Running Head: THE IMPLICIT SELF-THEORY SCALE

My Intelligence May Be More Malleable than Yours:

The Revised Implicit Theories of Intelligence (Self-Theory) Scale is a Better Predictor of Achievement, Motivation and Student Disengagement.

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Abstract

The belief that intelligence is malleable has important consequences for achievement and motivation (Blackwell et al., 2007; Dweck, 1999; Robins & Pals, 2002). However, believing that it is possible to improve intelligence does not necessarily mean students are always confident they can improve their own. The current study presents a revised 'self-theory' measure of the implicit theories of intelligence scale, which assess students' beliefs about their ability to mould their *own* intelligence in contrast to their beliefs about the malleability of intelligence in general. In testing with 643 Australian high school students (62% female) ranging from 15 – 19 years of age (M = 16.6, SD = 1.01), the belief that intelligence is 'fixed' was predictive of lower endorsement of achievement goals, greater helplessness attributions and poorer self-reported academic grades. Fixed 'entity' beliefs were also predictive of academic self-handicapping, truancy and disengagement. On all of these measures, the new self-theory scale, uniquely explained greater outcome variance. These results indicate that students' implicit beliefs – particularly about *their own* intelligence – may have important implications for their motivation, engagement and performance in school.

Key Words: Implicit Theories; Intelligence; Entity; Incremental; Achievement; Motivation; Self-handicapping

Introduction

Achievement and motivation have a long history of research in the field of psychology (Atkinson, 1957, 1978; Dweck & Wortman, 1982; McClelland, Atkinson, Clark & Lowell, 1953; Weiner & Kukla, 1970). Over the last four decades much of this work has focused on achievement goals (Ames & Archer, 1988; Elliot & Dweck, 1988; Elliot & Church, 1997), attributions (Ames, 1984; Weiner & Kukla, 1970; Wilson & Linville, 1985) and their impact on academic outcomes in school. But the goals students set for themselves and the attributions they make for their performance may stem in important ways from the beliefs they hold about the nature of intelligence. According to work by Dweck and colleagues (Dweck & Leggett, 1988; See Dweck, 1999 for a review), students typically view intelligence in one of two ways: Some believe it to be more of a fixed unchanging 'entity' (entity beliefs) while others regard it as something that is malleable – something that can be developed (incremental beliefs). Because these basic beliefs are associated with complex meaning systems, and because they are not always consciously held, they have also been referred to as 'implicit theories.' While there is growing research on implicit theories in other domains (Aronson et al., 2002; Tamir, John, Srivastava & Gross, 2007; Chen et al., 2008; Ommundsen, 2001; Knee, Patrick & Lonsbary, 2003), research on *implicit theories of intelligence* indicates these views have important consequences for students' goal choices, attributions and a wide range of academic outcomes, including grades and achievement test scores (Aronson, Fried & Good, 2002; Blackwell, Trzesniewski & Dweck, 2007; Good, Aronson & Inzlicht, 2003;; Robins & Pals, 2002). These beliefs are also thought to be associated with self-handicapping behavior, underachievement and student disengagement (Rhodewalt, 1994).

In academic settings, implicit theories have typically been measured by asking about students' views on the fixedness or malleability of intelligence as a *general construct*. For example, "you have a certain amount of intelligence, and you really can't do much to change

it". Unlike self-efficacy and self-concept ability – which assess students' beliefs about their current operative capabilities (Bandura, 1997; Marsh, 1990) – implicit theories uniquely target students' belief about *the potential* for change. However, believing that it is possible to improve intelligence does not necessarily mean students are confident they can improve their own. Students may, for example, hold different theories for themselves and others – endorsing entity or incremental beliefs more or less depending on whether they are appraising their own abilities.

Research on comparative bias tendencies, positive illusions and contrast effects have long pointed to the ways rational judgments are distorted when people consider their abilities relative to others (Alicke, 1985; Alicke & Sedikides, 2009; Dunning, Leuenberger & Sherman, 1995; Hepper, Gramzow & Sedikides, 2010; Gramzow, Elliot, Asher, & McGregor, 2003; Story & Dunning, 2002; Taylor & Brown, 1998; 1994; Taylor & Armor, 1996). While much of this work has focused on *self-enhancing* biases; unrealistic pessimism and *self-diminishing* biases are also linked with important outcomes including vulnerability to depression (Young-Hoon & Chiu, 2011; Sharot, Riccardi, Raio & Phelps, 2007); self-handicapping and ultimately poorer self-regulation and academic performance (Hepper, Gramzow & Sedikides, 2010; Martin, Marsh & Debus, 2001; 2003). Students' who endorse stronger entity beliefs for themselves than others (e.g. intelligence may be malleable in general but not for me) may therefore be particularly vulnerable to self-handicapping, helplessness and academic-disengagement. Ultimately, because personal and domain-specific beliefs tend to be more powerful predictors of goals, attributions and academic performance (Bandura, 1997; 2006), a first person, measure of students' implicit theories about *their own intelligence* may also serve as an even better predictor of students' motivation and engagement in school.

In the present study, we examine links between implicit theories of intelligence and students' academic goals and grades as well as their attributions for academic setbacks. We

also extend work in this area by examining whether implicit theories are related to academic self-handicapping and student disengagement. Most importantly, we examine whether students' theories about intelligence in 'general' differ from their theories about *their own intelligence*, and whether a revised first-person measure explains greater variance in achievement and motivation indicators.

Implicit Theories & Achievement Goals

One of the key ways that implicit theories have been found to affect achievement and motivation is by orienting students towards different kinds of goals: learning and mastery goals vs. performance goals, which involve displaying one's high level of competence or avoiding a display of incompetence (Elliot & Dweck, 1988). Research has shown that when students believe their intelligence or academic ability is fixed; they are more concerned with pursuing performance goals (Bempechat, London & Dweck, 1991: Blackwell et al, 2007; Chen & Pajares, 2010; Cury, Elliot, Da Fonseca & Moller, 2006; Dweck & Legget, 1988; Robins & Pals, 2002). As a consequence, these students are more likely to shun opportunities for learning (Hong et al., 1999); often select less challenging or somewhat familiar tasks, and report a preference for getting a "good grade" over "being challenged" (Blackwell, 2002). By contrast, incremental theorists pursue learning and mastery goals more frequently and select tasks that will enable them to improve their abilities and skills even if it means being faced with short-term confusion and mistakes (Blackwell 2002; Hong et al., 1999). This differential goal preference is apparent even when controlling for students' prior ability and has been demonstrated both in experimental studies and real-world settings (Blackwell et al., 2007; Robins & Pals, 2002).

