

Implicit Theories of Intelligence, Achievement Goal Orientation, and Academic Achievement of Engineering Students

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Abstract

The present study investigated how individuals' belief about intelligence affects their achievement goal orientation, and in turn, results to better academic achievement. More specifically, when learners believe that intelligence can be improved, their goal orientation is more on mastery and this leads to better achievement. A model was tested using path analysis with 291 engineering students in Manila, Philippines. It was found that achievement goal orientation had no direct effect on academic achievement. On theories of intelligence, incremental theory was both significantly predicted by performance approach and mastery approach while entity theory predicted performance approach and performance avoidance. This supports the findings that entity theorists indeed tend to adopt performance goals while incremental theorists tend to adopt mastery goals. It was also found in the study that even incremental theorists actually adopt performance approach goals indicating that individuals who believe that intelligence can be improved still carry out tasks in comparison to others.

Keywords: Incremental Theory, Entity Theory, Achievement Goal Orientation

Introduction

Individuals' beliefs about themselves influence much how they perform and what they can actually do. If a person thinks that one's characteristic like intelligence can be improved, they engage in ways to enhance it and this allows them to perform better in school or in any academic engagement. The idea on the belief about intelligence is explained by Blackwell, Dweck, and Trzesniewski, (2007) in their implicit theory of intelligence. The implicit theories of intelligence are based on the assumption that an individual's main beliefs have the power to determine the ways he or she responds to various situations including challenges and setbacks (Blackwell, Dweck, & Trzesniewski, 2007). In this theory, there are two governing beliefs of individuals about intelligence. The first one, entity theory of intelligence, which is described as individuals who believes that intelligence is fixed and thus, could not be changed. The second one, incremental theory of intelligence, is ascribed to individuals who believes that intelligence is malleable and therefore, could be improved. These theories exhibited as two contrasting mindsets are said to have a significant effects on the academic goals that individuals set for themselves.

It is proposed in the present study that individuals' implicit theory of intelligence produce distinct achievement goals. Achievement goals are "competence-relevant aims that individuals strive for in achievement setting" (Elliot, Maier, Binser, Friedman, & Pekrun, 2009, p. 15). Elliot and McGregor (2001) conceptualized achievement goals as a 2 x 2 framework.

- (1) Mastery approach goals – the goal is seeking to learn and to master the task.
- (2) Mastery avoidance goals - avoiding the task due to feelings of incompetence and incapability of accomplishing the task.
- (3) Performance approach – focusing on outperforming others.
- (4) Performance avoidance – avoidance of performing poorly relative to others.

It is postulated in the present study that individuals with an entity mindset tend to take on performance or avoidance goals in order to show or prove the intelligence that they have. On the other hand, individuals with an incremental mindset tend to take on mastery or learning goals in order to develop this intelligence (Mellat & Lavasani, 2011). Believing in an entity theory also means believing that one is predisposed with a specific amount of knowledge that one can no longer change; Entity theorists' orientation is towards measuring their given ability and avoiding challenges that might be a revelation of a lack of it. This characteristic allows them to have a performance or avoidance goal when engaging in tasks. On the other hand, believing in an incremental theory also means believing that things can be learned and intelligence can be developed; incremental theorists' orientation is towards sharpening their given ability and looking forward to challenges that can further enhance it (Blackwell, Dweck, & Trzesniewski, 2007). These characteristics are consistent with adapting a mastery goal that is associated with successful learning outcomes.

According to Dweck, incremental theorists focus on mastery goals rather than performance goals, believe in the utility over the futility of effort, and exhibit mastery-oriented strategies over helpless ones (Dupeyrat & Marine, 2005). However, implicit theorists of intelligence do not mean to claim that endorsing an incremental mindset follows the premise that everyone has the exact same potential in any field nor that everyone can learn everything equally. They believe that the intelligence of anyone can be developed.

In the academic setting, implicit theories of intelligence influence how students approach their learning and achievement, the goals they adopt, and the effort they expend in their work (Dupeyrat & Marine, 2005). Because the two key concepts of Dweck's postulates are the beliefs about intelligence (entity or incremental) and goal orientation (performance or mastery), the relationship between these two sets of twin constructs and their impact on academic achievement has been a widely researched area for the past two decades (Dupeyrat & Marine, 2005). However, previous studies only focused and used the old concepts of achievement goals with factors of performance and mastery. The relationship of implicit theories of intelligence with the 2x2 achievement goals needs to be validated if the same pattern of prediction will occur.

