Modelling of University Students' Study Behaviour and grade Point Average (GPA)

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.

Abstract

Two prospective surveys tested a theory based model of university students' study behaviour and grade point average (GPA). The theory of planned behaviour (TPB) and personality systems interaction (PSI) theory were tested. The TPB fitted the data well for self reported study behaviour but was less useful for predicting GPA. Some support for PSI theory was found although the pattern of results varied by outcome criterion. Specifically, in study 1, volitional competency by subjective norm interactive terms explained unique variation in study behaviour after TPB variables and past behaviour were controlled. In study 2 implicit attention control (IAC) had a direct effect on GPA after the TPB variables and past achievement were controlled. Implications for theory and the measurement of study behaviour and GPA discussed.

Key words: university students, study behaviour, grade point average, theory of planned behaviour, personality systems interactions theory.

Modelling of University Students' Study Behaviour and GPA

Modelling academic achievement related behaviours and outcomes is a precursor to designing effective interventions that help students reach their potential. Measures of scholastic grade point average (GPA), and cognitive ability (e.g., SAT and ACT) have been found to explain unique variation in university GPA (Bridgeman, Pollack & Burton, 2004; Ramist, Lewis & McCamley-Jenkins, 2001), collectively accounting for approximately 25% of the variance (Mathiasen, 1984; Mouw & Khanna, 1993) so leaving substantial variance unexplained. Non intellective measures have been found to correlate with students' academic achievement related behaviours and outcomesand to explain variance not captured by previous scholastic achievement and cognitive ability.. This is especially evident in post compulsory education where motivation to study is less regulated by teachers and parents and where university selection may attenuate variance in scholastic achievement.

The identification of non-intellective predictors of achievement related behaviours and outcomes is important as they may provide targets for interventions designed to improve academic achievement. Pintrich (2004) has highlighted the importance of self regulation for academic achievement. In general, self regulation theorists have shown that goal specific cognitions are more strongly associated with behaviour and outcomes and are more amenable to change (Ajzen, 1991; Burmudez, 1999; Chen, Gully, Whiteman, & Kilcullen, 2000; Kanfer, 1992; Lee, Sheldon & Turban, 2003; Phillips & Gully, 1997) than broader trait like factors which render them as potential promising targets for interventions designed to change behaviour.

Theorists have distinguished between motivation and volition, with motivation culminating in the formation of goals or behavioural intentions, and volition guiding the translation of goals into actions (Kuhl, 2000). According to Gollwitzer's (1990) "rubicon" model, decisions about "why" one should act and "where" one should invest effort are part of the goal setting process

which precedes goal commitment. Once a goal has been formulated, goal striving begins. In this phase, regulatory processes focus on *how* to best implement effort (Boekaerts & Corno, 2005). Students use of distinct self regulatory strategies may render such post-motivational, goal striving more or less effective, thereby, enhancing the prediction of performance. The theory of planned behaviour (TPB; Ajzen, 1991) is one of the most widely applied social cognitive models of motivation while personality systems interactions (PSI; Kuhl, 2000) theory outlines a range "volitional" processes which follow from intention formation and determine which intentions are translated into action (e.g., Kuhl & Fuhrmann, 1998).In a promising model of self regulated learning, that combined TPB and PSI theory, Orbell (2003) found that goal specific cognitions and more stable trait like volitional factors explained substantial variation in the number of hours studied by students (10-18%). However, it cannot be assumed that models of students study behaviour apply to more objective assessments of academic achievement. While studying is an important goal in and of itself, measures of time spent studying seem to be unrelated to, or weakly associated to students' grades (*r*s range from -.02 to .12), regardless of assessment method (e.g., number of hours studied or time diaries; Hill, 1990; Shuman, Walsh, & Olson, 1985) or performance criterion (e.g., cumulative GPA or course GPA). Thus, to establish the applied implications of Orbell's (2003) findings, replication and extention using objective achievement outcome data is necessary. GPA is an index of performance directly relevant to postgraduate selection, training and employment opportunities (Plant, Ericsson, Hill, & Asberg, 2005) as such, it is the key criterion of academic achievement.

In The most widely tested social cognitive self regulatory model is the theory of planned behaviour (TPB; Ajzen, 1991). The TPB proposes that behavioural intentions are the most immediate precursor of action. Individual differences in intention strength are assumed to reflect motivational factors and therefore the degree of effort exerted when striving towards goals (Ajzen, 1991). Attitudes, subjective norms and perceived behavioural control (PBC) are

identified as key psychological determinants of behavioural intentions. Attitudes reflect individual evaluations of performing the behaviour in question (e.g., "obtaining a good degree would be good/bad") while subjective norms represent important others' approval of the behaviour (e.g., "most people who are important to me think that I should obtain a good degree"). PBC refers to people's appraisal of goal feasibility in terms of perceived self-capabilities and perceptions of control over goal attainment and is similar to Bandura's (1997) concept of self-efficacy. The effects of PBC on behaviour are mediated by behavioural intentions since believing in the feasibility of an action (e.g., "it would be easy for me to obtain a good degree") bolsters motivation. To the extent that PBC provides a proxy measure of actual control it may also have an unmediated effect on behavioural outcomes (Ajzen & Madden, 1986). The TPB proposes that a more positive attitude, a more positive subjective norm, and greater PBC result in stronger behavioural intentions, which, in turn, predict greater effort and goal achievement. Thus from a goal perspective, goal achievement refers to obtaining a goal, whether for example, it refers to the number of hours studied or a GPA.