Implicit Theories & Attributions

In addition to influencing students' goal orientations, implicit theories can affect students' beliefs about effort and the way they make sense of their difficulties in school. For

entity theorists, the belief that intelligence is fixed suggests that academic outcomes can provide definitive information about one's abilities. In this light, effort places students at risk – success without trying indicates one "has" intelligence but failure following effort is compelling evidence of one's lack of intelligence or skill. These global, stable attributions for setbacks are important mediators of students' subsequent reactions and are consistently associated with helpless patterns of behavior and disengagement (Diener & Dweck, 1978; 1980; Dweck, 1975). Research looking at implicit theories and attributions has found that across studies, entity theorists more readily attribute poor performance to a lack of ability, that is, they are quick to make helpless attributions for their failures (Blackwell et al., 2007; Hong, Chiu, Dweck, Lin & Wan, 1999). This makes them vulnerable to negative feedback and criticism, and prone to disengagement when such threats emerge (Hong et al., 1999; Mangels et al., 2006). Incremental theorists by contrast, are less perturbed by failures and setbacks as these events reflect on effort or strategy and provide valuable information about how to improve. For this reason, incremental theorists are also less defensive about their shortcomings; show greater engagement, persistence and resilience in the face of setbacks with a focus on learning from their mistakes (Mangels et al, 2006; Hong et al., 1999). They are also more likely to pursue remedial action aimed at improving future performance (Hong et al., 1999). Interestingly, these beliefs also appear to operate similarly in extremely different cultural settings – for example in China (Hong et al., 1999).

Implicit Theories & Academic Achievement

Given the relationship between implicit theories, achievement goals and attributions, it is not surprising that implicit theories hold important consequences for academic performance. In both correlational and experimental studies, an incremental theory of intelligence predicts higher performance on standardized tests (Curry, Da Fonseca, Zahn & Elliot, 2008; Cury, Elliot, Da Fonseca & Moller, 2006; Good, et al., 2003) as well as grade differences in middle

school (Blackwell et al., 2007; Stipek & Gralinski, 1996), and college (Aronson et al., 2002). The causal relationship between implicit theories and achievement has also been demonstrated in interventions teaching an incremental theory to students. In one study, Blackwell et al. (2007) ran an intervention over 8 weeks that taught either an incremental theory or study skills to seventh grade students. While all students showed the typical downward trend in grades prior to the intervention, this decline was reversed for students who had received the 8-week incremental theory workshop. Students in the experimental condition were also three times more likely to be cited by their teachers (blind to the experimental and control conditions) as showing positive changes in classroom motivation. The impact of implicit theory interventions has also been documented in studies specifically targeting the negative impact of stereotype threat – underperformance among individuals who belong to negatively stereotyped groups (Aronson et al., 2002; Good, et al., 2003). In these studies, an incremental theory message was reinforced through pen pal letter-writing tasks (Aronson et al., 2002) and/or in discussions with college-aged mentors (Good et al, 2003). In both contexts, students who were exposed to the incremental theory message earned significantly higher achievement at follow-up as seen in their end of term GPAs or overall performance on statewide-standardized tests.

Implicit Theories, Self-handicapping & Disengagement

In addition to affecting students' goals, attributions and academic achievement, the beliefs students' hold about the mutability of intelligence may also lead to self-protective behavior and student disengagement. When students believe their intelligence is fixed and feel threatened by the prospect of poor performance, they may seek to deflect the causes of failure away from their 'fixed' level of ability onto a premeditated excuse should failure occur. In academic contexts, these 'self-handicapping' strategies can include the adoption of any impediment or obstacle to successful performance (Jones & Berglas, 1978). These include the strategic reduction of effort, procrastination, feigning sickness, or the choice of other

performance debilitating circumstances. Not surprisingly, in an attempt to distance themselves from failure, students often bring about the failure that they are trying to avoid. Ironically, this can confirm doubts about ability and further perpetuate defensive behavior (Nurmi, Aunola, Salmela-Aro, & Lindroos, 2003). Through a cascading effect, entity beliefs about intelligence may then ultimately lead to more serious problems such as truancy and disengagement from school altogether.

While there is limited research in this area, there is some evidence linking an entity theory with self-handicapping among college students. Early work by Rhodewalt (1994) found that high self-handicappers are generally more likely to hold entity beliefs about their abilities in academic, athletic and social domains. Entity beliefs about intelligence have also been linked with procrastination (Howell & Buro, 2009); reduced practice prior to tests (Cury, Da Fonseca, Zahn & Elliot, 2008); poorer coping strategies under stress (Doron, Yannick, Boiche & Le Scanff, 2009); and disengagement from math as a major or career path for women (Burkley, Parker, Stermer & Burkley, 2010). These findings suggest implicit theories may also be a key factor in explaining academic self-handicapping and student disengagement.

The Current Study

Given the impact of implicit theories on students' academic lives, it is important that existing scales are carefully tuned to the private beliefs that will most likely guide their thinking and behavior. Traditionally, these measures have assessed students' beliefs about the fixed or malleable nature of intelligence in *general*. It is not clear, however, if (and to what extent) students' general implicit theories differ from their personal theories about *their own* abilities. A measure of implicit theories that is sensitive to these subtle, contextual differences has theoretical and practical advantages and may also inform interventions aimed at restructuring self-limiting beliefs. In the current study we present a revised self-report measure of implicit theories of intelligence that explicitly targeted these private self-relevant views. To

do this, the general Implicit Theories of Intelligence Questionnaire (Dweck, 1999) was modified to form a first person, 'self-theory' scale. Consistent with previous research (Blackwell, et al., 2007; Robins & Pals, 2002, see Dweck 1999 for a review), we predicted (H1) entity beliefs about intelligence would be associated with poorer outcomes across a range of measures including: lower mastery goals; higher performance and performance-avoidance goals; and higher attributions of helplessness. Furthermore, we expected that an entity theory would be associated with higher truancy, self-handicapping and student disengagement, as well as lower self-reported academic performance. Across all achievement and motivation measures, we also expected (H2) that students' beliefs about *their own* intelligence (self-theory scale) would explain greater variance than their beliefs about intelligence in general (general scale). Finally, we predicted that (H3) students holding stronger entity belief on the self-theory scale than on the general (e.g. intelligence may be malleable for others but not for me), would report lower endorsement of achievement goals, lower academic grades and increased helplessness, self-handicapping, truancy and disengagement.

Method

Participants

Participants consisted of 680 Australian students from five different high schools (years 10 – 12) in the Australian Capital Territory. Schools were selected to capture a spread of low, intermediate and high performing schools based on national performance indicators. (Australian Tertiary Admission Rankings ATAR)[1] Of the total sample, 35 percent of students (N = 235) were from private schools and 65 percent (N = 445) were from public schools. Students ranged from 15 to 19 years of age (M = 16.6, SD = 1.01), 38 percent were male (N = 258).

