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Implicit Theories of Ability and Self-Efficacy:
Testing Alternative Social Cognitive Models to Science Motivation

Over the past two decades there has been enormous excitement over students' implicit theories of ability, which Dweck & Leggett (1988) defined as individuals' "implicit conception about the nature of ability" (p. 262). According to Dweck and Leggett, some students believe that they are born with a certain amount of ability, and that nothing can be done to change that. This *fixed theory of ability* differs from students who believe that their own ability is controllable and can therefore be augmented—they adopt an *incremental theory of ability*.

One reason why there is great fervor over this social-cognitive approach to motivation is that there are important interventions that can be implemented that target these "mindsets". Besides correlational studies that show the benefits of holding an incremental theory of ability (e.g., Dickhäuser, et al., 2016), intervention studies show great promise. For example, students who are involved in these interventions that help them adopt a *growth mindset* (i.e., incremental theory of ability) often persist through failure, set adaptive goals for themselves, and get better grades than their peers who hold are taught a fixed theory of ability (Blackwell, Trzesniewski, & Dweck, 2007). These interventions typically involve teaching students that their brains can grow by working hard and finding the appropriate strategies to solve a problem. The result of these relatively short interventions is that students believe that their intellectual capacity grows with effort. This change in mindset, on average, relates to adaptive motivational beliefs and better achievement (e.g., Blackwell et al., 2007). This is an especially attractive type of intervention because of its relative ease and low cost of implementing (Yeager & Walton, 2011). In one sense, this growth mindset intervention can be seen as an inoculation against negative

motivational and achievement outcomes in academic settings. In this present study, we refer to this as the *Growth Mindset as Inoculation Hypothesis*.

On the other hand, Bandura (1997) has argued that, "although belief in the acquirability of talent is conducive to high personal development, it does not necessarily ensure it. Many people are reluctant to go through the drudgery of perfecting skills that enable them to perform at extraordinary levels" (p. 119). Thus, a growth mindset alone, according to Bandura, does not necessarily inoculate against negative outcomes. Rather, a strong belief in one's personal capability to muster one's resources to accomplish a particular task—a strong sense of *self-efficacy*—is essential for adaptive motivational and achievement outcomes. This view represents the case *against* the Growth Mindset as Inoculation Hypothesis.

The case against the inoculation hypothesis runs counter to Dweck and Leggett (1988), who contended that, "when individuals held a learning goal, they would display the mastery-oriented pattern, even when they assessed their present ability level to be low" (p. 259). That is, students' perceived confidence[1] in their ability was rendered moot if students possessed a growth mindset. It was only when students held a fixed theory of ability that "confidence" mattered in predicting adaptive outcomes. In fact, Dweck and Leggett (1988) noted that, "Bandura and Dweck (1985) found that their learning-oriented children with low confidence were the most likely of any group to seek a challenging learning opportunity even though it carried the risk of negative ability judgments" (p. 262). In short, the Growth Mindset as Inoculation Hypothesis predicts the existence of a group of individuals that holds a growth mindset, and regardless of self-efficacy, would evince adaptive outcomes.

Some readers may argue that testing the inoculation hypothesis is merely an exercise of academic curiosity that has little to no practical value. However, we argue that, although testing this inoculation hypothesis is indeed designed to refine and clarify theory, there are important practical implications. If, on the one hand, there is empirical support for the inoculation hypothesis then relatively inexpensive interventions that help students see their abilities as augmentable rather than fixed traits could indeed be a good way to improve the educational experiences of students (Rattan, Savani, Chugh, & Dweck, 2015). However, if there is no clear empirical support for the inoculation hypothesis, then different approaches may be needed—ones that are attentive to other factors such as self-efficacy in addition to implicit theories of ability. With this study we are taking one step toward clarifying theoretical mechanisms behind each hypothesis.

Mechanisms Behind the Growth Mindset as Inoculation Hypothesis

Empirical work has amassed showing the positive benefits of espousing an incremental theory of ability (for a review see Yeager & Walton, 2011). The mechanisms regarding how implicit theories of ability translate into adaptive motivational and achievement outcomes centers on the pivotal role that implicit theories play in shaping the goal orientations that individuals hold. According to Dweck and Leggett (1988), students who hold an incremental theory of ability are mastery goal oriented—they pursue tasks primarily for the sake of learning more. On the other hand, students who hold a fixed theory of ability are performance goal oriented—they pursue tasks in order to be seen in a favorable light (i.e., performance approach goals) or to avoid being seen in a negative light (i.e., performance avoid goals).

The studies to build and confirm these early claims were primarily conducted within controlled laboratory settings. To bolster the ecological validity of these claims, there was a move toward exploring these effects within naturalistic settings. In a series of two studies, Blackwell, Trzesniewski, & Dweck (2007) showed that incremental theories of ability oriented students toward pursuing mastery goals, and also helped students see effort in a positive light. Students who held this constellation of beliefs also tended to use adaptive learning strategies, which in turn directly related to improved end-of-year grades. This causal chain presents a meditational pathway in which implicit theories of ability lead to goal orientations, which then lead to strategy-use, which then leads to higher achievement.