In this span of time, Dweck has lobbied for the validity of implicit theories of intelligence as a proximal determinant of achievement with the mediating role of achievement goal orientations. Other researchers followed and engaged in their own

investigation of the phenomenon (e. g., Robins & Pals, 2002; Gialamas & Leondari, 2002; Dupeyrat & Marine, 2005; Blackwell, Dweck, & Trzesniewski, 2007). However, results have not been consistent in supporting or negating Dweck's initial contention that one's theory of intelligence affects one's achievement goal orientation and in turn results to academic achievement.

First, there has seemed to be inconsistent relationships between implicit theories of intelligence and achievement goal orientation across studies. If any relationship was found, it was often weak and unstable across different studies (see Dupeyrat & Marine, 2005). It was revealed in one study that the entity theory had a significant relationship with performance goals but not with mastery goals. This implies that endorsing an entity theory does not mean an individual no longer pursues mastery goals. On the other hand, another study pointed that while the entity theory was negatively correlated with mastery goals, it had no significant relationship with performance goals. This also indicates that holding a fixed view of intelligence (entity theory) does not necessarily translate into preferring to display one's intelligence (performance goal orientation) over developing one's intelligence (Mastery goal orientation).

In the next postulate of Dweck's, the relationship between achievement goal orientation and academic achievement has been proven to be significant with the use of deep processing strategies and effort expenditure (Dupeyrat & Marine, 2005). It was found that setting up mastery goals leads to deep processing strategies and effort expenditure which in turn positively affects academic achievement. On the contrary, setting up performance goals leads to shallow processing strategies which in turn negatively affects academic achievement. Moreover, setting up work avoidance goals or performance avoidance goals leads to the use of shallow processing strategies and withdrawal or lack of effort required for academic achievement (Dupeyrat & Marine, 2005). In the course of the said study, employing a path analysis has also been proven to be useful in explaining the aforementioned variables on their relationships and in predicting academic achievement (Dupeyrat & Marine, 2005).

Furthermore, it has been established that goals do have an indirect effect over achievement via the mediation of perceived competence (Gialamas & Leondari, 2002). What has remained lacking until now is the consistent evidence on the significant relationship of implicit theories of intelligence and achievement goal orientations. Also, the positive influence of incremental theory on academic achievement has yet to be strongly established.

In the past, the positive effect of incremental theory of intelligence on academic achievement was longitudinal in nature (Blackwell, Dweck, & Trzesniewski, 2007). Incremental theory of intelligence forms an interrelated network of variables with learning goals, positive strategies, positive belief efforts, and low helplessness attributions, resulted to an increasing trajectory of math grades across junior high school (Blackwell, Dweck, & Trzesniewski, 2007).

In higher education, it is believed that entity theorists exhibit a pattern of helpless response while incremental theorists exhibit a mastery-oriented one in the

face of academic challenges. Because of such challenges, it was also revealed that self-esteem of entity theorists decline during college while that of the incremental theorists' increase through the mediation of achievement goal orientation (Robins & Pals, 2002). Moreover, there was also a study that revealed that college students who were taught modules on upholding an incremental mindset earned higher grades and SAT scores (Blackwell, Dweck, & Trzesniewski, 2007) than those who were not.

Using path analysis, this study aimed to add to the growing research about implicit theories of intelligence, achievement goal orientation, and academic achievement that attempts to clarify the relationship between these three constructs. For a wider and more recent explanatory finding, the research shall make use of the 2x2 achievement goal orientation proposed by Eliot and McGregor (2002) that includes mastery avoidance to the three previously constructed ones – mastery approach, performance approach, and performance avoidance.

On a more specific note, this study also tested whether incremental theory and entity theory affects academic achievement via achievement goal orientation. First, this study hypothesized that both incremental theory and entity theory predicts the four achievement goal orientations (mastery approach, mastery avoidance, performance approach, and performance avoidance). In turn, the use of such achievement goals leads to academic achievement.

Finally, the relationship between the three constructs will be contextualized by studying the phenomena among university students majoring in Engineering. The engineering students would be an appropriate sample to test the postulates on. Highly patterns of achievement behavior should be strongest when students are constantly faced with challenging tasks (Blackwell, Dweck, & Trzesniewski, 2007). By looking into highly varying patterns of achievement, the research also hoped to find a wider and more conclusive explanation of the proposed phenomenon.

