Epistemology, Self-regulation and Challenge

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Abstract
For prospective teachers, the development of self-regulatory behaviors—those which embody an incremental framework—is vital. This study examines the self beliefs and academic behaviors of pre-service teachers. The results of this investigation suggest that high achieving pre-service teachers endorse more strongly held incremental views and are more likely to exhibit academic self-regulatory behaviors in the face of challenge than are their lower-achieving counterparts.

Introduction
A mastery-oriented motivational pattern is a key component of academic success. Such a perspective incorporates self-regulatory strategies towards confronting and overcoming task-related setbacks. For more than a decade, numerous research studies have lauded the effectiveness of this approach, which leads to both greater persistence and greater performance (e.g. Pintrich & Garcia, 1991). Unfortunately, even high achieving students often retreat in the face of challenges and obstacles. In spite of a substantial list of efficacy-building successes, many students quickly withdraw from difficult, high-level tasks. Why might this be so?

Dweck and her colleagues have introduced a framework which helps to explain this conundrum. In this model, self-beliefs and goals create a motivational framework which shapes the manner in which an individual will consider and approach various tasks (Dweck & Leggett, 1988). Specifically, this theory identifies two opposing ways in which an individual may consider a personal attribute; from the perspective of an entity theorist, which holds that the attribute is relatively fixed, or that of an incremental theorist, who holds that the attribute is adaptable (Dweck & Leggett, 1988; Dweck et. al., 1995, Hong et. al., 1999; Dweck, 2000). The adoption of either perspective holds important ramifications for academic self-regulation (Dweck, 2000).

Those who express views consistent with that of an entity theorist are likely to set different goals in achievement situations than those who embrace the perspective of an incremental theorist. In a study of college students’ theories of intelligence, Hong and her colleagues (Hong et. al., 1998) discovered that students who hold a fixed view of intelligence (entity theorists) were more likely to express a performance goal orientation and less likely to exhibit effortful, self-regulatory behaviors in instances in which there was a threat of exposing their shortcomings than students with a malleable view of intelligence (incremental theorists). Since self-regulated behavior is predicated upon the strategic, goal-directed effort one puts forth in a given situation, entity theorists who are faced with complex tasks certainly face a higher level of risk for learned-helplessness and failure than do incremental theorists (Dweck, 2000).

Several previous efforts have explored the epistemological beliefs of pre-service and practicing classroom teachers. In a study of teacher education students in Hong Kong, Chan and Elliot (2004) suggested that classroom practices were driven by teacher beliefs about knowledge and intelligence. Chinese teacher-education students were most likely to endorse beliefs consistent with those of an incremental theorist and as a result, placed a great deal of emphasis on effort and hard work in the classroom.
Additionally, in a study of Norwegian student teachers, Braton and Stromso (2004) suggested that those who believed intelligence to be a fixed attribute were less likely to adopt mastery goals and more likely to adopt performance-avoidance goals than were incremental theorists. Further, Sinatra and Cardash (2004) report that those teachers who endorsed incremental views—specifically, those who believed that knowledge evolves—were more likely to embraced new ideas and pedagogical strategies than were those who expressed more static views of intelligence. This study will extend the literature by investigating pre-service teachers’ epistemological beliefs and patterns of specific self-regulatory behaviors on highly self-determined and more challenging academic tasks.

**Problem**

Specifically, this empirical investigation sought to answer the following questions:

1. Do academically-high performing pre-service teachers differ from their peers with respect to epistemological beliefs?
2. Might the self-regulatory behaviors of these two groups differ in the face of highly self-determined tasks?
3. Does this pattern of commitment change when each of these groups is faced with an academically challenging task?

**Methodology**

**Participants**

Participants in this study were those who voluntarily elected to participate from among all students enrolled in two sections of an undergraduate educational psychology course at a medium-sized Midwestern state university. The two sections were taught at different times on the same day; they were otherwise identical with respect to content and instruction, using the same textbook, syllabus, and Powerpoint-driven lectures. The course, which introduced theories of motivation and learning to pre-service teachers, was regarded as a general education requirement for undergraduate education majors. Students indicated their desire to participate by signing and returning a consent form that outlined the objectives for this study. Of the original target group of 48 students, 39 student-participants were identified. This final group was comprised of 21 males and 18 females. Twenty students (10 males and 10 females) from the morning section of the course chose to take part in the study, while 19 students (11 males and 8 females) self-identified as participants from the evening section. All were classified by the university as education degree-seeking, undergraduate students. The mean age for student participants was 26.61. The mean grade point average for student participants was 2.85.