Two issues remain unclear, however, given the studies mentioned above. The first issue is the role of self-efficacy within Dweck and her colleagues' social cognitive framework. In earlier work, Dweck and Leggett (1988) argued that students who espoused an incremental theory of ability, regardless of confidence, should evince positive outcomes such as persistence in the face of difficulty, adaptive strategy use, and ultimately adaptive achievement outcomes. Furthermore, Dweck (2002) has argued that the impact of implicit theories appears "to go beyond the impact of self-efficacy" (p. 75). However, the studies that she cited to support this claim are unclear. For example, in the Taberno and Wood (1999) study, although implicit theories of ability did indeed evince a strong effect on outcomes, those effects were fully mediated by self-regulatory responses. Furthermore, there was no evidence to suggest that self-efficacy moderated the effects of implicit theories on outcomes, as Dweck and Leggett's (1988) model would suggest. Also, in the Braten and Olaussen (1998) study, although implicit theories of ability did have a larger effect on strategy-use compared to self-efficacy, there was an

important limitation. The measure of self-efficacy was a global one, which is less predictive of outcomes compared to task-specific measures.

The second issue that remains unclear has to do with method of measurement and analysis. Given that Blackwell et al. (2007) explored the relationships using a path analytic model, they were only able to assess the influence of a *variable* on another variable, but were not able to discern how this "meaning system" (Hong et al., 1999) of multiple variables is configured within actual individuals. There is a need for this type of "person-centered" (Magnusson & Stattin, 2006) analysis regarding Dweck and Leggett's (1988) framework because Molden and Dweck (2006) argued that, "psychology is often a 'one size fits all'" (p. 192). This sort of predilection to search for "universal principles" can sometimes "obscure how *real people* actually function" (p. 192; emphasis added). In the case of Dweck and Leggett's social cognitive framework, pursuing a more "person-centered" analytic approach may reveal whether a subpopulation of individuals who hold, for example, a fixed theory of ability, performance goal orientation, and high self-efficacy actually exists. Furthermore, because goal orientations are commonly depicted in terms that are more complicated than simply learning goals versus performance goals, we modeled this "network of interrelated variables" as a profile or subpopulation rather than taking a variable-centered approach, which Dweck and her colleagues have typically done. In fact, Dweck and Leggett (1988) noted that, "indeed, Bandura and Dweck (1985) found that their learning-oriented children with low confidence were the most likely of any group to seek a challenging learning opportunity even though it carried the risk of negative ability judgments" (p. 262). Therefore, we wanted to put to empirical scrutiny the hypothesis

that there are indeed actual individuals who hold an incremental view of ability with the corresponding mastery goal orientations, but yet are *not* self-efficacious.

Concerning measurement, Dweck and her colleagues have argued that a fixed theory and incremental theory of ability are opposite ends of a unidimensional construct. However, some scholars have questioned that claim (see Lüftenegger & Chen, 2017 in this issue; Tempelaar et al., 2014). In fact, Tempelaar et al. argued that reducing implicit theories into a unidimensional construct "would be defensible only when the two related, unipolar constructs prove empirically indistinguishable" (p. 102). The results of their study suggested that having a unidimensional construct with incremental theory and fixed theory on opposite ends of that continuum was not empirically justified. Therefore, we also decided to model an incremental theory and fixed theory as separate constructs.

The Case Against the Growth Mindset as Inoculation Hypothesis

Implicit theories of ability represent individuals' beliefs about the *nature* of their own capacities as either fixed or malleable. However, self-efficacy represents individuals' beliefs about whether they can organize and mobilize the personal resources necessary to achieve a particular goal. Although implicit theories of ability might set individuals up for persisting through difficult tasks, Bandura (1997) argued that ultimately, individuals' firm sense in being able to muster up the personal resources that are necessary to accomplish a task have the casting vote in what they do and how well they succeed.

Taberno and Wood (1999) demonstrate one mechanism by which self-efficacy might operate within an implicit theory framework. In their study, they tested a mediational model versus a moderating model. In the mediational model, implicit theories influence self-efficacy,

which then influences self-set goals, satisfaction with performance, and finally, achievement. In this model, they found that implicit theories of ability did not have a direct effect on performance, but did have a direct effect on self-efficacy and satisfaction with performance. Self-efficacy, however, had both an indirect effect *and* a direct effect on performance. Such a model would suggest that individuals with a growth mindset should have a strong self-efficacy, whereas those with a fixed view of ability should have a weak self-efficacy. Some other empirical evidence also points to this claim (e.g., Chen & Pajares, 2010).