Method

Participants

The participants were 291 Filipino college students from a university in the National Capital Region of the Philippines. Ages ranging from 17 to 22 years ($M = 19.09$, $SD = 1.25$), the sample is composed of 215 males and 76 females ($N = 291$) all enrolled in an engineering course. All the participants were engineering majors and proficient in English.

Instruments

Implicit Theory of Intelligence Scale (ITIS). The ITOS was developed by Abd-El-Fattah and Yates (2005) to measure individuals' implicit theories of intelligence. The scale originally consists of 14 items. Out of the 14, the 10 items with the highest factor loadings, .60 and above, were used in the study. There are 5

items that measure entity theory while the other 5 measure incremental theory. Participants rate how much they agreed with each statement on a 4-point Likert type starting with 1 for “Strongly Disagree” to 4 for “Strongly Agree.” Sample questions are “You can develop your intelligence if you really try” for incremental theory, and “You are born with a fixed amount of intelligence” for entity theory. The two subscales proved to be appropriate with a satisfactory goodness of fit and internal reliability (Abd-El Fattah & Yates, 2005).

Achievement Goal Orientation Questionnaire. The instrument was constructed by Elliot and McGregor (2001), the scale aimed to measure the different goal orientations individuals in a 2x2 framework with profiles such as mastery approach, mastery avoidance, performance approach, and performance avoidance. There is a total of 12 items with 3 items per each profile. Participants rate how much they agree with each statement on a 7-point Likert scale starting with 1 for “Not very true of me” to 7 for “Very true of me.” Sample questions are “It is important for me to do better than other students” for performance approach, “I worry that I may not learn all that I could possibly learn in this class” for mastery avoidance, “It is important for me to understand the content of this course as thoroughly as possible” for mastery approach, and “My goal in class is just to avoid performing poorly” for performance avoidance. All the 12 items had over .70 in factor loadings. The scale exhibits internal consistency and empirical difference among its constructs (Elliot & McGregor, 2001). Through an exploratory factor analysis, four indices emerged from the constructed achievement goal orientation. These four indices also proved to be separate entities and internally consistent.

Cumulative Grade Point Average. The engineering student CGPA was determined at the end of the semester or term. This CGPA was used as an indicator of students achievement.

Procedure

Engineering classes were randomly selected in different colleges and universities. For the first five minutes of each class period, the students were asked to answer the questionnaires. On the upper part of the questionnaire, the cumulative grade point average (CGPA) was also requested. All of the respondents were first informed about the purpose of the study and their consent was asked. The participants took about 20 to 30 minutes in completing the questionnaires.

Path analysis was used to explain the hypothesized causalities among the implicit theories of intelligence, achievement goal orientation, and academic achievement. All causalities were additive and linear.

Out of the 300 questionnaires given, nine were deemed invalid because no CGPAs were included. Without the CGPA, the other variables will not be able to contribute to the expected outcome. The remaining 291 responses were encoded and

analyzed statistically using a zero-order correlation and then the hypothesized model was tested using a path analysis. The model was tested if it fits the observation by examining the goodness of fit indices using Root Mean Square Error Approximation (RMSEA), Goodness of Fit Index (GFI), Adjust GFI (AGFI), and Chi-square test of variance.

Results

The mean scores and standard deviations of the measured variables were tabulated. The variables entity theory, incremental theory, mastery approach, mastery avoidance, and performance approach, performance avoidance, and CGPA, were intercorrelated. A path analysis was then conducted to test the effect of entity theory and incremental theory on the four achievement goal orientations.

Table 1
Mean Scores and Standard Deviations of Implicit Theories of Intelligence, Achievement Goal Orientation, and Cumulative Grade Point Average

	<i>M</i>	<i>SD</i>	<i>N</i>
Entity Theory	2.30	0.53	291
Incremental Theory	3.30	0.66	291
Mastery Approach	5.64	1.10	291
Mastery Avoidance	4.73	1.33	291
Performance Approach	4.50	1.37	291
Performance Avoidance	5.31	1.28	291
CGPA	2.48	0.48	291

For the scale measuring implicit theory of intelligence, scores for entity theory averaged at 2.30, just a few values above midpoint. Meanwhile, scores for incremental theory averaged near the highest possible value which is 4. For the scale measuring achievementgoal orientation, mastery avoidance scored high at 5.64 out of a possible 7, being the highest value one can rate his or her agreement with a specific goal orientation. Performance avoidance is also above midpoint at 5.31. Mastery avoidance and performance approach averaged at the proximal distance of the midpoint, which represents the rating given by an individual if he or she is not sure or just stand neutral on a statement referring to a particular goal orientationat 4.73 and 4.50 respectively.