The TPB has been shown to provide a useful framework for modelling students' study behaviour. For example, Orbell (2003) found that the number of hours studied over two-weeks were significantly related to students' behavioural study intentions, which, in turn were codetermined by attitudes, subjective norms and perceptions of control (see too Leone, Perugini, & Ercolani, 1999). The TPB has also been shown to predict objective achievement outcomes at university. One of the first ever applications found that undergraduates' intentions to obtain an 'A' grade correlated with course grades attained several weeks later (Ajzen & Madden, 1986). The GPA outcome criterion coincides with Ajzen's (2001) recommendation of 'aggregation' when it is not feasible to measure every action or behaviour involved in goal attainment. Moreover, it is consistent with goal theory, which focuses on the

relationship between goal level and task performance rather than discrete intentions to undertake specific actions (Locke & Latham, 1990).

More recently, Phillips, Abraham and Bond (2003) replicated the findings of Ajzen & Madden (1986) using cumulative achievement episodes that are more reliable than grades for single courses. In a prospective study, they found an extended TPB explained 65% of the variance in the intention to obtain a good degree and 32% of the variance in overall degree marks. Both intention (21%) and PBC (11%) had an unmediated effect on GPA while PBC and subjective norm were significant predictors of intention (see too Armitage, 2008, Manstead & Van Eekelen, 1998).

Personality systems interactions theory (PSI)

Personality systems interactions (PSI) theory specifies various neuro-cognitive and affective processes that regulate action. The theory suggests that difficulties in goal striving can be due to inefficient motivational processing (e.g., failure to enhance goal attractiveness), emotional processing (e.g., inability to disengage from negative mood) or attentional processing (e.g., failure to remain task focused) (Kuhl, 2000; Maes & Karoly, 2005) during challenging goal striving. Consequently, it has been suggested that PSI theory may usefully complement the predictive utility of the TPB for challenging goals such as studying(Kuhl, 2000; Orbell, 2003).

According to PSI theory the optimal mode of action control is "self regulation" which facilitates access to core values, needs and beliefs during goal striving and helps to protect goals from unwanted thoughts or distractions. PSI contrasts conscious action control processes such as planning and impulse control with relatively automatic self regulatory processes - which embrace both goal achievement and self maintenance motives (Kuhl, 2000).

The volitional components inventory (VCI; Kuhl & Fuhrmann, 1998) was developed to assess individuals' volitional capacities during challenging goal striving. Students operating in the self regulatory mode are expected to report moderate levels of conscious attention control (CAC) and moderate to strong levels of implicit attention control (IAC) and self determination (SD). Volitional competencies may also strengthen commitment to one's goals and therefore moderate the relationship between intention and behaviour. Supporting this, Orbell (2003) found that measures of CAC, IAC and SD explained variation in the number of hours studied by students after the TPB and past study behaviour were controlled. Moreover the same competencies moderated the effects of intention and subjective norm on study behaviour.

The evidence suggeststhat the TPB is a useful organising framework for modelling oboth self report study behaviourand GPA. Moreover, it seems likely that the volitional processing capacities outlined by PSI theory may add to the prediction of study behaviour and grade goals. . Volitional competencies may also strengthen commitment to one's goals (e.g., intention to obtain a good degree) and therefore moderate the relationship between intention and goal achievement, . Following Orbell (2003) it is also anticipated that volitional competencies may facilitate goal striving under conditions of low subjective norm. Activation of the self system during challenging situations (e.g., discouragement from studying by friends) may help to protect goals. Clarifying these relationships is important theoretically and practically in that volitional competency measures may enhance the predictive utility of models such as the TPB and, like TPB-specified cognitions, such competencies are potentially modifiable (Kuhl, 2000).

Controlling for past behaviour

Past behaviour is often shown to be a better predictor of future behaviour than behavioural intention (e.g., Ajzen, 2001; Ouellette & Wood, 1998). Consequently, to provide

a more conservative test of the volitional components, measures of past behaviour were included. Following Orbell (2003) the volitional components were examined before and after past behaviour was controlled. This sequence of model testing is important, because although used as a statistical control in the current studies past performance may also causally impact on achievement and bias interpretation of the findings.

Study 1

Our first aim was to replicate Orbell's (2003) findings with self reported study behaviour. Four hypotheses were tested.

1. Intentions, attitudes, subjective norms and PBC will be positive correlates of the number of self reported hours studied.
2. Volitional competencies (conscious attention control, implicit attention control and self determination) will be positively related to the number of hours studied and explain variation after controlling for TPB-specified cognitions.
3. Volitional competencies may interact with the effects of intention and subjective norm on the number of hours studied.
4. The effect of PSI theory on the number of hours studied will remain after controlling for past behaviour.

Method

Participants and Procedure

Second year undergraduates studying in the schools of life sciences, humanities and social sciences at the authors university were invited to take part during their spring term. A priori power analysis based on 80% power, p<.05 alpha criterion, medium effect size (see Orbell. 2003), and an R^2 change hierarical regression based on a total of 8 predictors and/or tested predictors revealed that a sample size of 100 was sufficient (Faul, Erdfelder, Lang, & Buchner, 2007). Participants were approached individually and asked to logon to a website where they could complete the study questionnaire. Participants reported their email address, date of birth and gender so that follow up questionnaires could be sent and their data matched across two time points. 120 students completed the questionnaire at time 1 which contained this study's predictor measures. Two weeks later (time 2) 91% *(N* = 110, 97 female and 13 male*)* participants responded to an email asking them to self report the number of hours that they had studied over the previous two weeks Participants' ages ranged from 18 to 46 years at time 1 *(M* = 21.49, *SD* = 4.73*)*, and from 18 to 46 years at time 2 *(M* = 21.53, *SD* = 4.94*)*. All participants were offered free entry into a prize draw and the chance to win one of 4 £25 cash prizes. Participation was voluntary and all respondents were informed that their responses would remain confidential.