[1] Our sample of schools included: Radford, Merici, Melba Copland, Canberra College and Lake Ginninderra. Rankings for these schools based on the Australian Tertiary Admission Rank (ATAR) can be found at: www.bettereducation.com.au/results/ACT/2010/ACT.aspx

Materials

Implicit Theories of Intelligence (General Scale).

Students' theories of intelligence were measured using the 8-item Implicit Theories of Intelligence Scale (Dweck, 1999). The complete scale contains 4 incremental and 4 entity theory items and assesses general beliefs about the fixedness vs. malleability of intelligence (See Appendix 1 for scale items). The four incremental scale items were then reverse scored and all eight items were summed with higher scores indicating greater endorsement of entity beliefs about intelligence. Overall, research indicates the scale displays good internal consistency (α = .82 to .97) and test-retest reliabilities at 2 weeks (α = .80 to .82, Dweck, Chiu & Hong, 1995). The scale has also demonstrated good construct validity with scores predicting theoretically meaningful relationships with a range of variables (Dweck et al., 1995). The scale further appears unaffected by social desirability, intellectual ability, political beliefs or self-presentation concerns, indicating good discriminate validity against a range of potentially confounding variables (Dweck et al., 1995). In the current study, the general implicit theories of intelligence scale again demonstrated good internal reliability with a combined Chronbach's alpha for the general entity and incremental subscales of .87.

Implicit Theories of Intelligence (Self-Theory Scale).

The self-theory version of the theories of intelligence scale was based on the original measure by Dweck and colleagues (Dweck, 1999). All 8-items were re-worded so that each statement reflected a first-person claim about the extent to which intelligence was fixed or malleable (see Appendix 1 for scale items). Efforts were made to ensure items stayed closely aligned to the originals. Incremental items on both measures were reversed scored and the average scores across the 8-items provided a measure of students' entity beliefs about their own intelligence. Like the general, this scale showed good internal consistency, α = .90.

Achievement Goals.

To assess students' goal orientations, subscales were drawn from Elliot and McGregor's (2001) revised Achievement Goal Questionnaire (AGQ-R). Each orientation consists of three items that assess different kinds of achievement goals. Students were told "the following questions ask about what is important to you as a student." They were then asked to indicate how much they agreed or disagreed with each of the following statements: *Performance Approach Goals* ("It is important to me to do better than other students;" "It is important to me to do well compared to others in my classes;" and "My goal in class is to get a better grade than most of the students")*; Performance-Avoidance Goals* ("I just want to avoid doing poorly in my classes;" "My goal for class is to avoid performing poorly;" and "My fear of performing poorly in class is often what motivates me"); and *Mastery Approach Goals* (e.g. "I want to learn as much as possible in class;" "It is important for me to understand the content of my courses as thoroughly as possible;" and "I desire to completely master the material presented in my subjects"). Research indicates that the scale is psychometrically sound, reliable and a replicable measure of achievement goal constructs (Church, Elliot & Gable, 2001; Donnellan, 2008; Fryer & Elliot, 2007; McGregor & Elliot, 2002). In the current sample all three subscales displayed adequate reliability (Performance approach, $\alpha = .91$; Performance avoidance, $\alpha = .75$; Mastery, $\alpha = .83$).

Helplessness Attributions.

Attributions of helplessness were measured using the 7-item 'Helplessness Beliefs' sub-scale from the Strategy and Attribution Questionnaire (Nurmi, Salmela-Aro & Haavisto, 1995; SAQ). SAQ items are designed to assess helplessness beliefs in a school context (e.g. "I do not have the means to affect the way my studies go"). Overall, the scale has demonstrated good internal reliability and test-retest reliability at 6 months (Eronen, Nurmi & Salmela-Aro, 1998; Nurmi, Onatsu & Haavisto, 1995). Cronbach alpha for the current sample was .74.

Academic Achievement.

Because academic records could not be obtained, self-reported grades were measured with four items asking students to describe their general academic performance and their comparative standing relative to other students in their class or year (e.g. "In the past 12 months the grades I mostly received were _____;" "I would describe myself typically as a _____ student;" "Compared to others my age I think I'd be _____;" and "Compared to others in my class I think I'd be _____")[2]. Responses were coded on a 7-point Likert scale and scores ranged from 1 ("Ds;" "D-average;" "Among the worst students" or "Among the worst in my class") to 7 ("As;" "A-average;" "Among the best students" or "Among the best in my class"). Mean scores across the four items provided an average index of students' reported grades[3]. Although self-report measures of this kind are subject to memory distortions or bias, research indicates that the extent of these biases is typically small (Cassady, 2001). While a minority (2-3%) of students may over-report by a letter grade or more (Gramzow, Elliot, Asher, & McGregor, 2003; Maxey & Ormsby, 1971), in most cases this deviation is less than .1 on a 4-point scale (Gramzow et al., 2003; Gramzow & Willard, 2006). Cronbach alpha for the current sample was .90.

Self-Handicapping.

Academic self-handicapping behavior was measured using the 6-item subscale from the Patterns of Adaptive Learning Survey (PALS; Midgley, et al., 1998). Each of the 6 items asks about an a priori defensive strategy used to excuse poor performance (e.g. "Some students fool

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[2] In the Australian Capital Territory grades in both public and private schools are distributed independent of the student's relative performance in their class. Grade inflation (by school) is controlled for using the ACT Scaling Test, which is administered to students in all schools and is used to rank schools for calculating students' Australian Tertiary Admission Rank (ATAR). Unfortunately, students' grades and scores on national scaling exams are not available for research purposes hence the need for self-report measures in most educational research of this kind within Australia.

[3] To examine construct validity of this 4-item measure, we conducted a principal components factor analysis on achievement items. Results yielded a strong single factor solution (Eigen value = 3.11) accounting for 78% of the overall variance. The second, third and fourth factors hand Eigen values < .47. All item loadings for the single factor solution were > .86 and communalities for all items were > .75. The Kaiser-Meyer-Olkin measure of sampling adequacy was also .79, (above the commonly recommended value of .6), and Bartlett's test of sphericity was significant ($\chi 2$ (6) = .1753.73, $p < .001$).

around the night before a test. Then if they don't do well, they can say that is the reason. How true is this of you?"). Responses ranged from 1 (not at all true of me) to 7 (very true of me). Unlike earlier measures of self-handicapping, the PALS items assess the use of intentional strategies and behaviors and are thereby distinguishable from post-hoc excuses and attributions. Previous research indicates that the 6-item scale shows good validity and internal consistency ($\alpha = .84$) and sound construct validity, relating in predictable ways to theoretically relevant variables (Midgley, Arunkumar & Urdan, 1996; Midgley et al., 1998; Midgley & Urdan, 2001). Participants' responses were summed across the 6 items (scores ranging from 6 to 42), providing an overall index of students' tendency to engage in self- handicapping strategies. Cronbach alpha in the current sample was .86.