On the other hand, in their test of the moderator effect, Taberno and Wood (1999) found no empirical support for the moderator hypothesis, which Dweck and Leggett's (1988) model would have predicted. Those who support this model posit that self-efficacy influences outcomes only when students held a fixed view of ability—students with an incremental theory would evince adaptive outcomes *regardless* of self-efficacy. Our goal, as mentioned earlier, was to explore whether a person-centered approach could reveal whether the subpopulations Dweck and colleagues have referred to actually exist.

Overview of Present Study

Our goal in this study was to test two main hypotheses. First, is there empirical evidence for the presence of the following subpopulations, which Dweck and Leggett (1988) proposed in their social cognitive model: those who espouse (1) an incremental theory of ability, mastery goal orientation, and high self-efficacy; (2) an incremental theory, mastery goal orientation, and *low* self-efficacy; (3) a fixed theory of ability, performance goal orientation, and high self-efficacy; and (4) a fixed theory, performance goal orientation, and *low* self-efficacy? Second, we tested whether these four profiles differed in the types of outcomes that Dweck and Leggett

(1988) predicted. For example, Dweck and Leggett predicted that there would be a group of individuals with an incremental theory of ability and mastery goal orientations, and that *regardless of self-efficacy*, these individuals would be less anxious, more confident in their ability to self-regulate, and ultimately earn better grades in the long term than would individuals with a fixed mindset, performance goal orientations, and low self-efficacy. We explored whether the empirical evidence with a sample of Grade 6 and Grade 10 students because Dweck (2002) has suggested that implicit theories do not form the interconnected network of beliefs until after 10-12 years of age. Our Grade 6 students were about 11 years old, so some of the effects of implicit theories that might be predicted might not be present in this sample, but might be present in the Grade 10 students who were about 15 years old. Although these data have been analyzed and published before (Chen, 2012; Chen & Usher, 2013), in the present study we are exploring the data by clustering variables according to Dweck and Leggett's framework to explore whether the profiles that they predicted to exist actually surface. Although Dweck and Leggett discuss people espousing a network of beliefs, their analyses have never reflected that person-centered nature.

Methods

Participants

A sample of Grade 6 students n=506 and a sample of Grade 10 students n=354 in a middle school and two high schools in the Southeastern part of the United States participated in the study. The population of the middle school was 19.1% Asian, 47.6% White, 16.3% Black, and 10% Hispanic, and 41.5% female. 28% of the students qualified for free or reduced price lunch—a measure of the socioeconomic status of the students who attend the school. The

population of one high school was 20% Asian, 53% White, 17% Black, 8% Hispanic, 49% female, and 20% qualified for free or reduced price lunch. The population of the other high school was 39% Asian, 31% White, 16% Black, 12% Hispanic, 38% female, and 23% qualified for free or reduced price lunch.

Instruments

All questions for the survey were presented in a 6-point Likert-style format. For self-efficacy items, a rating of (1) indicated that participants were "not at all confident" about the task in question, and a (6) indicated that participants were "completely confident" about the task in question. For all other items, participants showed their level of agreement to statements as such: (1) Completely disagree, (2) Mostly disagree, (3) Somewhat disagree, (4) Somewhat agree, (5) Mostly agree, and (6) Completely agree.

Implicit theories of ability. Items were adapted from those used by Dweck (2000), and consisted of six items that asked students about their abilities in science rather than just their general intellectual abilities. Although Dweck's original scale refers to abilities in general, Stipek and Gralinski (1996) posited that adolescent students may have subject-specific ability beliefs. Therefore, items were worded so as to focus students on the subject of school science. Three items assessed students' fixed theory of ability (e.g., "You have a certain amount of science ability, and you really can't do much to change it") and three others assessed their incremental theory (e.g., "No matter who you are, you can change your science abilities a lot"). Cronbach's alpha coefficients of .76 for fixed theory of ability and .87 for incremental theory of ability were obtained.

***Science grade self-efficacy*.** Students' confidence in obtaining either an A, B, C, or D in their science class was assessed using a 4-item instrument (e.g., "How confident are you that you can earn a grade of "C" or better in science this semester?") (see Bandura, 1997, for assessment procedures consistent with tenets of self-efficacy theory). Students provided a rating for each of the four grades mentioned above. We obtained a coefficient alpha of .88 for this instrument.

Self-efficacy for self-regulated learning. Self-efficacy for self-regulation in science was assessed using a 7-item subscale adapted from the Children's Multidimensional Self-Efficacy Scale (Zimmerman & Bandura, 1994), which assesses students' confidence in using various self-regulated learning strategies (e.g., "How well can you study when there are other interesting things to do?"). The scale was adapted from the original by including only the items that had to do with managing one's time and motivation effectively, and in managing competing alternative activities.