To assess the representativeness of our sample χ^2 tests were conducted to compare the gender distribution with the cohort from which they were drawn. In the current sample, there was a greater ratio of female students, χ^2 *(1)* = 26.81, $p < .001$ (88% female in the current sample versus 67% in the cohort). Thus somewhat more women responded to our survey. Note that more females (than male students) study subjects in the schools of life sciences, humanities and social sciences at the university where this research was conducted.

Measures

Items were reverse scored where necessary and averaged across relevant items to form scales. With exception of conscious attention control, table 1 shows that all multi-item scales had good reliability. Note that for each item, higher values represent stronger, positive beliefs.

TPB constructs were operationalised in terms of the number of hours spent studying. A previous pilot study (N = 20) had shown that 40 was the median number of reported hours that 2nd and 3rd year students study over a 2-week period. Consequently, all TPB measures specified studying "for a minimum of 40 hours over the next 14 days, i.e. 20 hours per week". TPB measures were based on items used by Ajzen (1991) and Manstead and Van Eekelen (1998). *Attitudes* were measured by evaluations of studying for a minimum of 40 hours over the next 14 days on 5 semantic differential scales (i.e. bad/good, unpleasant/pleasant, unenjoyable/enjoyable, unsatisfying/satisfying, worthless/worthwhile). *Subjective norms* were measured using 5 items (e.g., "people who are important to me think that I should study for a minimum of 40 hours over the next 14 days"), with anchored response options that ranged from 'should not' to 'should'). 5 items measured *PBC* (e.g., "how much control do you feel you have over your studying for a minimum of 40 hours over the next 14 days", 'no control' to 'complete control'). *Intentions* to study were assessed by 4 items (e.g., "over the next 14 days I intend to study for a minimum of 40 hours", 'strongly disagree' to 'strongly agree').

Self-regulated volitional efficiency was assessed by measures of conscious attention control (CAC), implicit attention control (IAC) and self determination (SD) as specified by the English language version of the VCI (Version 6, US-1 personal communication, Arno Fuhrmann; see Kuhl and Fuhrmann, 1998). Each item comprised a self descriptive statement that might be characteristic of the self when trying to pursue a challenging goal. All items

were measured with the stem "These days how often does each statement accurately describe you?" ('almost never' , 'seldom', 'somewhat seldom', 'sometimes', 'somewhat often', 'often', 'almost always'). *Conscious Attention Control* comprised 7 items (e.g., "concentrating only on whatever is important at the moment", "deliberately paying attention to anything that is important for the matter at hand"). *Implicit Attention Control* was measured by 7 items (e.g., "automatically paying attention only to those things that will bring me closer to my goal", "staying focused on the business at hand without any effort"). An 8-item scale assessed *self determination* (e.g., "sensing that it is I who want to pursue a difficult goal", "taking action in the knowledge that I am acting on my own free will").

Past Behaviour was measured by a single item: "over the past 14 days I have studied for a minimum of 40 hours, i.e. 20 hours per week" ('disagree' to agree').

Self reported study behaviour

Participants responded to an email at time 2 (two weeks after completing the questionnaire at time 1 that included i) a definition of study behaviour and ii) three self report questions about study behaviour. Specifically studying was defined as "lecture/seminar attendance and independent study". Following the definition of studying, participants were presented with three questions about self reported study including a free response item ("how many hours did you study over the past 14 days"), and two items using 7 point likert type scales ("over the last 14 days I have studied for a minimum of 40 hours" and "over the last 14 days I have studied for a minimum of 50 hours") ('disagree strongly' to 'agree strongly'). Participants were asked to answer the questions and return the email to the sender. Upon receipt of the participant's responses a study debrief was emailed to the participant. The scores on these items were converted into z scores prior to computation of the mean scale score.

Results

Representativeness Check

The representativeness of the sample at time 2 was checked using *t* tests for all variables measured at time 1 comparing those who stayed in the study and those who did not. No significant differences were found (all *p*s >.05) suggesting that the final sample was representative of the larger sample from which it was drawn.

Analytic Strategy

Hypotheses were tested in three analytic steps. First correlations between predictor variables and study behaviour were examined. Second hypothesised interactions between volition measures and TPB-specified measures were tested using the procedure outlined by Aiken & West (1991). Third hierarchical multiple regression was used to explore the relative predictive utility of significant correlates and interaction terms before and after controlling for past study behaviour.

Of the TPB variables, the bivariate correlations reported in table 2 show that intention (*r* =.63), PBC (*r* = .39), and attitudes (*r* = .29), were all positively associated with the number of hours studied by students supporting our first hypothesis. Neither IAC, (*r* = .13) or SD (*r* = .09) were statistically significantly related to the criterion although CAC obtained marginal statistical significance(*r* =.19, p = .05) offering some support for our second hypotheses. As expected, past study behaviour was a strong positive correlate of self reported study (*r* = .61).

Moderation Analyses

To provisionally test our third hypotheses a series of hierarchical regressions were conducted using the procedures outlined by Aiken and West (1991). In each model the number of hours studied was regressed onto the focal predictor (e.g., intention) at step 1, the focal moderator at step 2 (e.g., CAC) and the product of the focal predictor and moderator (which were mean-centred and standardised before multiplication) at the third step. Results showed that only the volitional components by subjective norm interactive terms reached significance or marginal statistical significance. Thus these data provide some support for hypotheses 3 in that subjective norm moderates the influence of the volitional competences on study behaviour. However contrary to prediction no support for theorised interactions between volitional possessing and behavioural intentions was found. Consequently, only the volitional components by subjective norm interactive terms were included in subsequent analyses.