Table 2
Intercorrelations among Implicit Theories, Goal Orientations and CGPA

	Performance Approach	Mastery Approach	Mastery Avoidance	Performance Avoidance	Entity Theory	Incremental Theory
Cumulative Grade Point Average	.01	.04	.04	-.04	.04	.00
Performance Approach	---	.08	.28*	.22*	.24*	.17*
Mastery Avoidance		---	.49*	.28*	.11	.11
Mastery Approach			---	.36*	.04	.29*
Performance Avoidance				---	.23	.13*
Entity Theory					---	.16*
Incremental Theory						---

$p < 0.05^*$

Results of the zero-order correlations show that three out of four goal orientations, performance approach, mastery approach, and performance avoidance, were significantly intercorrelated. Moreover, entity and incremental theories were also significantly intercorrelated. Building on the proposed model, entity theory was only significantly correlated to performance approach while incremental theory was significantly correlated to performance approach, mastery approach, and performance avoidance. CGPA did not significantly correlate to any subscale of the achievement goal orientation or implicit theories of intelligence.

The path analysis was used in order to test the hypothesized model. First, entity and incremental theories were used to predict the four achievement goal orientations, mastery approach, mastery avoidance, performance approach, and performance avoidance. Then the four achievement goal orientation was used predict CGPA.

The results showed that both entity theory and implicit theory were significant predictors of performance approach with .219 and 0.138 estimates respectively ($p < 0.01$). Meanwhile, incremental theory was the only significant predictor for mastery approach with an estimate of .287 ($p < 0.01$). Entity theory was

the only significant predictor for performance avoidance. Both entity and incremental theories did not significantly predict mastery avoidance.

In the initial path analysis, the variables in the model produced a very high variance ($\chi^2 = 150.00$). The significant χ^2 value means that there is a huge difference between the model and observed covariance of the model. The Root Mean Square Error of Approximation (RMSEA) of 2.33 for the default model and 1.83 for the independence model failed to reach the standard of 0.05 to be considered a good fit or at least 0.08 for an adequate one. The values stating the goodness of fit index (GFI) are 0.866 for the default model and 0.799 for the independence model. Both values fell short of 0.900, the least value a model must arrive at for goodness of fit. Support for the model was not established well. The values for the Adjusted Goodness Fit (AGFI) were also far from their (GFI). AGFI value for the default model was 0.582 while 0.732 for the independence model. The closer the AGFI is to the GFI, the better the fit of the model.