***Achievement goal orientations*.** Achievement goal orientations were assessed using a scale derived from the Patterns of Adaptive Learning Survey (PALS) (Middleton & Midgley, 1997; Midgley et al., 2000). Items were adapted to reflect goals toward tasks in science class. Mastery goal orientations (5 items) concern pursuing a task for the sake of understanding and learning (e.g., "I like science assignments I can learn from, even if I make a lot of mistakes"). Performance approach goal orientations (5 items) concern doing a task to demonstrate one's high ability (e.g., "I want to do better than other students in my science class"). Performance avoid goal orientations (6 items) entail avoiding tasks that would cast light on one's incompetence (e.g., "It's important to me that I don't look stupid in science class"). In the present study,

coefficient alphas of .86 for Mastery goal orientations, .83 for Performance Approach, and .81 for Performance Avoid were obtained.

Achievement. The numerical grade that students earned in their science class was obtained from school records. The grades are computed on a scale of 100 points.

Analyses

All analyses were performed on the mean raw scores for each construct that was included in the study because all constructs were assessed on a 6-point scale. We used a person-centered analytical approach (Magnusson & Stattin, 2006) because we assumed that a group of beliefs operates together within an individual. We were also not interested in explicitly positioning implicit theories of ability, self-efficacy, and goal orientations within some causal structure. Rather, we wanted to cluster all of these variables together and explore whether different subpopulations exist when clustered on these specific constructs. In addition, we

We conducted one set of analyses on just the students in Grade 6, and then the identical analyses on the students in Grade 10 because Dweck (2002) posited that "for the first time at ages 10-12, perceptions of ability start forming a network with other beliefs, as well as with values and goals" (p. 69). Thus, Grade 6 students, who are about 11 years old may exhibit a different set of profiles than students in Grade 10, who are about 15 years old and should have their network of beliefs more solidified compared to their peers in Grade 6. These are the underlying assumptions by which we operated.

We answered our research questions using a two-step process. First, we manually examined the dimensionality of the data across the variables of interest via the k-means cluster analysis and principal components analysis functions found in the statistical software R (R Core

Team, 2016). We then conducted a latent profile analysis (LPA) using the *mclust* package, also in R (Fraley et al., 2012). Final models were chosen based on the Bayesian Information Criteria (BIC) value.

By independently exploring dimensionality first from an unguided (exploratory) method, then from a guided (LPA) method without having one influence the other, we could be more confident in the findings of our LPA model fits. To determine if given profiles were related to various distal outcomes, we replicated our final models in MPlus 7.4 (Muthén & Muthén, 2016) and tested for differences in mean values of the outcomes across various profiles.

Results

Research Question 1: Evidence of Profiles

In our first research question, we asked the following: What evidence is there for the four hypothesized profiles that Dweck and Leggett (1988) proposed? Using exploratory analyses of the Grade 6 students, we detected three patterns of responses that may explain a substantial proportion of variation in the scores we observed. We note in Figure 1 these three distinct patterns that arose in the data, as indicated by the k-means cluster analysis plotted against the first three principal components. Post-hoc testing confirmed that the three clusters were neither parallel (Approx. $F(10,966)=98.69$ $p<.001$) nor equal in level ($F(2,502)=136.00$, $p<.001$), meaning that, from a statistical perspective, these profiles were distinct from each other. We chose the number of latent profiles in our final model based on the parameterization that maximized the Bayesian Information Criteria (BIC) value. Based on this, we chose a model (BIC = -9034.04) with three latent profiles that were variable in volume and shape, but equal in orientation (Scrucca, Fop, Murphy, & Raferty, 2016). We note in Figure 3 (results from the LPA

conducted in Mplus) that this model yields results that are quite similar to the exploratory analyses presented in Figure 2, above.

Our exploratory analysis of the Grade 10 data yielded a two-cluster solution (Figure 4). Again, this seems to indicate that two patterns of response might explain a large proportion of the variation in observed scores across the measured constructs. Examining the associated profile plot of variable means by cluster, we note that these two profiles correspond to the general patterns seen in the Grade 6 sample (Figures 5-6). Again, post-hoc analyses show that these were neither parallel (Approx. $F(5,348) = 127.47$, $p<.001$) nor equal in level ($F(1,352) = 127.47$, $p<.001$), meaning that, from a statistical perspective, the two profiles were distinct from each other.

Growth mindset profile. We call the first pattern (Profiles 2 and 3 for Grade 6; and Profile 2 in Grade 10) the *Growth Mindset* profile—in line with Dweck and her colleagues' nomenclature for people who: (1) believe that their abilities are augmentable; (2) disagree with the fixed theory of ability; (3) oriented toward mastery goals instead of performance- approach and avoid goal orientations; and (4) are quite confident in achieving high grades in science. Using the most likely class membership based on posterior probabilities, we found that 67% of the Grade 6 sample, and 32% of the Grade 10 sample could be classified in this profile.

All moderate profile. We call the second pattern (Profile 1) an *All Moderate* profile. Students in this profile tended to report moderate agreement with both the fixed theory of ability and the incremental theory of ability. They tended to moderately disagree with a mastery goal orientation, but moderately agree with a performance approach and performance avoid goal orientation. Although their self-efficacy was lower than the other profiles, they were moderately

confident in their ability to do well in science. Students in this *All Moderate* profile made up 33% of the Grade 6 sample, and 68% of the Grade 10 sample.