Regression Analyses

A moderated hierarchical regression was conducted (cf. Baron & Kenny, 1986). The number of hours studied was regressed onto the TPB variables at step 1, the focal volitional component at step 2 and at step 3 the focal volitional component by subjective norm interaction term. The TPB variables explained 41% of the variance, F (4, 105) = 18.08, $p < .001$ although intention was the only unique predictor ($\beta = .64$). The addition of the volitional components at step 2 did not add to the model (βs = .02, -.05 and -.12 for CAC, IAC and SD respectively). The volitional component by subjective interaction terms were significant for IAC, F change = 4.62, $p < .05$ and marginally significant for CAC, F change = 3.02, $p < .07$ and SD, F change, 2.58, $p < .09$.

To explore whether these effects were retained after past study behaviour was controlled the number of hours studied was regressed onto the TPB variables at step 1, past study behaviour at step 2 and the focal volitional component by subjective norm interactive term at step 3.

Results reported in table 3 show that past study behaviour added significantly to the model, *F* change = 7.65, $p < .01$ and that intention retained a significant beta value ($\beta = .43$). At step 3, subjective norm interaction terms with IAC and SD added significantly to the model, *F* change = 4.75 and 3.33 respectively, $p < .05$ while the CAC by subjective norm term obtained marginal statistical significance ($p < .09$).

In summary these results provide good support for hypotheses one because intention is a good predictor of study behaviour. Hypotheses two is not supported as none of the volitional competencies had a direct impact on the behavioural outcome. Partial support for hypotheses three and four was found as significant volitional competency by subjective norm interaction terms explained unique variation in study behaviour after behavioural intention and past behaviour were controlled. Nonetheless, for the volitional competency by intention terms neither hypotheses 3 or 4 were supported.

Simple slopes

The significant interaction effects were decomposed using simple slopes analysis (Aiken & West, 1991). Thus, the effect of the volitional components on study behaviour was tested at high, low and moderate levels of subjective norm (one standard deviation above, and below the mean, and at the mean itself, respectively). The predicted values of the volitional components at each level of the moderator variable are shown in Table 4. The results show that there was no significant effect of the volitional components at high and moderate levels of subjective norm. However at low levels of subjective norm, IAC ($\beta = .42$, $t = 2.98$, $p < .01$) and CAC ($\beta = .60$, $t = 3.39$, $p < .01$) were significant predictors. There were no significant predictive effects for self determination. Decomposition of the significant interaction effects is illustrated, using CAC an example in Figure 1. Consistent with Orbell, these findings illustrate that high CAC and IAC can offset the negative effects of low subjective norm on the number of hours studied by students.

Discussion of Study 1 Findings

Study 1explored the utility of combining TPB and PSI theory in a predictive model of university students' self reported study behaviour. Consistent with the TPB, intention was a significant predictor of the number of hours studied explaining 41% of the variance, a similar level to that observed in TPB applications, more generally (Armitage & Conner, 2001). PBC was not a unique predictor after intention was controlled indicating its influence of behaviour is through intention.

Contrary to expectation measures from PSI did not exhibit significant linear effects on study behaviour. Moreover, the volitional competencies did not moderate the intention-behaviour relationship. Nonetheless, interactions between subjective norm and volitional competencies reached statistical levels of significance both before and after past study behaviour was controlled, explaining an additional 3-5% of the variance. The SD by subjective norm findings were non significant when examined separately from the TPB variables and past behaviour indicating that its significance in the combined models reflects and anomaly of shared variance. Consistent with previous research (Orbell, 2003) decomposition of the interactive terms revealed that students with high volitional competency performed significantly better under conditions of low subjective norm than those with lower volitional capacity suggesting that volitional efficiency can offset the negative influence of low social support for studying among students.

Contrary to previous research and expectation none of the volitional components had a direct effect after behavioural intention was controlled. Moreover, only one of the volitional competencies (CAC) had a significant bivariate association with study behaviour and none of them moderated the intention behaviour relationship This contrasts with Orbell's (2003) findings and questions the robustness of such effects.

Study 2

Study 1 provided support for the utility of the TPB in academic settings and partial support for combining TPB and PSI theory. Study 2 extended this work by employing an objective measure of academic achivement. Students' grade point average (GPA) was selected as it is an easily accessible domain-common measure of achievement that captures many general aspects of learning and academic achievement. GPA is meaningful to students and has real-life implications including applications for graduate employment and postgraduate training (Plant, Ericsson, Hill, & Asberg, 2005). Four hypotheses were tested.

1. Intentions, attitudes, subjective norms and PBC will be positive correlates of GPA.
2. Volitional competencies (conscious attention control, implicit attention control and self determination) will be positively related to GPA and explain variation after controlling for TPB-specified cognitions.
3. Volitional competencies may interact with the effects of intention and subjective norm on GPA
4. The effect PSI theory on GPA will remain after controlling for previous university achievement.

Method

Procedure and participants

A prospective online survey was conducted of second and third (and final) year full time undergraduates studying at the university of the authors. All assessments contributing to these

students' degree grade (GPA) took place during their second and third years. Participants were recruited online using a standardised protocol that offered free entry into a prize draw to win one of four £25 cash prizes. Participants were informed that participation was voluntary and that responses would be confidential. Names were not recorded but participants were asked to consent to their personal details being used to acquire their GPA scores from university records.

Participants were enrolled on a number of majors covering humanities, social and life sciences. Complete data was collected for 257 students including 193 (79%) women and 51 (21%) men (with 13 unspecified). Their ages ranged from 18 to 51 years (M = 22.39, SD = 4.33).