**Instrument**

In week one of the semester, students were administered the Theories of Intelligence Scale (Dweck, 2000). This is a four-item instrument designed to investigate perceptions of the malleability of intelligence. Student-participants completed this instrument by responding to four items on a 6-point Likert scale which ranged from strongly agree (1) to strongly disagree (6). The four items of this measure depict intelligence as a fixed entity (i.e. “You have a certain amount of intelligence and you can’t really do much to change it”); confirmation and validation studies suggest that disagreement with these items reflects agreement with incremental theory. Previous data further suggest that, with respect to construct validity, this measure is distinct from those of cognitive ability, self-esteem and self-efficacy (Dweck et. al., 1995). Chronbach alpha reliability for this version of the scale was established as .80 (Hong et. al., 1999).

**Task**

As a regular feature of the educational psychology course, four objective examinations were administered. These examinations consisted of 50 multiple choice Praxis-type items which were electronically scored. For comparative purposes, the mean average of these four examination scores was utilized to create the independent variable, enabling the comparison of the highest performing students in the course (those who scored at the 75th percentile or above) with their
relatively lowering scoring peers. Students were also made aware of a feature of the course through which each student was given an opportunity to write and submit short-answer and multiple choice questions for textbook chapters covered in each week’s instruction. This methodology served two purposes for students in the course: 1) this self-regulatory strategy helped them to learn the material and prepare for the upcoming Praxis examination and 2) students were able to earn extra-credit points towards their final grade in the course. The points earned for writing a question and supplying the corresponding answer could then be used to bolster a student’s mean grade in the course. Points earned were based upon the cognitive complexity of the question: completion items were worth one point each, multiple choice items measuring knowledge were worth two points each and multiple-choice items measuring comprehension were worth three points each. At the beginning of each week, students were also asked to indicate how many items they expected to write for a particular week and, on a ten point scale, both how important it was for them to obtain bonus points and how confident they were in their ability to complete this self-regulatory task.

Initially, students were informed that they were free to select from any of the three question formats when composing their questions. For the final one half of the course, (after the administration of exam 2) students were then informed that only multiple choice items measuring comprehension (3-point items) would be accepted.

Results
Results from tests one through four were recorded and averaged for each student, yielding a mean score. This score was then used to classify students into one of two groups; those who scored at the 75th percentile or above (n=11) and those who scored below the 75th percentile (n=28). For this sample, the mean score for the four objective examinations was 78.42; those scoring at or above the 75th percentile achieved a mean score of 86.00 or higher. See website http://rapidintellect.com/AEQweb/win2006.htm

Table 1 displays mean values for the Theories of Intelligence Scale. For each item, those students whose average score was at or above the 75th percentile expressed more strongly held incremental views (as evidenced in a higher score for each item, which expresses a higher level of disagreement with entity beliefs and a greater endorsement of incremental beliefs) than those whose average examination score was below the 75th percentile. As there were only two groups of interest being examined in this study, an independent sample t-test was utilized. Equal variances for the two groups were determined by a Levene’s test of Variance (as the F value equaled 1.11, yielding a p value of greater than .05). The result of an independent sample t-test of group difference is displayed in Table 4; this mean difference approached statistical significance (as the t(32) value equaled 1.93, yielding a p value of less than .07). Thus, the tendency for higher-scoring students to express more strongly held incremental views of intelligence than their lower-scoring peers approached statistical significance.

For the first half of the course, students who elected to write text-related questions for extra credit were free to select from among the three formats provided. Table 2 displays mean values for the number of free-format questions predicted, those written and the percentage of those written with respect to those predicted for the two groups of interest in this study. Again, group differences were investigated using an independent sample t-test. A Levene’s test of Variance reflected differences in within-group variance among the two groups (as the F value equaled 22.84, yielding a p value of less than .01); subsequently, analysis of the mean scores were analyzed in light of standard mean error differences (which are reported as .31 and .51 for the higher and lower performing groups, respectively). As is displayed in Table 4, the independent sample t-test suggests that there is no statistically significant difference between those who scored at or above the 75th percentile on the examinations and those who scored below the 75th percentile with respect to the mean percentage of free-format questions written as per the number predicted (as the t(8.31) value equaled 1.35, yielding a p value greater than .05).