Given these two basic patterns, we also point to the fact that there was no empirical evidence for profiles in which an incremental theory of ability was paired with low self-efficacy. Neither was there empirical evidence of any profiles showing a clear fixed theory of ability, along with its associated goal orientations. When we built our latent profile models to "force" a fixed theory of ability, the models resulted in non-positive definite errors, suggesting that the data did not fit a model that included such profiles. This was true both for the Grade 6 and Grade 10 samples.

Research Question 2: Outcomes

For our second research question, we asked the following: What evidence is there that the hypothesized profiles proposed by Dweck and Leggett (1988) were associated with differential outcomes in line with what Dweck and Leggett would have expected? Post-hoc testing with the Grade 6 sample shows that, compared to their *All Moderate* peers, the students in the *Growth Mindset* profiles (Profiles 2 and 3) reported greater confidence in being able to self-regulate their learning (1(M=3.75) vs. 2(M=4.67): $\chi 2$=75.41, p<.001; 1(M=3.75) vs. 3(M=4.99): $\chi 2$=172.11, p<.001), and are less anxious with science (1(M=3.08) vs. 2(M=2.37): $\chi 2$=28.74, p<.001; 1(M=3.08) vs. 3(M=1.81): $\chi 2$=118.77, p<.001). Furthermore, *Growth Mindset* students received higher end-of-year grades (Profile 2: M=82.66 vs. Profile 3: M=89.17) compared to their *All Moderate* peers (M=77.54).

Post-hoc testing with Grade 10 students showed that, compared to their *All Moderate* peers, the *Growth Mindset* students (Profile 2) were more confident in being able to self-regulate

their learning (1(M=3.66) vs. 2(M=4.38): $\chi 2=62.30$, $p<.001$), and less anxious with science (1(M=3.09) vs. 2(M=2.12): $\chi 2=71.16$, $p<.001$). Furthermore, *Growth Mindset* students received higher end-of-year grades (M=90.78) compared to their *All Moderate* peers (M=78.55).

Discussion

Our findings did not completely confirm or disconfirm the Inoculation Hypothesis—rather, a more nuanced conclusion should be drawn. On the one hand, there was some empirical evidence to support Dweck and Leggett's (1988) contention. For example, as Dweck and Leggett (1988) would have predicted, we did find evidence of a profile in which students: (1) believe strongly in the incremental nature of ability; (2) reject the notion that ability is a fixed trait; (3) orient themselves toward tasks for the sake of learning rather than for the sake of showing off or avoiding embarrassment; and (4) are highly confident in their ability to succeed. As expected, these students also achieved high grades, were confident in their abilities to self-regulate their learning, and did not report maladaptive anxiety in science.

On the other hand, there was no empirical evidence of a profile with a fixed theory of ability, even when we "forced" the data to conform to such a model. This result implies that students in our samples did not report a combination of (1) a fixed theory of ability and (2) a clear preference for performance goal orientations over mastery goal orientations. This contrasts from what Dweck and her associates have claimed—that about 15% of the population is undecided about how malleable their abilities are, and the remaining 85% is evenly split between a fixed and incremental theory of ability.

Recall in our study, more than 35% of students in Grade 6 and more than 60% of students in Grade 10 could be classified in the *All Moderate* profile. We can only speculate about why

there are more All Moderate students in the older cohort, but perhaps as students transition into high school where the material becomes more difficult and other environmental factors become salient (e.g., rigid ability grouping) they start doubting how malleable their abilities really are. This would make sense because, unlike their Grade 6 peers, there was no profile for the Grade 10 students that represented a less enthusiastic endorsement of the incremental theory. There were only Grade 10 students who either enthusiastically endorsed the incremental theory, or there were those who were fairly unsure. This would mirror developmental trends that others have noted showing the gradual progression toward maladaptive motivation in students the older they get (e.g., Archambault, Eccles, & Vida, 2010). In our case, there was still a group of enthusiastic incremental theory endorsers in Grade 10, but the less enthusiastic endorsers perhaps disappeared in favor of a more moderate and uncertain profile. Those interested in a developmental progression could investigate in future research what happens as people progress into adulthood. Is it possible that subpopulations of people with a fixed theory of ability surface in our analyses? Might a subpopulation of people who endorse an incremental theory but low self-efficacy surface? With developmental trends that possibly allow individuals to be more reflective and realistic about their capabilities perhaps samples of adults would evince different profiles than the ones in our sample.

Another possible explanation for why we could not confirm or disconfirm the inoculation hypothesis deals with measurement. Although we have successfully used the self-report instrument for implicit theories in the past, we did adapt it for use in science class by asking about students' "science ability", which could have tapped into a different belief than if we had asked about their intelligence, which is what the original scale does. Nevertheless, Dweck

(2002) has noted that, “although there are meaningful differences between the terms ‘intelligence’ and ‘ability’, I will use them more or less interchangeably here because the phenomena I am examining most typically apply to both” (p. 58).