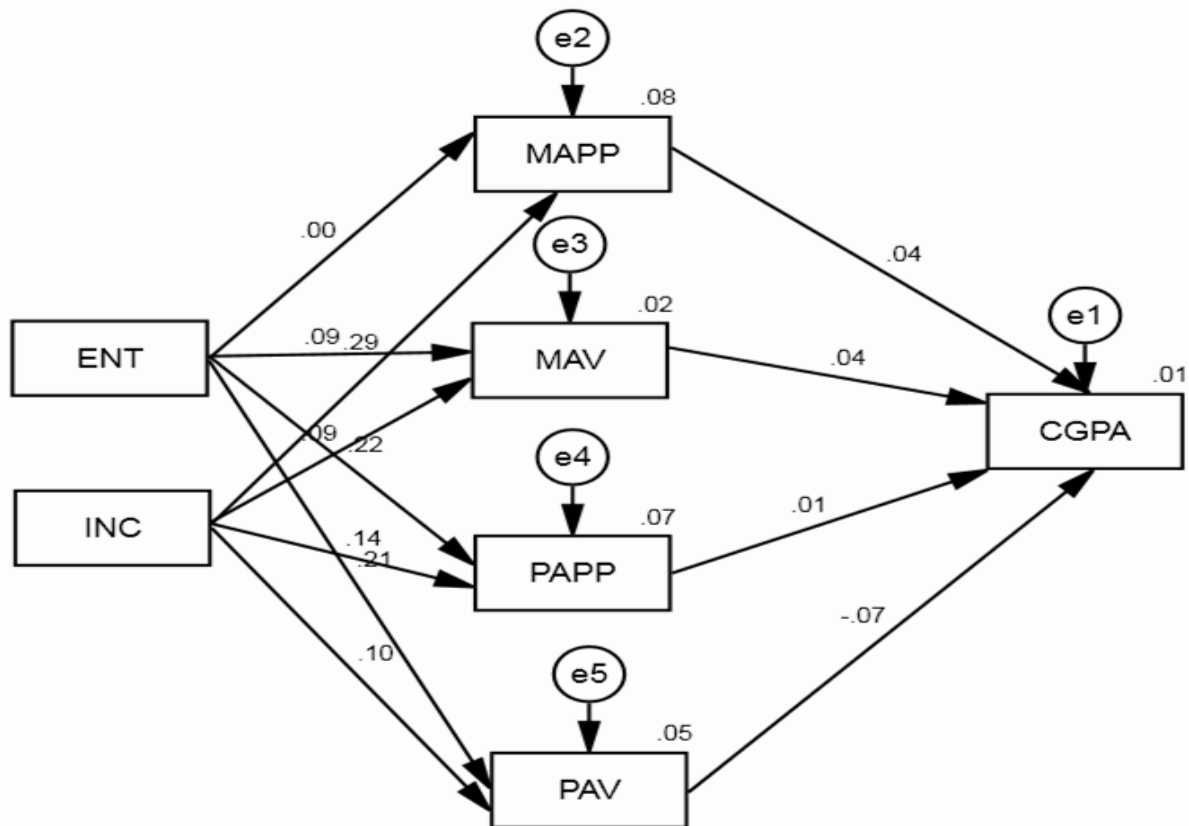


Figure 1. Path Diagram of Hypothesized Model. ENT: Entity theory, INC: Incremental theory, PAPP: Performance approach, PAV: Performance avoidance, MAPP: Mastery approach.

To fir the model better, a second path analysis was conducted to test only the variables that proved to have significant paths coefficients. The χ^2 value dropped to 68.43 indicating improvement in the model. There was also an improvement in the RMSEA and GFI with values .06 and .91 respectively.

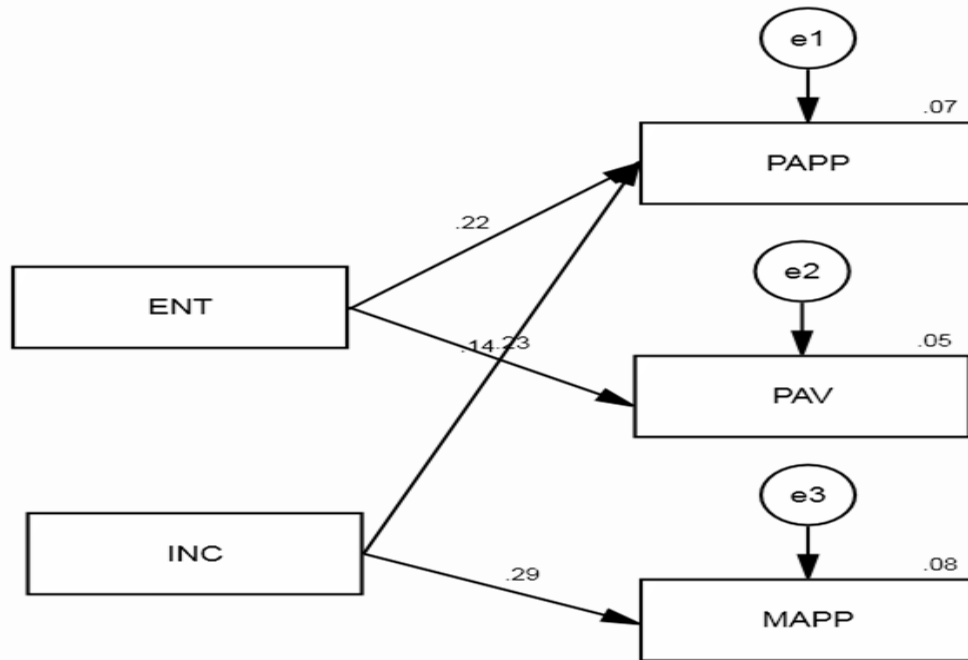


Figure 2. Adjusted Path Diagram of Hypothesized Model. ENT: Entity theory, INC: Incremental theory, PAPP: Performance approach, PAV: Performance avoidance, MAPP: Mastery approach.

Discussion

The study initially hypothesized that entity and incremental theory if intelligence will have distinct effects on a specific achievement goal orientation while the use achievement goals like mastery results to better achievement. However, the results did not support all hypothesized effects. The findings showed that the students' achievement goal orientation did not significantly predict their CGPA.

