | | | 18 | W | 07/03/2016 11:25 |

complete lack of finance would be a – would be the first one

| | | | | 19 | W | 01/02/2016 12:59 |

it's (stutter) very much, uh, curriculum driven

### Nodes\\Ecology of Resources codes\\Filter element\Barrier

| | | | | 1 | W | 01/02/2016 12:46 |

the local hub meetings, um, all conveniently start at 400, which is…when I finish school

| | | | | 2 | W | 01/02/2016 12:46 |

they're about 25 miles away

| | | | | 3 | W | 22/02/2016 12:09 |

the feedback I've heard from other people that have been on them, says they're not worth the money

| | | | | 4 | W | 01/02/2016 12:50 |

£120 for a two-hour webinar, doesn't sound like value to money to me

| | | | | 5 | W | 22/02/2016 12:09 |

I haven't had a huge amount over the past five years because during all of our sort of in-service training time at school, our sort of protected CPD periods, I'm normally delivering it rather than receiving it

| | | | | 6 | W | 01/02/2016 12:58 |

complete lack of finance would be a – would be the first one

### Nodes\\Ecology of Resources codes\\Filter element\Catalyst

| | | | | 1 | W | 01/02/2016 11:51 |

free CPD there at weekends. Um, and that introduced me to things like App Inventor, um, which I'd hadn't seen before.

| | | | | 2 | W | 01/02/2016 11:51 |

It was straight up on CAS. I just looked for events within 50 miles, um, they came up, and that was it

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| | | | | 3 | W | 01/02/2016 12:59 |

it's (stutter) very much, uh, curriculum driven

### Nodes\\Ecology of Resources codes\\Filter element\Filter for attending CAS in-person events

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| | | | | 1 | W | 07/03/2016 11:38 |

the local hub meetings, um, all conveniently start at 400, which is…when I finish school

| | | | | 2 | W | 07/03/2016 11:38 |

they're about 25 miles away

### Nodes\\Ecology of Resources codes\\Filter element\Filter for attending CAS in-person events\Proximity to home or school

| | | | | 1 | W | 07/03/2016 11:38 |

they're about 25 miles away

### Nodes\\Ecology of Resources codes\\Filter element\Filter for attending CAS in-person events\Timing of events

| | | | | 1 | W | 07/03/2016 11:38 |

the local hub meetings, um, all conveniently start at 400, which is…when I finish school

### Nodes\\Ecology of Resources codes\\Filter element\Filter for PD

| | | | | 1 | W | 07/03/2016 11:23 |

free CPD there at weekends.

| | | | | 2 | W | 07/03/2016 11:23 |

free CPD there at weekends.

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| | | | | 3 | W | 07/03/2016 11:24 |

It was straight up on CAS. I just looked for events within 50 miles, um, they came up, and that was it

| | | | | 4 | W | 07/03/2016 11:24 |

the feedback I've heard from other people that have been on them, says they're not worth the money

| | | | | 5 | W | 07/03/2016 11:24 |

£120 for a two-hour webinar, doesn't sound like value to money to me

| | | | | 6 | W | 07/03/2016 11:24 |

I haven't had a huge amount over the past five years because during all of our sort of in-service training time at school, our sort of protected CPD periods, I'm normally delivering it rather than receiving it

| | | | | 7 | W | 07/03/2016 11:24 |

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| | | | | 8 | W | 07/03/2016 11:25 |

complete lack of finance would be a – would be the first one

## Nodes\\Ecology of Resources codes\\Filter element\Filter for PD\Cost

| | | | | 1 | W | 07/03/2016 11:23 |

free CPD there at weekends.

| | | | | 2 | W | 07/03/2016 11:24 |

£120 for a two-hour webinar, doesn't sound like value to money to me

| | | | | 3 | W | 07/03/2016 11:25 |

complete lack of finance would be a – would be the first one

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
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**Nodes\\Ecology of Resources codes\\Filter element\Filter for PD\Ease of finding offerings**

| | | | | 1 | W | 07/03/2016 11:24 |
|---|---|---|---|---|---|---|

It was straight up on CAS. I just looked for events within 50 miles, um, they came up, and that was it

**Nodes\\Ecology of Resources codes\\Filter element\Filter for PD\Feedback on quality**

| | | | | 1 | W | 07/03/2016 11:24 |
|---|---|---|---|---|---|---|

the feedback I've heard from other people that have been on them, says they're not worth the money

**Nodes\\Ecology of Resources codes\\Filter element\Filter for PD\Teacher's available time**

| | | | | 1 | W | 07/03/2016 11:24 |
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**Nodes\\Ecology of Resources codes\\Filter element\Filter for PD\Timing of offering**

| | | | | 1 | W | 07/03/2016 11:23 |
|---|---|---|---|---|---|---|

free CPD there at weekends.