To assess the representativeness of our samples *t* tests were conducted to compare the gender distribution and GPA scores with the cohort from which they were drawn. In the current sample, higher GPA scores were found, t (2421) =2.20, $p < .05$ (M = 62.99, SD = 5.82 versus M = 63.84, SD = 6.20) and a greater ratio of female students, t (2409) = 4.15, $p < .001$ (79% female in the current sample versus 69% in the cohort). Thus somewhat more women responded to our survey and on average our sample performed one percentage point higher in their overall degree then their cohort. Neither of these differences is substantial (cf., Cohen, 1992) indicating fairly good cohort representativeness. Further T tests were conducted to check for differences in the study measures between second and third year students. Results showed that there were no differences between the groups [Intention t (255) =.29, p >.05 (M = 5.49, SD = 1.29 versus M = 5.26, SD = 1.48); Attitude t (253) = -.45, p>.05(M =6.28 , SD = .67 versus M =6.32 , SD =.68); Subjective norm t (255) = -.46 (M = 5.00, SD =2.00 versus M = 5.03, SD = 1.48); PBC t (255) = .59 , p>.05(M = 4.34, SD = .95 versus M = 4.26 , SD = 1.16); past GPA t (251) = .07, p>.05(M =63.47 , SD = 7.98 versus M =63.41 , SD =5.38); CAC, t (255) = 1.34, p>.05(M = 4.49 , SD = .93 versus M =4.65 , SD =.93); IAC, t (255) = -1.57, p>.05 (M = 4.39 SD = 1.15 versus M =4.59 , SD = .95); SD t (255)= 1.35, p>.05(M =4.78 , SD = 1.11 versus M = 4.60, SD = .99)] indicating that they can be treated as a single sample.

Measures

Unless stated otherwise, all measures were assessed using 7 point Likert scales. Multi-item scale scores were computed by averaging responses across the relevant items. Table 5reports the means, standard deviations and Cronbach's alphas with higher scores indicating higher levels of the focal construct. All multi-item scales had acceptable levels of internal reliability.

Insert table 5

TPB measures were based on items developed by Ajzen (1991) and Manstead and van Eekelen (1998). A preliminary pilot study (N = 40) had shown that 65% was the average GPA that 2nd and 3rd year undergraduates' intended to obtain. Thus, in order to reduce restriction of range problems, and negative skew in the distribution, all TPB-specified measures referred to obtaining a GPA of 65% (or above). *Intention* was measured by 3 items (e.g., "I aim to graduate with a mean credit weighted score of 65 % (or above)": 'disagree strongly' to 'agree strongly'). Five semantic differential response options measured students' *attitude* (bad/good, unpleasant/pleasant, unenjoyable/enjoyable, unsatisfying/satisfying, and worthless/worthwhile). *Subjective norm* was measured by 3 items (e.g., "people who are important to me think that I should graduate with a mean credit weighted score of 65% (or above)":'should not' to 'should' and 5 items tapped students' *PBC* (e.g., "for me to graduate with a mean credit weighted score of 65 % (or above) would be": 'extremely difficult' to 'extremely easy').

Volitional competencies were assessed by using scales from part 1 of the volitional components inventory (Kuhl & Fuhrmann, 1998) as described in study 1.

GPA

As with most UK university students, our participants were awarded an overall end-of-year mean mark (GPA) out of 100 combining all formally assessed pieces of coursework and unseen examinations taken that year. The year 2 GPA contributed 40% of the final GPA while the year 3 GPA contributed 60%. Final year marks are translated into degree classifications with first class honours being awarded to students with a final score of 70% or more while students scoring 60-69, 50-59 and 40-49 are awarded upper second class, lower second class and third class honours degrees, respectively. GPA scores were used to create a binary outcome variable . GPA

scores lower than 65 were coded as 0 while scores of 65 or more were coded as 1. Prior academic achievement was indexed by the previous year's GPA as recorded on university records. For the 2nd year sample first year GPA was used, while for the final year students second year GPA was employed.

Results

Hypotheses were tested in three analytic steps. First correlations between predictor variables and GPA were examined. Second, hypothesised interactions between volition measures and TPB-specified measures were tested using the procedure outlined by Aiken & West (1991). Third, hierarchical logisticregression was used to explore the relative predictive utility of the measures before and after previous GPA scoreswas controlled. Nagelkerke's R is used to report the percentage of variance explained in GPA by the models.

Of the TPB variables, the bivariate correlations reported in table 6 show that intention (r = .32), PBC (r = .32), and subjective norm (r = .13) were all positively associated with GPA ssupporting our first hypothesis. However, contrary to expectation and hypotheses 1 attitudes (r = -.20) was inversely related to the criterion. Hypotheses 2 was supported for IAC, (r = .18) which was significantly correlated with GPA. However, contrary to expectation, and our second hypotheses neither CAC (r = -.05) or SD (r = .08) were correlated with the criterion. As expected, previous GPA scores were a strong positive correlate of the GPA criterion (r = .45).

Insert table 6

Moderation Analyses

To provisionally test our third hypotheses a series of hierarchical logistic regressions were conducted using the procedures outlined by Aiken and West (1991). None of the interactive terms reached statistical significant and are therefore not included in any further analyses. Thus, contrary to our third hypotheses these data offer no support for theorised interactions between volitional possessing and achievement goal cognitions in relation to GPA.

In order to test the hypotheses that PSI theory enhances the prediction of GPA at university GPA was regressed onto the TPB measures at step 1 and the focal volitional component at step 2. Collectively, the TPB variables accounted for 20% of the variance in GPA, χ^2 (4) =41.89,$p < .001$ with intention ($\beta = .49$) and PBC ($\beta = .45$) as significant predictors. Consistent with the bivariate associations, neither CAC or SD added to the model. The addition of IAC at step 2 explained a further 2% of the variation in GPA , χ^2 (1) = 4.20 $p < .05$. Thus, combined intention, PBC and IAC explained 22% of the variance in GPA, χ^2 (5)= 46.08, $p < .001$.