The results in the zero-order correlations initially showed the implicit theories of intelligence and achievement goal orientation with the academic achievement as measured through the CGPA are not linear as it was proposed. Academic achievement may not be as easily derived at by the chain of constructs such as belief and goal orientations. Previous studies suggest some specific competence variables allow one's achievement goals to predict academic achievement. There are also some studies indicating the lack of potency of achievement goals in predicting students achievement (see Gialamas & Leondari, 2002). The quality of action and strategies an individual utilizes greatly influences

the fulfillment of his goals and the birth of his achievement. Related literature strongly indicate that achievement goal orientation has a direct effect on academic achievement when mediated by deep processing strategies and effort expenditure (Dupeyrat & Marine, 2005; Blackwell, Dweck, & Trzesniewski, 2007). In the case of the studies findings, it is not only implicit theories of intelligence that determines the goal that one sets for himself in the academic workplace. There is also academic self-efficacy or one's belief in his academic capabilities and epistemological beliefs of learning or how learning takes place and how it is acquired. Intelligence is a multi-dimensional construct and students view some aspects of their intelligence such as mathematical or verbal and together with achievement goals could not serve as a stable predictor of general academic achievement such as CGPA. Among Asian learners, aside from beliefs about constructs of intelligence and the intelligence one has, other factors such as priorities, family roles, and other environmental factors also have a hold in determining students' academic achievement.

What is notable in the results is that performance approach was consistently predicted by both incremental and entity beliefs of intelligence. This turned meaningful in the model considering the social nature of the performance approach goal. The performance approach goal is focused on wanting to be perceived by others as competent but not to improve oneself. The performance of the individuals depend on others perception. Given ones belief about intelligence, the expected perception is not differentiated between both entity and incremental. Both beliefs regardless whether it is fixed or changing make individuals see the importance of others in shaping their performance on a task. However, this goal does not actually translate and facilitate into ones academic achievement.

Entity and incremental beliefs effect on achievement goals was distinguished for performance avoidance and mastery approach. The results of the model showed that individuals with entity beliefs about intelligence adopt more of a performance avoidant goal while individuals' who has an incremental belief adapts more of the mastery approach. This was consistent with the hypothesis of the study. A fixed belief about intelligence makes one avoid challenging and difficult tasks. In other words, when one believes that intelligence cannot be improved, they avoid tasks that would be difficult for them. However, they maintain certain effort in their performance when comparing themselves with others (effect of entity on performance approach is also significant).

On the other hand, the results also showed that individuals' with incremental beliefs about intelligence adapts mastery orientation. In other words, when learners view intelligence as changing and improving, it allows them to focus on mastering and learning tasks. Mastery approach goal is adapted by individuals who exert effort in learning for the sake of learning and not comparing themselves with others. This goal is best predicted when individuals view intelligence as a construct that can be improved.

It can be drawn from the study that an individual subscribing to the belief that intelligence can be developed do not necessarily mean that the they are limited to endorsing goals that are mastery-oriented and intelligence-developing in nature.

This result showed that even an incremental mindset can set up goals that allow them to exhibit their skill sets and to perform normatively well. However, only entity theory was a significant predictor of performance avoidance. This implies that since an entity theorist is convinced that his intelligence is only up to a certain point; they will avoid situations wherein they will perform poorly. For them, the intelligence they have can no longer be improved or built upon. This result supports the previous findings that entity theorists exhibit more helpless response patterns than their incremental counterparts (Blackwell, Dweck, & Trzesniewski, 2007; Robins & Pals, 2002). Only an incremental theory was a significant predictor of mastery approach. This confirms Blackwell, Dweck, and Trzesniewski's (2007) hypothesis that believing intelligence as malleable leads to endorsing goals that can further enhance or develop one's skills and abilities as much as he can. In the educational setting, this affirms the importance of teaching or encouraging students to uphold a personal belief that they can improve and always build on whatever knowledge that they have. Moreover, informing students of the repercussion that comes with endorsing an entity theory and performance avoidance goals at the same time may enable them to be more cautious of responding to academic challenges with a helpless response rather than a learning response.

The distinction between entity and incremental theory of intelligence are further distinguished by the achievement goal orientation that they produce. This further extends theory on the implicit theory of intelligence especially how each belief leads to a specific achievement goal. This perspective further supports the link between implicit theory of intelligence and achievement goals.

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