| | | | | 2 | W | 07/03/2016 11:24 |
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I haven't had a huge amount over the past five years because during all of our sort of in-service training time at school, our sort of protected CPD periods, I'm normally delivering it rather than receiving it

**Nodes\\Emerging codes\\Impact on Teaching\Connect with other people**

| | | | | 1 | W | 11/02/2016 15:17 |
|---|---|---|---|---|---|---|

actually do-doing a bit of networking is always a good thing, cause you get to put faces to names

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
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### Nodes\\Emerging codes\\Impact on Teaching\Helped teacher's understanding

| | | | | 1 | W | 11/02/2016 15:13 |

he said, well actually, that's not entirely true, and if you word it like this it's more accurate, and I got some real expert input, um, I – and I've blankly (?) shared that back up onto CAS. So I think version 4 or something is up there now. But that was something that was very, very beneficial for me. Cause it was an area I wasn't familiar with,

### Nodes\\Emerging codes\\Impact on Teaching\Taught teacher something new

| | | | | 1 | W | 11/02/2016 15:17 |

the events that I go to…um, which have mostly been, um, a little bit of CPD, some of the Raspberry Pie stuff, they have helped broaden my knowledge, and they do have an impact on, I suppose on, um, the co-curricular things that I can offer.

### Nodes\\Emerging codes\\Motivator to check CAS

| | | | | 1 | W | 23/02/2016 12:00 |

once a mo – once every half term, so, maybe every six weeks or so, every two months, I'll go and I'll just check the events and say well is there anything posted that's pulling up either CPD for myself or um things like the Raspberry Jams.

### Nodes\\Emerging codes\\Motivator to check CAS\Needs to find out or learn something

| | | | | 1 | W | 02/02/2016 14:29 |

if something comes up and it's a topic um… or, one of my sixth formers is doing a project and if they say, well, I want to do something like, this…um…it's one of the places I will go to, as well as just Googling it, to see if I can – I can find some information on it.

### Nodes\\Emerging codes\\Motivator to check CAS\When planning

| | | | | 1 | W | 02/02/2016 14:27 |

I'll have my year planner in front of me and I'll go, well actually in terms of sort of co-curricular enrichment and things, what are the events that are planned

| | | | | 2 | W | 02/02/2016 14:28 |

if I'm going to do a new topic, so if in 2 weeks time I'm about to start teaching the floating point arithmetic, I'll think, well I've got my resources, but I'll just have a quick poll to see if you know somebody's come up with this superb, unique, dynamic way of doing it that suddenly makes it simple.

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
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### Nodes\\Emerging codes\\Preparedness for the computing curriculum

| | | | | 1 | W | 01/02/2016 11:48 |

I had to, um, basically re-reacquaint myself with the languages. I'd taught in VB6 back in the day. And prior to that I'd done some work with Pascal. Um, and obviously as a child of the 70s I was familiar with the BBC Micro. But, um, so basically I taught myself Python

| | | | | 2 | W | 01/02/2016 11:49 |

I am still struggling. I think I've still – because I'm not a computing specialist, I'm a mechanical engineer, really, I've found the move to sort of object oriented programming, um, and using modules like Pi game or Takinter (??) to actually create graphical user interfaces through Python quite challenging. Just because I hadn't had any training in that. So there's been

| | | | | 3 | W | 01/02/2016 11:50 |

I was fortunate in having taught sort of A-level computing (pause) 10 or more years ago. Um, some of the fundamentals don't change. So, normalising a database, doesn't change. Um…the need to have selection and iteration and sequencing – (stutter) the basics don't change

| | | | | 4 | W | 01/02/2016 11:50 |

picking up a new language was a little bit tricky. Um…some of the bits on the spec…um…for example, regular expressions is on the A-level spec, um, that I – I'd never taught about regular – I didn't know what a regular expression was

### Nodes\\Emerging codes\\Preparedness for the computing curriculum\Did not feel prepared for the new curriculum

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### Nodes\\Emerging codes\\Preparedness for the computing curriculum\Felt prepared for new curriculum

| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|

| | | | | 1 | W | 01/02/2016 11:50 |

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| Classification | Aggregate | Coverage | Number Of Coding References | Reference Number | Coded By Initials | Modified On |
|---|---|---|---|---|---|---|
| **Nodes\\Emerging codes\\Usage of CAS** | | | | | | |
| | | | | 1 | W | 02/02/2016 14:27 |
| it's frequently while I'm at home | | | | | | |
| **Nodes\\Emerging codes\\Usage of CAS\From home** | | | | | | |
| | | | | 1 | W | 02/02/2016 14:27 |
| it's frequently while I'm at home | | | | | | |