Disengagement & Truancy.

Three items were used to measure disengagement and were adapted from the Motivation and Engagement Scale (MES-HS; Green, Martin & Marsh, 2007). These items included: "I often feel like giving up in school"; "I've pretty much given up being interested in school" and "I really couldn't care less about school." Based on psychometric testing with over 21,000 students in Australia, the MES-HS has been found to be a valid and reliable instrument with a sound factor structure and demonstrates factorial invariance across gender, subject and year level (Green et al., 2007; Martin, 2001; 2003). In addition to measuring students' general disengagement from school, two items were included to assess self-reported truancy: "I sometimes wag school" and "I'll skip class when I can get away with it". These items were written in Australian vernacular specifically for use with high school students.

Procedure

All survey items were administered to students online under normal classroom conditions and took approximately 20-30 minutes to complete. Measures were presented in the following order: achievement goals; implicit theories of intelligence (general and self-theory scales);

helplessness attributions; self-handicapping; disengagement; truancy; grades. Supervising teachers informed the students that participation was voluntary and anonymous, and that there were no right or wrong answers. They were also informed that the information would be kept confidential and that no one at home or school would see their results. Ethics approval for the project was obtained from appropriate governing bodies including the Department of Education and Training (DET) and the Catholic Education Office (CEO), as well as principals and teachers at participating schools, and all students gave informed consent.

Results

Prior to analysis, all variables were examined through SPSS for missing values and distributional assumptions of multivariate analysis (Tabachnick & Fidell, 2007). Of the total 680 respondents, 37 surveys were left incomplete (missing data > 25 per cent) and were deleted reducing the total sample to 643. For the remaining cases, missing data was extremely rare (< .01 per cent) and where present were replaced with the mean for that variable – a conservative technique in such cases (Tabachnick & Fidell, 2007).

Internal Consistency

Full-scale scores for both the general Implicit Theories of Intelligence Questionnaire and the new self-theory measure, as noted, demonstrated good internal consistency ($\alpha = .87$ and $\alpha = .90$ respectively). Individual incremental and entity subscales also showed strong internal consistency (subscales ranging from $\alpha = .87$ to .92). Reliability ratings for sub-scales can be seen in Appendix 1.

Confirmatory Factor Analysis

To test the higher order structure of the revised scale, confirmatory factor analysis (CFA) was conducted on both the Original and Self-Orientated Implicit Theories of Intelligence measures using AMOS 18.0 (Arbuckle & Worthke, 1999). Structural Equations Modelling (SEM) allows for a test of the hypothesised two-factor structure by evaluating item

loadings on the Entity and Incremental constructs. Estimation using maximum likelihood was used for all analyses (see Figure 1 and 2). For each of the scales, fit indices were compared for a one-factor congeneric model (Model 1) and the hypothesised two-factor structure (Model 2). Variances for the latent factors were fixed at unity while entity and incremental items were allowed to load freely on the latent factor(s).

[Figure 1 and 2 about here]

In evaluating the fit of the measurement models, the likelihood ratio χ^2 statistic and goodness of fit indices were examined. The χ^2 test assesses the discrepancy between the sample and fitted covariance matrices and decreases as model fit improves. However, the χ^2 test is considerably inflated with large samples (Stevens, 1996). For this reason several commonly used goodness of fit measures were also considered in assessing model fit. These included: the goodness of fit (GFI), adjusted goodness-of-fit (AGFI) and the comparative fit index (CFI). For these measures values approaching 1.0 indicate better fit of the model to the data (Dickey, 1996). The root mean square error of approximation (RMSEA) was also consulted and indicates adequate fit with values less than .08 and very close fit with values less that .05 (Browne & Cudeck, 1993). Finally, the parsimonious goodness-of- fit index (PGFI) was used take into account model parsimony. In evaluating the PGFI, higher values are desirable since a better fit can always be achieved by adding more parameters (Dickey, 1996). These results are reported in Table 1

[Table 1 about here]

The goodness of fit statistics indicated that model fit was slightly better for the Self-Theory scale, and for both scales the two-factor model (Model 2) fit the data very well

performing better than the one-factor model (Model 1). All latent variables and factor loadings were significant. In all analyses the χ^2 test was significant but χ^2 was reduced significantly using the two-factor model and the goodness of fit measures indicated good overall fit to the data[4].

The high reliabilities for the combined and reverse-coded scales ($\alpha = .87$, $\alpha = .90$) also indicate that both measures perform well as one-dimensional instruments and were used in this way in the following analyses[5]. Although there is some research in which entity and incremental beliefs have been examined as independent constructs or typologies (Dupeyrat & Marine, 2005; Hong, Chiu, Dweck, Lin & Wan, 1999), they are more widely examined along a single continuous dimension with entity beliefs at one end, and incremental beliefs at the other (Beer, 2002; Blackwell Trzesniewski & Dweck, 2007; Cury, Da Fonseca, Zahn & Elliot, 2008; Niiya, Crocker & Bartmess, 2004; Robins & Pals, 2002). This approach simplifies multivariate analyses (particularly in our case when using two version of the implicit theory scale), and avoids the loss of power associated with typologizing variables (Cohen, 1983, 1988; Peterson, 1995).

Hypothesis 1: Links to Achievement and Motivation

Means (M), standard deviations (SD), ranges, internal consistencies (α) and correlations for all variables are presented in Table 2. Both the general and self-theory of Intelligence measures demonstrated significant correlations with the achievement and motivational variables, with the exception of performance approach goals, which were significantly correlated only with the self-theory scale. An entity theory of intelligence was negatively

[4] Further evidence that the general and self-theory measures are two distinct constructs, comes from a second CFA conducted using all implicit theory scale items. We correlated error terms between matching general and self-theory scale items while comparing a single factor model (with all 16 items loading on a single factor) with a two-factor solution in which scale items loaded on their corresponding general and self-theory factors. The two-factor solution ($\chi^2 = 1860.7^{**}$, GFI = .69, AGFI = .55, CFI = .78, RMSEA = 17, PGFI = .48) fit the data better than the single factor model ($\chi^2 = 2279.7^{**}$, GFI = .64, AGFI = .49, CFI = .73, RMSEA = 19, PGFI = .45), further indicating that the general and self-theory measures are assessing independent (yet related) constructs.