Table 7shows that the effect of IAC on GPA remains significant after controlling for previous university GPA . When past GPA was added to the model at step 2 an additional 17% of the variance in GPA is explained (χ^2 (1)= 39.11, $p < .001$) while at step 3, IAC explained a further 2% of the variation, χ^2 (1)= 7.59, $p < .01$. These results provide some support for the TPB and hypotheses 1. Our second hypothesis was supported for IAC but not for CAC or SD. Our third hypothesis was not supported as none of the volitional competency by TPB specified cognitions interaction terms was significant. Finally, our fourth hypotheses was supported for IAC but not for either CAC or SD.

Insert table 7.Discussion of Study 2 Findings

The findings provide partial support for the TPB (Ajzen, 1991) by emphasising the predictive utility of PBC and intention. However, they offer little support for the utility of volitional measures derived from PSI theory in predicting university students' academic achievement.

However, IAC had a significant direct effect on GPA which retained significance after past achievement was controlled. None of the volitional component by TPB interactive terms were significant.

Consistent with Phillips et al. (2003) the TPB model predicted GPA. Specially, measures of intention and PBC explained 14% of the variation in GPA. The effects observed here are smaller than those reported by Phillips et al. (2003), probably because Phillips et al. sampled third year students' close in proximity to their final examinations when at least 60% of their overall grade had already been determined. Consequently, intention was likely confounded by past grades that were included in the final outcome measure. Surprisingly, attitude was inversely correlated with intention (as also reported by Manstead & van Eekelen, 1998), and GPA. Supplemental analyses revealed that this negative effect was extinguished for students with GPA scores below average (r = .02, ns i.e., those earning a GPA below 63.84%) . Thus, the negative association may reflect aspiration for higher grades among students who previously performed well (i.e., 65% or better)

Controlling for TPB, only IAC (implicit attention control) from Kuhl's PSI theory increased the predictive utility of the model. This suggests that the capacity to focus attention on achievement and ignore other distractions is an important self regulatory skill for undergraduate students. The effect of IAC on GPA remained after previous GPA scores were controlled suggesting that this is a robust effect. Previous GPA was the most important predictor of GPA and extinguished the influence of intention on GPA. Although primarily used as a statistical control in the present studies, we speculate that previous GPA may be broken down into theoretical constituents that causally impact on GPA. In addition to cognitive ability, we speculate that past GPA scores, as measured in study 2 provide a proxy of a range constructs such as other self regulatory capacities, not captured by PSI theory including automatic

behavioral responses (both in terms of behavoural frequency and responses to cues in the environment). For example, it seems likely that habitual study patterns, that are not consciously deliberated e.g., turning the television off when studying influence GPA. This is certainly supported by the finding that IAC directly predicts GPA. Nonetheless, it is noteworthy, that intention was measured on a 7 point scale which may have led to an under estimation of its role in predicting GPA, which together with previous GPA was measured on a 100 point scale. Nonetheless, PBC, also measured on a 7 point scale remained a significant predictor of GPA after past behaviour was controlled, highlighting the self regulatory challenge involved in obtaining a good GPA that may be related to a number of non deliberative, automatic processes.

Contrary to expectation no significant interactions between goal specific cognitions and Kuhl's volitional measures were obtained. Thus, using GPA as our dependent measure, we did not replicate the main and interactive effects of volitional competencies reported by Orbell (2003) or the volitional component by subjective norm interactions obtained in study 1 (when self reported study behaviour was used as the dependent measure)

General Discussion

Our findings support the TPB as a model of the determinants of self-reported student study behaviour and provide some support for the theory as a model of GPA achievement. However, with exception of the influence of implicit attention control (IAC), on GPA and the significant subjective norm by volitional competencies interaction predicting self-reported study behaviour, none of the volitional components from PSI theory (or their combination with TPB-specified cognitions) predicted goal achievement. Importantly, past achievement extinguished the effect of intention on GPA suggesting that studying is an effortful goal striving process that may be governed by implicit non deliberative processes. The finding that IAC has an unmediated

influence on GPA over and above past behaviour highlights the relevance of implicit self regulation for achievement.

Our studies are some of the first field studies to utilise measures from the VCI which has, more typically, been tested in short, resource-intensive, experimental settings (e.g., Kuhl & Kraska, 1994). As such the findings demonstrates the utility of applying the VCI to long-tem real-world goals but with exception of IAC, provide limited support for the measures as characterisations of individual differences predictive of academic achievement.

The results emphasise the importance of motivation for student study behaviour with 41% of students' self-report study explained by their self-report study intentions. However, failure to fully replicate these findings with the objective achievement data is disappointing and may imply that interventions targeting behavioural rather than achievement outcomes may not be as effective in improving achievement as expected in higher education settings. Indeed, in the GPA sample, intention was reduced to non significance after past behaviour was added to the model. Unfortunately, the studies did not include both GPA and study behaviour data, thus it remains to be clarified whether variation in observed effects between the two studies may be attributable simply to differences in the nature of modelled outcomes. We speculate that memory biases associated with self-report measures (e.g. Murdock, 1962) may explain variation in observed effects between the two studies. However, it is acknowledged that an alternative interpretation could be that time spent studying is unrelated to GPA. In light of the reduced variation in intelligence scores among university students, and the 75% of variance that remains after tests of cognitive ability and scholastic achievement are controlled (e.g., Robbins et al. 2004) we maintain that self regulatory motivational strategies for learning remains an important area of research. Other

theories of self regulation such as Temporal self regulation theory (Hall & Fong, 2007) may provide better measures for moelling self regulatory capacity and/or habitual aspects of learning. In any case theoretical models which explain self reported study behaviours cannot be assumed to for GPA. Future research that validates self reported study behaviours including the number of hours studied is needed.