On a related note, self-report measures may not be able to accurately capture individuals’ implicit theories of ability, especially if they perceive the fixed theory items as socially less acceptable. This may explain why a fixed theory of ability did not surface in our samples. In fact, as Dweck (2015) herself has observed, individuals many times may claim to hold an incremental theory but do not act as if they do, which poses the question of whether people accurately report their beliefs about the nature of their abilities. Researchers interested in the issue of accurately measuring implicit theories may look to other methods to assess these beliefs (see Lüftenegger & Chen, 2017 in this issue).

We started the paper asking whether an incremental theory of ability (i.e., a growth mindset) could inoculate against maladaptive beliefs and achievement outcomes. Unfortunately, there is no clear evidence to support such a hypothesis because there were not enough students in our particular samples who reported a clear fixed theory of ability pattern. Perhaps asking such a question is overly simplistic—few things in the social sciences can truly be an inoculation. A few decades ago, researchers and educators thought that self-esteem could be an effective inoculation against a host of maladaptive outcomes (see Baumeister, Campbell, Krueger, & Vohs, 2003). However, such an assumption proved overly simplistic and incorrect (Baumeister et al., 2003).

Our results suggest that, instead of relying solely on developing an incremental view of ability in students in an effort to inoculate against maladaptive outcomes, the question might be

better framed by asking how educators can direct their students' motivational resources toward a sustained commitment to pursue a task. Framing the question like this is more complicated. Yes, helping students to see their abilities as growable is helpful. However, our results also suggest that being confident in accomplishing certain goals (i.e., self-efficacy) is also important. Contrary to the relatively quick and efficient methods involved in convincing students that their intellectual capacity is augmentable, there is no easy formula to developing students' self-efficacy.

How do students become more self-efficacious? The most influential way to build students' self-efficacy is through *mastery experiences*, or the experiences of success that people accumulate in a certain task. Developing mastery in a skill requires many hours of hard work attaining success in challenging academic tasks. This requires more than a quick and efficient intervention in thinking that one's abilities can grow with effort. Therefore, in addition to helping students see their intellectual capacity as malleable, educators also need to help their students develop real mastery in challenging and worthwhile tasks.

However, as Bandura (1997) has argued, it is not the performance or the experience *alone* that determines people's self-efficacy. Rather, it is the way in which they *interpret* their experiences that ultimately matters. Implicit theories of ability are one source of bias that can alter the ways in which people interpret the sources of self-efficacy. In this way, implicit theories of ability may bias cognitive processing of the sources of self-efficacy. Chen (2012) provided some preliminary evidence to show that this might indeed be the case. Chen (2012) drew from a larger portion of the dataset from which the current study is based, but calculated a mean implicit theory score in the same way that Dweck and her colleagues do. In that study, the

authors found that students whose mean implicit theory score was higher (denoting a stronger belief in the incremental theory of ability) tended to draw information from a greater diversity of efficacy-relevant sources. In contrast, students with a lower implicit theory score tended to draw information primarily from *physiological and affective states* such as anxiety, moods, and feelings. Because their study was only correlational in nature, scholars interested in pursuing further research in this area should conduct experimental research to explore how implicit theories bias the ways in which people attend to and integrate information from the four sources of self-efficacy.

In conclusion, although there was not strong empirical support for the Inoculation Hypothesis as framed by Dweck and Leggett (1988), it is possible that students with an incremental theory of ability may be more likely to process efficacy-relevant information in a more adaptive manner compared to their peers who believe that ability is a fixed trait. However, because we were unable to "force" our data to conform to our latent profile models, we were not able to test whether an incremental theory of ability renders self-efficacy moot. If an incremental theory of ability biases efficacy-relevant information in an adaptive manner, then such a belief might inoculate against maladaptive self-regulatory processes (rather than outcomes). That is a hypothesis that can be tested in future experimental studies.

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Footnotes

[1] Dweck & Leggett (1988) defined "confidence" as the degree to which students are certain or sure about their own level of intelligence. For example, items on their confidence instrument include ones such as, "I feel pretty confident about my intellectual ability."