[5] Because implicit theories scales have been used in different ways in the research literature, we replicated our analyses using the two distinct sub-scales for incremental and entity beliefs separately.

associated with achievement goals and this was true for mastery, performance approach, and performance-avoidance goal subtypes[6]. On both measures, students who believed intelligence was fixed also displayed higher attributions of helplessness; were more likely to self-handicap, skip class and disengage from school; and they reported poorer overall academic performance.

[Table 2 about here]

Hypothesis 2: General Beliefs vs. Personal Beliefs

To examine whether students' beliefs about *their own* intelligence differed from their beliefs about intelligence in general, we first conducted a within-subjects t-test to compare students' scores on the general and self-theory scales. Results revealed that students endorsed entity beliefs less when asked about their personal ability to improve their intelligence (M = 2.96) than when asked about intelligence in general (M = 3.14), $t(642) = 6.96$, $p < .001$. This was a small effect by Cohen's (1988) standards (d = .17).

To further explore whether the first person, self-theory measure explained greater variance in goals, attributions and academic outcomes, we conducted a series of two-step hierarchical regressions analyses (see Table 3). Variables were first centred by subtracting the mean (Tabachnick & Fidell, 2007). Despite the high correlation between the general and self-theory measures (r = .80), there was no evidence of multicollinearity (all VIF's < 2.84). For each of the dependent variables, the general theories of Intelligence measure was entered first, followed by the self-theory measure in the second step[7]. Table 3 displays the standardized regression coefficients (β), R^2 and R^2 change for the full and restricted models in each analysis.

[6] In our supplementary analysis with the separate sub-scales, entity beliefs were negatively associated with performance approach; performance avoidance and mastery goals and Incremental beliefs were positively associated with all three goals constructs.

[7] In a second set of analyses we repeated the hierarchical regression in the reverse order entering the self-theory scale in the first step and the General Theory scale in the second. The General scale failed to explain unique variance on any of the dependent variables when controlling for 'self-theories'. The only exception was

[Insert Tables 3 about here].

Both scales accounted for a significant amount of variance in all analyses (with the exception of performance-approach goals[8], which were significant only for the revised scale). The belief that intelligence was fixed predicted lower endorsement of achievement goals and self-reported grades, greater attributions of helplessness, and increased self-handicapping, truancy and disengagement. Importantly, and in line with our predictions, of the two scales, the self-theory measure explained significantly more outcome variance when both measures were used to predict the dependent variables. That is, the self-theory measure consistently predicted unique variance in outcomes above and beyond the general measure of theories of intelligence. This was true for all dependent variables except performance-avoidance goals, for which there was no significant difference between the general and self-theory scales. While the additional variance explained was small (typically between 1 and 6 per cent), the self-theory scale was consistently superior when both measures were used to predict the dependent variables.

Hypothesis 3: When "My" Intelligence is More Fixed

In addition to examining the predictive power of both scales, we expected that the difference between the two scales (e.g. intelligence may be malleable in principal, but not for me) would also be associated with achievement and motivation outcomes. To examine this hypothesis, a difference score was computed by subtracting students' scores on the general scale from their scores on the self-theory scale (see Table 2). Positive values indicate comparatively higher entity beliefs on the self-theory scale e.g. "My intelligence is more fixed than others". Consistent with predictions, students who endorsed stronger entity beliefs for

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performance approach goals, where the general scale contributed 1% of unique variance ($\beta = .17$, $R^2 = .02$, $R^2_{change} = .01$).

[8] While the general entity theory of intelligence scale was on its own, not a significant predictor of performance-approach goals, it became so when the self-theory scale was entered into the equation. This may indicate the existence of suppression of the former by shared variance with the latter.

themselves than others held lower performance-approach and mastery-approach goals; reported increased helplessness; self-handicapping and disengagement; as well as lower academic grades. The difference between the two scales however, was not associated with performance-avoidance goals or truancy.

Discussion

In the current study we sought to examine links between implicit theories of intelligence and students goals, attributions, achievement and engagement in school. We also sought to contribute to research on implicit theories by developing and evaluating a revised self-theory measure, which explicitly asked students about their *personal ability* to improve their intelligence as distinct from their views about the nature of intelligence in general.

Consistent with previous research (Dweck, 1999; Dweck, Chiu & Hong, 1995; Levy & Dweck, 1998; Rhodewalt, 1994), the more students endorsed an entity theory of their intelligence, the lower mastery-approach goal striving. When asked about their academic performance, entity beliefs were predictive of lower self-reported grades and an increased likelihood of making helpless attributions about one's studies. An entity theory of intelligence was also associated with increased self-handicapping, truancy, and a greater likelihood of giving up on school altogether. These findings are noteworthy particularly given the lack of research on implicit theories, self-handicapping, truancy and disengagement in high school settings. Traditional models explaining how implicit theories give rise to academic outcomes have often concentrated on the role of achievement goals, causal attributions and effort (Blackwell et al., 2007; Robins & Pals, 2002). However, results from the current study indicate that – consistent with early work by Rhodewalt (1994) – entity beliefs are also associated with a greater likelihood of engaging in maladaptive self-protective strategies that may ultimately serve to undermine academic performance. While both the general and personal scales

predicted goals, attributions and academic outcomes, the new scale explained unique variance on these measures.

Interestingly, counter to predictions, entity beliefs also predicted lower performance-approach and performance-avoidance goal striving. This finding is inconsistent with research that has found a positive association between entity beliefs and performance goals (Chen & Pajares, 2010; Bempechat, London & Dweck, 1991: Blackwell et al, 2007; Cury, Elliot, Da Fonseca & Moller, 2006; Dweck & Legget, 1988; Robins & Pals, 2002). However, some studies have also failed to replicate these effects (Dupeyrat & Mariné, 2005; Ommundsen et al., 2005). In the current study, performance goals also appear to have had adaptive associations with motivation and engagement, negatively correlating with helplessness, self-handicapping, truancy and disengagement, and correlating positively with academic grades. These findings, and the positive correlation between mastery and performance goals is also consistent with research that indicates these goals can operate in combination, often with more adaptive outcomes for achievement and motivation (Barron & Harackiewicz, 2001; De Castella, Byrne & Covington, 2013; Midgley, Kaplan & Middleton, 2001; Pintrich, 2000). It is also worth noting that implicit theories predict attributions and helplessness regardless of goal condition (Erdley, Cain, Loomis, Dumas-Hines & Dweck, 1997), coloring the meaning that goals and outcomes have for individuals (Hong, Chiu, Dweck, Lin & Wan, 1999).