Based on our findings, future intervention research could examine whether interventions promoting motivation, PBC, and implicit attention control enhance GPA directly and whether interventions targeting the volitional components specified by PSI theory more generally overcome low subjective norms for particular student sub groups. Moreover, implementation intentions (Gollwitzer and Sheeran, 2006) could be examined as a compensatory strategy for students with low IAC. In a brief goal setting intervention, Latham and Brown (2006) report that GPA was significantly higher among students who set proximal goals (including grade goals), in addition to distal outcome goals, than those who only set distal goals or those who were urged to do their best. PBC is also a potentially important target for intervention, because these beliefs are deemed to be modifiable at a relatively low cost. Bandura (1997) specifies four methods for raising self-efficacy including the facilitation of vicarious learning, mastery experiences and re-attribution of responses to physiological sensations in addition to the presentation of persuasive communication.

In conclusion, our results are consistent with Orbell (2003) in showing that significant volitional component by subjective norm interactions explained significant proportions of

variance, after controlling for TPB variables and past study behaviour. However, our findings emphasise the limits of self reported study behaviour as an index of academic achievement in higher education settings. PBC, IAC and previous GPA were the strongest predictors of GPA indicating that obtaining a good grade at university is a complex challenging goal that requires self regulatory capacity.

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Future research needs to break down influence of past beha

Role of personality

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Table 1.

Means, Standard Deviations and Cronbach's Alphas of Study 1 Measures

Study 1 Measures	No of items	Range (Low)	Range (High)	Mean	SD	α
Number of hours studied	3	-1.10	2.45	.00[a]	.89	.86
Past behaviour	3	1.00	7.00	3.27	1.76	.82
Intention	4	1.00	7.00	4.37	1.52	.92
Attitudes	5	2.80	7.00	5.06	.88	.74
Subjective norm	5	1.00	7.00	4.29	1.16	.85
PBC	5	1.20	6.80	4.59	1.06	.70
CAC	7	3.14	6.43	5.09	.59	.63
IAC	7	1.71	6.57	4.33	.85	.84
SD	8	2.38	7.00	5.00	.89	.85

Note. PBC = perceived behavioural control; CAC = conscientious control; IAC = implicit attention control; SD =selfdetermination.

[a]the mean for this variable is 0 because this value represents standardised scores,

Table 2

Correlations Among Study 1 Measures

Study 1 Measures		1.	2.	3.	4.	5.	6.	7.	8	.9
1.	Hours studied	.61**	.63**	.29**	.13	.39**	.19	.13	.09	
2.	Past behaviour		.73**	.38**	.15	.60**	.24*	.28**	.24*	
3.	Intention			.55**	.28**	.51**	.20*	.22*	.27**	
4.	Attitude				.18	.50**	.34**	.37**	.51**	
5.	Subjective norm					.13	.12	-.07	.00	
6.	PBC						.25**	.34**	.44**	
7.	CAC							.57**	.40**	
8.	IAC								.43**	
9.	SD									

Note.N = ; PBC = perceive behavioural control; CAC = conscious attention control; IAC = implicit attention control; SD = self determination.
*p < .05, **p < .0.1

Table 3
Study 1 Linear Regression Model Predicting the Number of Hours Studied (with Past Behaviour)

Step	**Variables Entered**	β	β	β	β	β
	Study 1			CAC	IAC	SD
1.	Intention	.64**	.43**	.40**	.41**	.44**
	Attitude	-.12	-.08	-.07	-.03	-.03
	Subjective norm	-.04	-.03	.05	.04	-.01
	PBC	.13	.01	.02	.02	.00
2.	Past behaviour		.32**	.31*	.32**	.35**
3.	VCI			-.01	-.07	-.12
	VCI x Subjective norm			-.19*	-.23**	-.17*
	R^2	.41	.45	.48	.50	.48
	F_{change}	18.08***	7.65**	2.69[x]	4.75*	3.33*
	Model F	18.08***	16.91***	13.24***	14.30***	13.57***

Note. β = standised beta coefficient; PBC = perceived behavioural control; CAC=conscious attention control; IAC = implicit attention control; SD = self determination; VCI = volitional components inventory.
* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4
Predicted Values of Volitional Components at Each Level of Subjective Norm (Study 1)

	Level of Moderator Variable (Study 1)		
Moderator	Low	Moderate	High
CAC	.60**	.13	-.33
IAC	.42**	.14	-.14
SD	.18	.09	-.01

Note. Low, 1 SD Below the Mean; Moderate, Mean; High, 1 SD Above the Mean;
values are unstandardised regression coefficients for subjective norm; CAC=conscious attention control; IAC = implicit attention control; SD = self determination.

**$p < 0.1$

Table 5. Means, Standard Deviations and Cronbach's Alphas of Study 2 Measures

Measures (Study 2)	No of items	Range (Low)	Range (High)	Mean	SD	α
GPA	1	40.00	78.20	63.84	6.20	N/A
Past achievement	1	44.00	79.73	63.19	5.90	N/A
Intention	3	1.06	6.50	4.30	1.07	.92
Attitude	5	1.00	7.00	5.36	1.40	.90
Subjective norm	3	3.80	7.00	6.30	.68	.87
PBC	6	1.00	7.00	5.00	1.36	.83
Conscious attention control	7	1.75	6.50	4.58	.93	.80
Implicit attention control	7	1.25	7.00	4.51	1.05	.77
Self determination	8	1.50	7.00	4.68	1.05	.82

Note. GPA = grade point average; PBC = perceived behavioural control.

Table 6.

Correlations among Study 2 measures.

Study 2 Measures	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. GPA	.45**	.32**	-.20**	.13*	.32**	-.05	.18**	.08	
2. Past behaviour		.37**	-.16*	.18**	.23**	-.15*	.02	-.07	
3. Intention			-.16**	.36**	.61**	-.03	.21**	.26**	
4. Attitude				-.07	-.27**	.08	.09	.06	
5. Subjective norm					.30**	.00	.07	-.02	
6. PBC						-.01	.14*	.28**	
7. CAC							.23**	.22**	
8. IAC								.60**	
9. SD									

Note. N =; PBC = perceive behavioural control; CAC = conscious attention control; IAC = implicit attention control; SD = self determination; *p < .05, **p < .01.