Table 1

Zero-order correlations for all variables in the study

	Mean	SD	1	2	3	4	5	6	7	8
1. Incremental Theory	4.70 / 4.44	1.17 / 1.07		*** -.54	*** .43	*** .11	*** -.24	*** .30	*** .39	*** .23
2. Fixed Theory	2.92 / 2.84	1.28 / 1.06	*** -.60		*** -.30	.05	*** .37	*** -.26	*** -.28	*** -.27
3. Mastery Goal	4.23 / 3.82	1.16 / 1.09	*** .37	*** -.35		*** .21	*** -.26	*** .39	*** .61	*** .25
4. Perf. App Goal	4.24 / 4.44	1.19 / 1.01	** .17	** -.17	*** .36		*** .24	.06	** .11	.08
5. Perf. Avoid Goal	3.12 / 3.07	1.21 / 1.03	** -.16	* .13	-.06	*** .32		*** -.27	*** -.31	*** -.29
6. Self-Efficacy	4.84 / 4.56	1.23 / 1.31	*** .27	*** -.25	*** .39	*** .23	* -.17		*** .54	*** .54
7. SE for Self-Reg	4.45 / 3.94	0.96 / 0.90	*** .33	*** -.26	*** .44	** .16	-.10	*** .48		*** .38
8. Achievement	82.99 / 83.82	10.52 / 11.76	.11	** -.19	*** .31	*** .28	.04	*** .66	** .20	

Note. Grade 6 means and standard deviations are listed first, and are separated from Grade 10 means and standard deviations with a forward slash. Grade 6 correlations are on the shaded upper half of the correlation table, whereas Grade 10 correlations are on the bottom half.

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

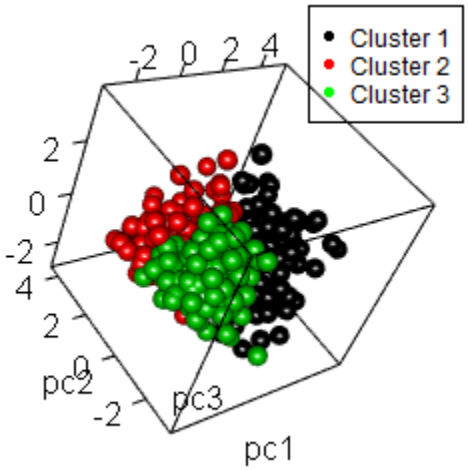

Figure 1. Dimensionality of 6th grade responses (k-means clusters plotted against principal components).

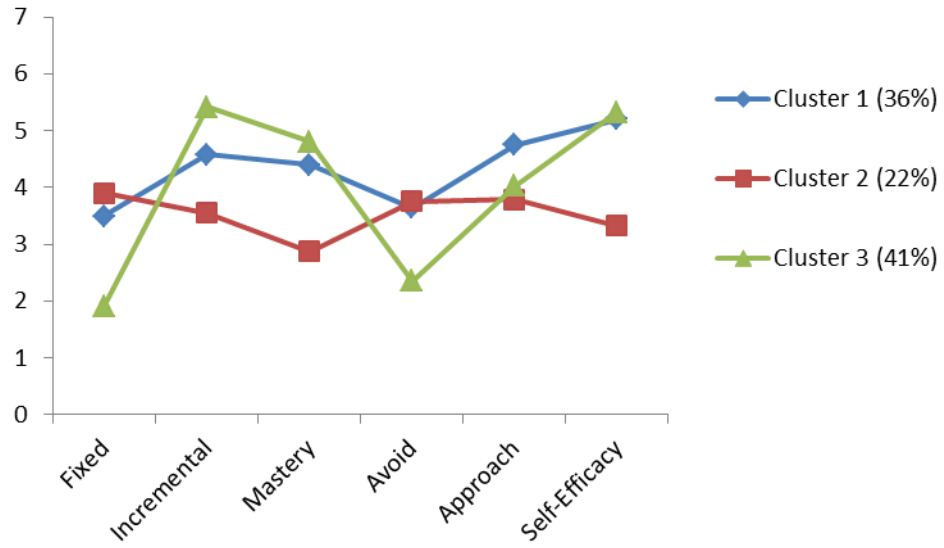

Figure 2. Mean values of measured constructs across the three k-means clusters for 6th grade students (n = 505).

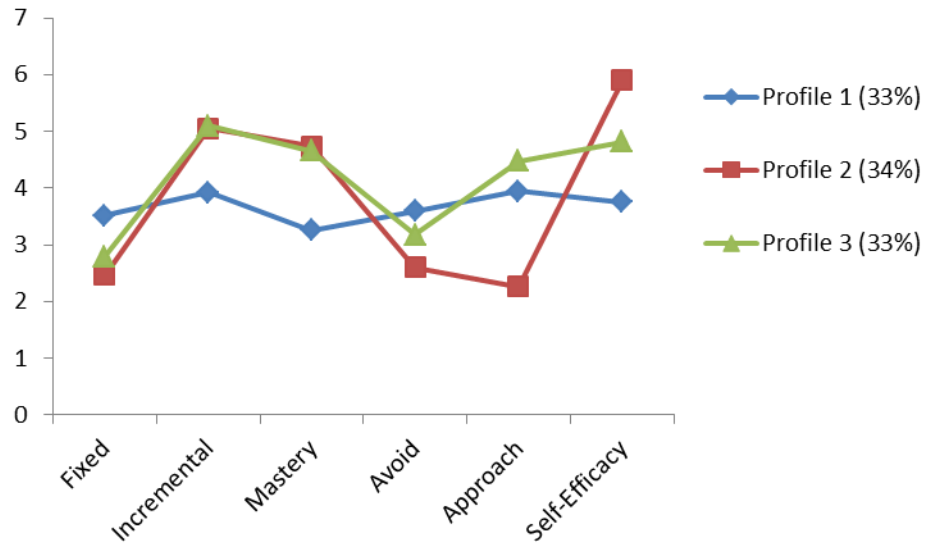

Figure 3. Profile plot of 3-cluster LPA (ellipsoidal, equal orientation) for 6th grade students (n=505).