Results from the present study indicate that students' belief in their *personal* ability to improve their intelligence is an even better predictor of achievement and motivation in school. A significant difference also emerged between students' responses on the two measures of intelligence theories. On average, students reported significantly lower endorsement of entity items when appraising their own intelligence and higher endorsement of entity items when considering intelligence as a broader construct. This finding is consistent with research on the distinction between students' intrapersonal and interpersonal (normative) ratings of their

potential for improving their academic competencies (Kärkkäinen, Räty & Kasanen, 2008). It is also consistent with research on self-presentational biases, positive illusions, and contrast effects (Fisher & Katz, 2000; Gramzow, Elliot, Asher & McGregor, 2003; Story & Dunning, 2002; Taylor & Armor, 1996). The belief that intelligence is 'more malleable' for oneself than others may therefore be a strategy that works to boost self-esteem, improving and protecting students' academic self-concept.

Implications

The current study makes a number of contributions to research on implicit theories, achievement and motivation. Implicit theories have been examined in a variety of contexts, including personality and morality (Dweck, 1999); emotion (Tamir, John, Srivastava & Gross, 2007); sport (Chen et al., 2008; Ommundsen, 2001); interpersonal and romantic relationships (Knee, Patrick & Lonsbary, 2003); stereotype threat (Aronson et al., 2002; Levy & Dweck, 1998); memory (Werth & Forster, 2002); fame (Maltby et al., 2008) and shyness (Beer, 2002). The development of self-theory measures may thus have potential in many areas where self-efficacy and ability attributions play a predominant role.

Recognizing potential discrepancies between students' broader implicit theories and their personal beliefs is also important in the context of interventions and training. Research on implicit theories has repeatedly demonstrated that simple interventions can lead to long-lasting change (Aronson et al., 2002; Good et al., 2003; Blackwell et al., 2007). Entity and incremental beliefs have been induced experimentally through explicit messages, case studies and vignettes (Bergen 1992) and indirectly through feedback, praise or criticism (Kamins & Dweck, 1999; Muller & Dweck, 1998). Other interventions have taught an incremental theory through online programs (Brainology, 2010), workshops (Blackwell et al., 2007), videos, mentoring, and letter writing tasks (Aronson et al., 2002; Good et al., 2003). These initiatives typically focus on teaching students about memory, brain plasticity and its potential for development and growth.

While this message is powerful – particularly for 'entity theorists' who may have doubts about one's capacity for improvement – it is a message that may not reach all students. The results of the current study demonstrate that for many, knowing change is possible is not the same as believing *personally* in one's ability to change.

For underachieving students, particularly those vulnerable to self-handicapping and disengagement, the shift from general to personal belief in one's ability to improve may not be a simple process. Yaeger & Walton (2011) argue that this kind of change takes place through gradual private successes and recursive processes that slowly shift achievement trajectories as students gain momentum over time: "when students achieve success beyond what they thought possible, their beliefs about their potential may change, leading them to invest themselves more in school, further improving performance and reinforcing their belief in the possibility of growth" (p. 286). Understanding how to help students internalize this message will be an important area for future research.

Limitations and Future Directions

While the current study contributes to research on implicit theories and achievement motivation, several limitations should be noted. First, the measures used in the current study to assess achievement goals, attributions and self-handicapping and disengagement are by no means the only measures available. There is a long history of debate in the achievement motivation literature particularly around the assessment of achievement motives and goals (Atkinson & Litwin, 1960; Donnellan, 2008). Approach and avoidance motivations for example, have been viewed as stable personality traits and as antecedents to achievement goals (Atkinson, 1957; McClelland et al., 1953), measured with self-report instruments as well as with implicit tasks such as the projective picture-based Thematic Apperception Test (TAT; McClelland et al., 1953) and semi-projective instruments like the Achievement Motives Grid (Schmalt, 1999). Goal theorists, by contrast, have focused more on the importance of

performance approach, avoidance, and mastery goals (Martin 2003; Midgley et al., 2001), and even the role of 'mastery avoidance' – goals to avoid intrapersonal or absolute incompetence (Elliot, 1999; Elliot & McGregor, 2001; Cury, Elliot, DaFonseca & Moller, 2006). Cury, Elliot, Da Fonseca and Moller (2006) for example argue that entity theorists are motivated by performance goals because normative competence feedback provides the most *diagnostic* information about ability. Incremental theorists, on the other hand, endorse mastery-approach and mastery-avoidance goals because task or temporal competence feedback provides the clearest information regarding the *development* of ability. Given the negative association between entity beliefs and all three forms of achievement goals in the current study, it may be useful to examine alternative measures of achievement goals and motives in future research in order to replicate or extend our findings.

Second, despite examining a wide range of achievement and motivation outcomes, it is important to recognize that findings in the current study are based on participant self-reports. Self-report measures are used in much of the research on implicit theories (see Dweck, 1999 for a review) and self-reported handicapping and disengagement have been validated against actual behaviour (Deppe & Harackiewicz, 1996; Strube, 1986; Rhodewalt & Fairfield, 1991). Nonetheless, many students may engage in these strategies unconsciously or be disinclined to concede that they adopt them. For this reason, it is possible that higher-rates of self-handicapping, truancy and student disengagement exists among these student populations.

Third, it is important to note that the findings reported in the current study are also based on relatively small effect sizes. These results however, are consistent with much of the existing research in the field (Harris, Snyder, Higgins & Schrag, 1986; Haynes, Daniels, Stupnisky, Pery & Hladky, 2008; Howell & Buro, 2009; Martin & Brawley, 2002; Midgley & Urdan, 2001; Ommundsen, 2001), and likely reflect the multiplicity of factors that give rise to achievement and motivation outcomes in school. It is also important not to overlook the fact

that small effect sizes can have a major impact on academic performance over time (Abelson, 1985; Blackwell et al., 2007; Dweck, 2008; Rosenthal & Rubin, 1982).

Where possible, future research on implicit theories and student disengagement should seek to incorporate data derived from additional sources such as ratings from parents and teachers, academic and absentee records – which were unavailable in this study. It may also be interesting to examine whether the impact of implicit self-theories is dependent on the domain or school subject in questions (see for example: Bempechat et al., 1991; Kärkkäinen, Räty and Kasanen, 2008), and whether students' beliefs in the malleability of *their own* intelligence decreases overtime, as seen in when comparing the third- and sixth-grade student ratings on various subjects (Kärkkäinen, Räty and Kasanen, 2008). Experimentally manipulating students' beliefs about the malleably of *their* intelligence and/or examining their resilience to setbacks would also help clarify the causal role these beliefs play in self-handicapping and student disengagement. This may be particularly important, as entity theories of intelligence are not always predictive of poor academic achievement, and may even fuel great accomplishments by orienting students towards "proving" their ability or self-worth (Dweck, Chiu & Hong, 1995b). Furthermore, given the complex associations between implicit theories, goals, and attributions, it may also be interesting to examine the role of these or other variables – including other types of achievement goals (see Grant & Dweck, 2003) – as potential mediators between students' personal implicit theories and their achievement and motivation in academic settings. In this respect, use of advanced statistical methods and longitudinal designs would also be beneficial. Despite these limitations, results from the current study indicate that the beliefs students' hold about intelligence is associated with a range of achievement and motivation outcomes. Most importantly, it appears that it is the beliefs students' hold about *themselves* and their ability to improve that is most predictive of their willingness to embrace opportunities for learning.