Table 7
Study 2 Logistic Regression Model Predicting GPA (with past behaviour)

Step	**Variables Entered**	β	SE	Wald	β	SE	Wald	β	SE	Wald
		CAC	CAC	CAC	IAC	IAC	IAC	SD	**SD**	SD
1.	Intention	.49	.20	6.24*						
	Attitude	-.28	.14	3.96						
	Subjective	.01	.15	.01						
	Norm	.45	.19	5.64*						
	PBC	-.37	.14	6.99**						
	χ^2 (4) = 41.887***									
	R^2 = .20									
2.	Intention	.14	.22	.40						
	Attitude	-.17	.15	1.26						
	Subjective	-.04	.16	.08						
	Norm	.59	.21	7.80**						
	PBC	.14	.22	27.55***						
	Past behaviour									
	χ^2 (1) = 39.11***									
	$R^{2\Delta}$ .17									
3.	Intention	.14	.22	.40	.03	.22	.02	.10	.22	.23
	Attitude	-.17	.15	1.26	-.24	.16	2.38	-.19	.16	1.53
	Subjective	-.04	.16	.08	-.07	.16	.16	-.03	.16	.03
	Norm	.59	.21	7.72**	.57	.21	7.23**	.55	.22	6.46*
	PBC	1.17	.22	27.24***	1.25	.23	28.97***	1.20	.23	27.88***
	Past behaviour	.00	.16	.00	.45	.17	7.27**	.13	.16	.66
	VCI									
		χ^2 (1) = .00 ns			χ^2(1) = 7 .59**			χ^2 (1) .67ns		
		$R^{2\Delta}$ = .00			$R^{2\Delta}$ =.39			$R^{2\Delta}$ = .00		

Note. β = unstandardised beta coefficient; SE = standard error;; IAC = implicit attention control; CAC=conscious attention control; SD= self determination; PBC = perceived behavioural control; VCI = volitional component inventory
* $p < .05$, ** $p < .01$, *** $p < .001$.

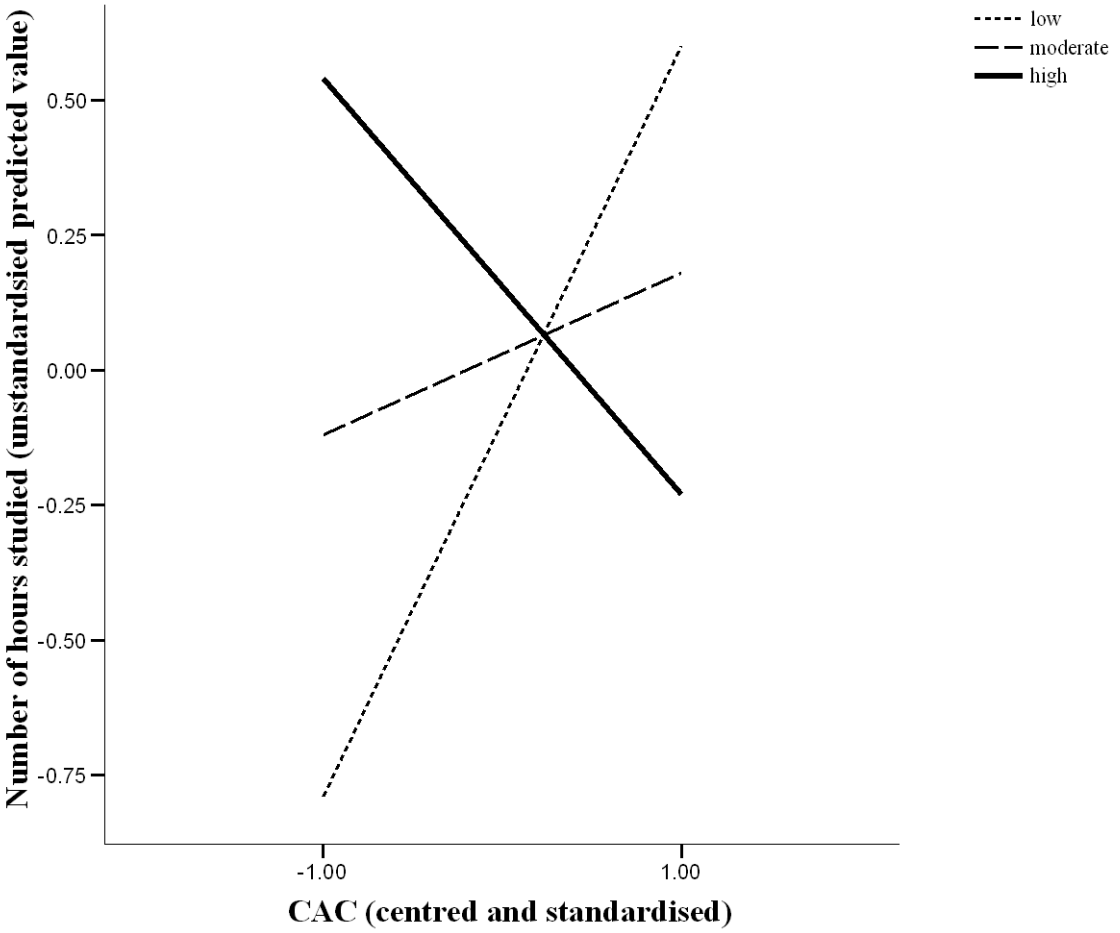

Figure 1. Study 1 Moderated Regression Model of Conscious Attention Control (Centred) for each Level of Subjective Norm