For the second half of the course, students were informed that they could only earn extra credit points by writing comprehension questions, which were worth 3 extra credit points towards the
final grade. Table 3 displays mean values for the number of fixed-format questions predicted, those written and the percentage of those written with respect to those predicted for the two groups of interest in this study. Group differences were once again investigated using an independent sample t-test. Equal variances for the two groups were determined by a Levene’s test of Variance (as the F value equaled 1.48, yielding a p value of greater than .05). As is displayed in table 4, an independent sample t-test suggests that there is a statistically significant difference between those who scored at the 75th percentile or above on the examinations as compared with those who scored below the 75th percentile with respect to the mean percentage of fixed-format questions written as per the number predicted (as the t(32) value equaled 2.32, yielding a p value of less than .05). Higher performing students wrote a significantly higher percentage of predicted fixed-format questions than their lower-performing counterparts.

Discussion
Among this sample of pre-service teachers, those who averaged at or above the 75th percentile on the course examinations expressed more strongly held incremental beliefs than their lower-performing peers in this sample. There was also a statistically significant difference between the likelihood that high-achievers would fulfill their self-regulated goals in the face of a challenging assignment and the rate of follow-through among students who failed to score at the 75th percentile of the class on course examinations. While the two groups did not differ statistically with respect to the percentage of free-format questions written relative to those predicted, high-performing pre-service teachers were far more likely to fulfill self-regulatory requirements on the second more challenging fixed-format assignment. This difference emerged despite the fact that the two groups did not differ significantly with respect to ratings of the importance of the assignment to their academic goals. This was established on a scale from 1 (not important at all) to 10 (extremely important) at 6.6 and 6.46 for the higher and lower performing groups, respectively. Academic efficacy beliefs for the course on a scale from 1 (not confident at all) to 10 (extremely confident) were also very similar; 6.6 and 6.64 for the higher and lower performing groups, respectively.

As both teachers and students are regularly expected to perform challenging tasks to meet situational classroom demands, it is vital that students embrace self-regulatory attitudes and behaviors. This entails a strategic approach to learning which enables the learner to persevere in spite of challenges. Teachers who emphasize self-regulation in their classrooms promote autonomy and mastery (Paris & Paris, 2001). The extent to which practicing teachers adopt this view may find its genesis in their own former practices as students. In a study of self-regulatory strategy use among teacher-education students, Hwang and Vrongistinos (2002) found that pre-service teacher strategy utilization predicted future achievement level, echoing results of a decade earlier (i.e. Pintrich & Garcia, 1991). The results of this study are consistent with previous findings, which suggest that pre-service teachers would benefit from explicit self-regulatory instruction throughout their teacher education program.

As the study of self-regulation and academic motivation has led to cries for the restructuring of teacher education programs, many have called for teacher education program design formats to explicitly implement instruction in self-regulated learning (Kremer-Hayon & Tilma, 1999). Further, several published studies have reported negative correlations between a belief in fixed intelligence and metacognitive and cognitive strategy use (i.e. Schraw et. al., 2002, Braten & Stromso, 2005). Considering these findings in concert with the results of this study would imply that instruction in academic self-regulation may serve as a vehicle through which to promote the adoption of favorable epistemological beliefs among pre-service teachers. Such a format would promote conceptual change, metacognitive awareness and the utilization of learning strategies in an effort to dislodge stubbornly held beliefs about the fixed nature of knowledge.

There is empirical evidence to support this assertion. Hong and colleagues (1999) demonstrated that implicit theories of intelligence help to shape attributions in instances of both success and failure and the likelihood of taking remedial action when the demands of a particular situation calls for it. Additionally, Lidor and colleagues (2005) report that practicing teachers who express an incremental view of intelligence are likely to initiate conversations with their students which
promote a strategic approach to problem solving. Given the plethora of challenges practicing teachers face on a daily basis, it would seem that any program that deliberately considers the principles of self-regulated learning and epistemology would certainly help to shape pre-service teacher beliefs about intelligence and provide a foundation for optimism and sound pedagogical practice.

As is the case with students across grade levels, the epistemological beliefs of classroom teachers hold serious ramifications for the process of teaching and learning. Those who internalized a fixed-entity conception of intelligence are more likely to view their efforts as merely a means to reinforce a preexisting ability-based classroom hierarchy, while those who express an incremental view of intelligence direct their efforts towards promoting self-regulatory behaviors among their students. The results of this study suggest that epistemological differences exist among pre-service teachers at precisely a moment in which they should be receptive to the notion of teacher development and student learning as a gradual, effort-laden process and that these differences affect the way in which they approach academic tasks. Further consideration of this data implies that teacher education programs need work towards the promotion of incremental theorists.

Bibliography

125

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