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Appendix 1: Scale Items and Reliabilities

Implicit Theories of Intelligence (General)	**Implicit Theories of Intelligence (Self-Theory)**
Stem: The following questions are exploring students' ideas about intelligence. There are no right or wrong answers. We are just interested in your views. Using the scale below, please indicate the extent to which you agree or disagree with the following statements.	**Stem:** The following questions are exploring students' beliefs about their personal ability to change their intelligence level. There are no right or wrong answers. We are just interested in your views. Using the scale below, please indicate the extent to which you agree or disagree with the following statements.
Entity Beliefs Subscale (α = .87)	Entity Self Beliefs Subscale (α = .90)
1. You have a certain amount of intelligence, and you can't really do much to change it.	1. I don't think I personally can do much to increase my intelligence
2. Your intelligence is something about you that you can't change very much.	2. My intelligence is something about me that I personally can't change very much.
3. To be honest, you can't really change how intelligent you are.	3. To be honest, I don't think I can really change how intelligent I am.
4. You can learn new things, but you can't really change your basic intelligence.	4. I can learn new things, but I don't have the ability to change my basic intelligence.
Incremental Beliefs Subscale (α = .88)	Incremental Self Beliefs Subscale (α = .92)
1. No matter who you are, you can significantly change your intelligence level.	1. With enough time and effort I think I could significantly improve my intelligence level
2. You can always substantially change how intelligent you are.	2. I believe I can always substantially improve on my intelligence
3. No matter how much intelligence you have you can always change it quite a bit.	3. Regardless of my current intelligence level, I think I have the capacity to change it quite a bit.
4. You can change even your basic intelligence level considerably	4. I believe I have the ability to change my basic intelligence level considerable over time.

Table 1: ***Chi-Square and Goodness-of-Fit Indices for the Implicit Theories Scale (Original and Self-Orientated)***

Model	*df*	χ^2	GFI	AGFI	CFI	RMSEA	PGFI
Theories of Intelligence (General)							
1 – Factor Model	20	913.4**	.68	.42	.71	.26	.38
2 – Factor Model	19	158.4**	.94	.88	.95	.11	.49
Theories of Intelligence (Self-Orientated)							
1 – Factor Model	20	963.1**	.68	.32	.77	.27	.36
2 – Factor Model	19	95.4**	.96	.93	.98	.08	.50

Note. *N = 643.* ***p*<.*00* for all χ^2 values. GFI = Goodness-of-fit; AGFI = Adjusted Goodness of Fit; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; PGFI = Parsimony Goodness of Fit Index.

Table 2: ***Descriptive Statistics, Cronbach's Alphas and Pearson Product-Moment Correlations (N =643).***

					Correlations										
Variable	M	SD	Range	α	1	2	3	4	5	6	7	8	9	10	11
1. Entity Theory of Intelligence (General)	3.14	1.05	1.00 – 7.00	.87	1	.80**	-.28**	-.03	-.11*	-.18**	.38**	.17**	.14**	.16**	-.09^
2. Entity Theories of Intelligence (Self-Theory)	2.96	1.08	1.00 – 7.00	.90		1	.35**	-.12**	-.12*	-.23**	.45**	.22**	.20**	.18**	-.13**
3. Difference (Self – General)	-1.48	5.38	-28.00 – 20.00	.94			1	-.14**	-.02	-.09^	.13**	.08^	.12**	.04	-.08^
4. Performance-Approach	14.64	3.95	3.00 – 21.00	.91				1	.18**	.42**	-.22**	-.13**	-.18**	-.17**	.42**
5. Performance-Avoidance	15.54	3.78	3.00 – 21.00	.75					1	.29**	-.10^	.07^	-.00	-.07	-.05
6. Mastery-Approach Goals	16.30	3.15	3.00 – 21.00	.83						1	-.30**	-.21**	-.25**	-.24*	.22**
7. Helplessness Attributions	19.69	6.11	7.00 – 49.00	.74							1	.40**	.39**	.31**	-.30**
8. Self Handicapping	19.28	7.80	6.00 – 42.00	.86								1	.44**	.40**	-.31**
9. Disengagement	9.70	4.34	3.00 – 21.00	.82									1	.50**	-.38**
10. Truancy	5.60	4.88	2.00 – 14.00	.86										1	-.29**
11. Grades	19.15	4.88	4.00 – 28.00	.90											1

^p<0.05 *p<0.01 ** p < 0.001

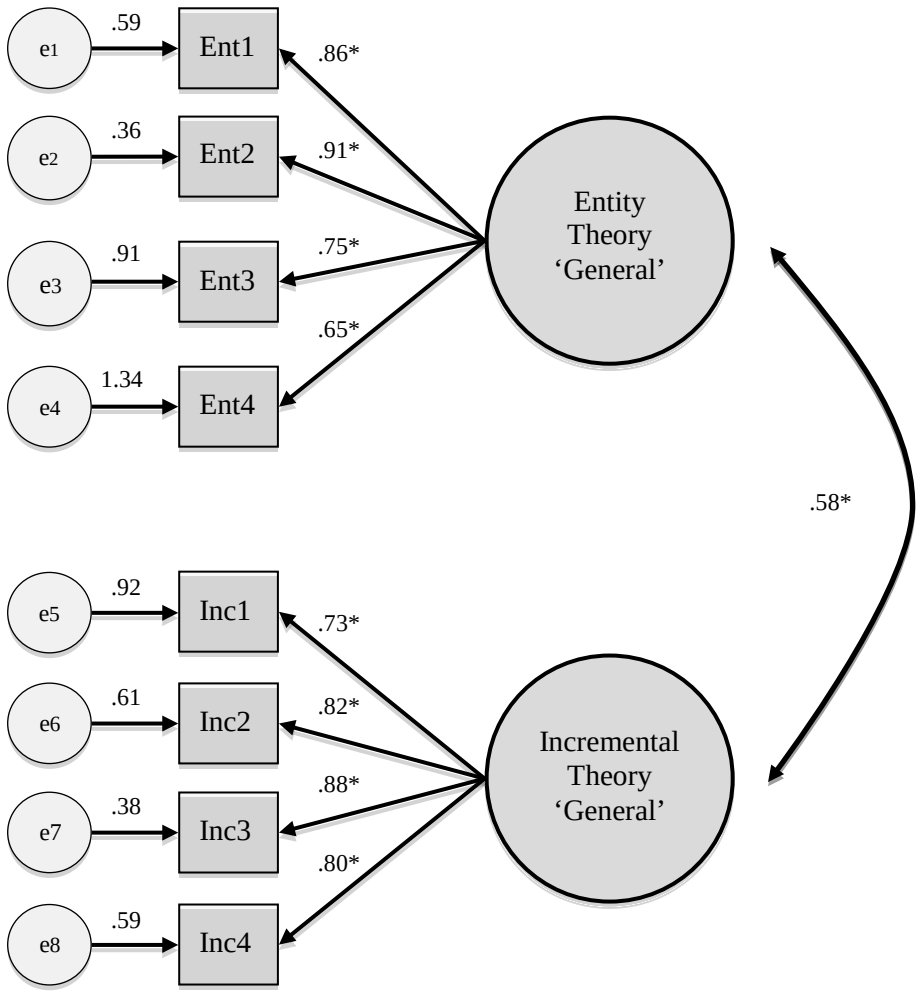
Table 3: ***Results of Hierarchical Multiple Regression Predicting Achievement Goals and Attributions from the General and Self-Theory of Intelligence Measures (N = 643)***