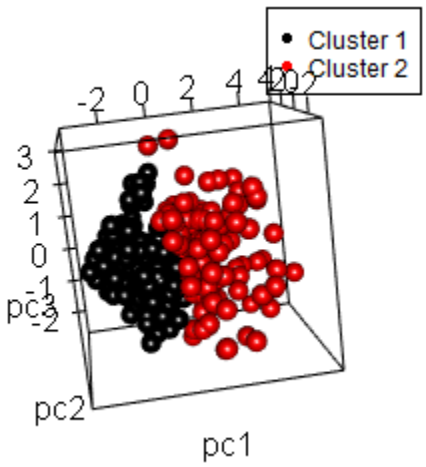

Figure 4. Dimensionality of 10th grade responses (k-means clusters plotted against principal components).

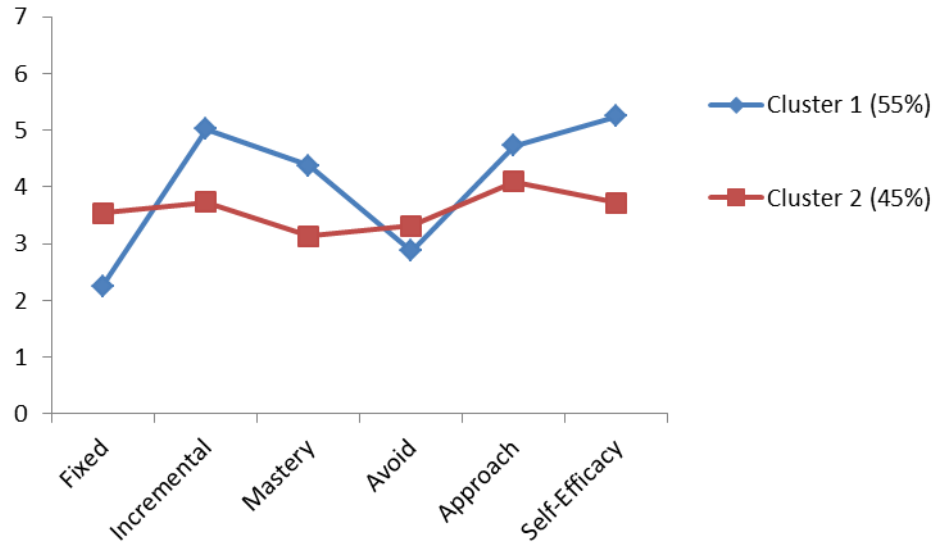

Figure 5. Mean values of measured constructs across the three k-means clusters for 10th grade students (n = 354).

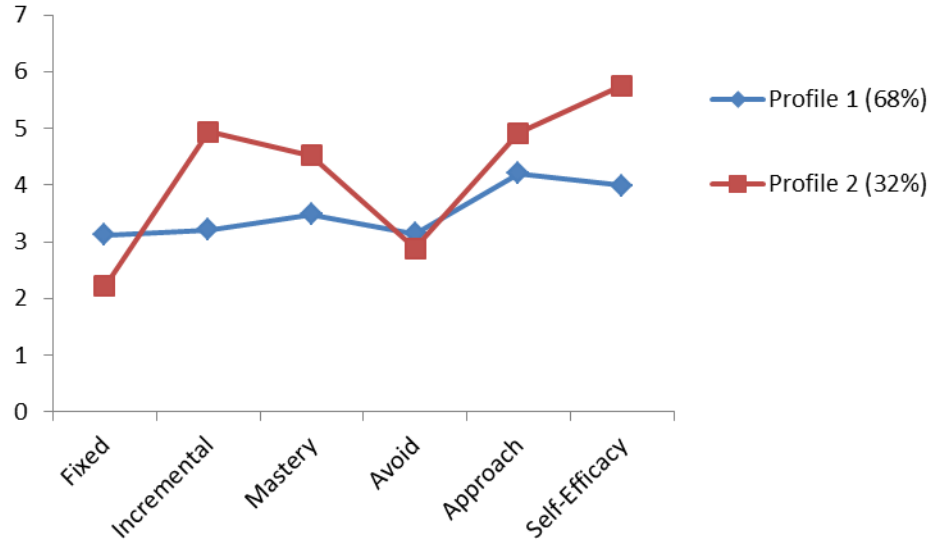

Figure 6. Profile plot of 2-cluster LPA (ellipsoidal, equal orientation) for 10th grade students (n=354).