Dependent Variable and Step	β At Step	β Final	R^2	R^2Change
Performance-Approach Goals				
1. Implicit Theories (General)	-.03	.17*	.00	
2. Implicit Theories (Self)		-.25**	.02**	02**
Performance-Avoidance Goals				
1. Implicit Theories (General)	-.11**	-.04	.01**	
2. Implicit Theories (Self)		-.09	.01**	.00
Mastery-Approach Goals				
1. Implicit Theories (General)	-.18**	.02	.03**	
2. Implicit Theories (Self)		-.24**	.05**	.02**
Helplessness Attributions				
1. Implicit Theories (General)	.38**	.06	.14**	
2. Implicit Theories (Self)		.40**	.20**	.06**
Self Handicapping				
1. Implicit Theories (General)	.17**	-.00	.03**	
2. Implicit Theories (Self)		.23**	.05**	.02**
Disengagement				
1. Implicit Theories (General)	.13**	-.08	.01**	
2. Implicit Theories (Self)		.26**	.04**	.03**
Truancy				
1. Implicit Theories (General)	.16**	.05	.02**	
2. Implicit Theories (Self)		.14*	.03**	.01*
Grades				
1. Implicit Theories (General)	-.09*	.06	.01*	
2. Implicit Theories (Self)		-.18**	.02**	.01**

**$p < .001$ * $p < .05$

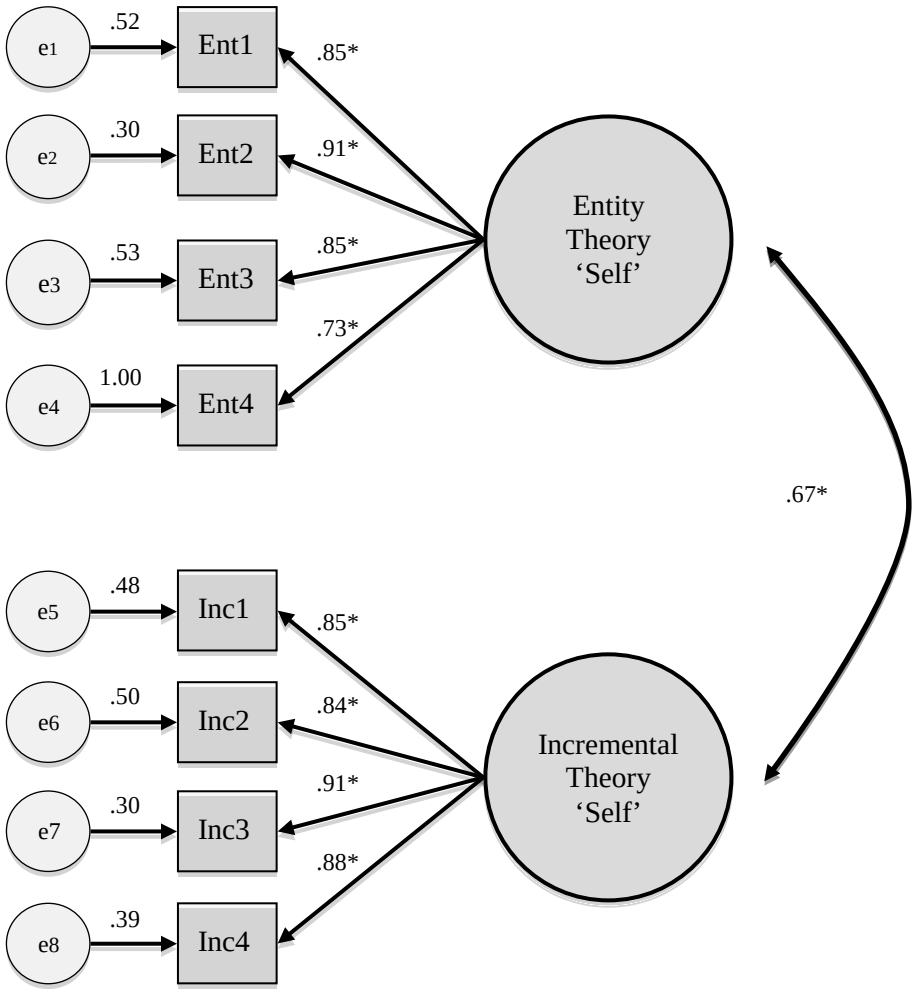
Results from hierarchical regression analyses reported above. Beta is the standardised regression coefficient, and significance levels are based on two-tailed significance tests. Increments for variables entered at R^2Change significance levels are based upon F tests for that step. Reversing this process on each measure – Self-theory scale entered in the first step and general theories in the second step – also demonstrated that the general scale did not explain unique variance when controlling for students' implicit self-theories. Findings were also replicated using the 4-item entity belief sub-scales for both measures. All results reported above were significant and the general scale did not explain unique variance when controlling for students implicit self-theories.

Figure 1: ***Estimated factor inter-correlations, factor loadings and error variances of the CFA for the General Theories of Intelligence Measure***



* $p < .001$. Factor loadings are standardized coefficients. Error variances are presented as unstandardized scores

Figure 2: ***Estimated factor inter-correlations, factor loadings and error variances of the CFA for the Implicit Theories of Intelligence (Self-Theory) Measure***



* $p < .001$. Factor loadings are standardized coefficients. Error variances are presented as unstandardized scores