

Influence of Epistemological beliefs and Goal Orientation on Learning Performance in CSCL

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Abstract: Epistemological beliefs were found to affect students' cognitive engagement, study strategies, as well as motivation in classroom settings. However, research on the relationship between epistemological beliefs, motivation, and student learning in online settings has been under-studied and under-theorized. This study investigated the relationships among epistemological beliefs, achievement goals, and learning performance in online discussions. 124 students participated in discussion activities in an online instructional technology course. The results from correlation analysis and structural equation modeling indicate that epistemological beliefs have significant effects on students' learning performance, through the mediation of achievement goals.

Introduction

Epistemological beliefs (EB) were found to affect students' cognitive engagement, study strategies, as well as motivation. However, research on the interplay between EB, motivation, and student participation and perception in the context of online learning has been under-studied and under-theorized. In order to fill this gap in the literature, this study built and tested a model among EB, motivation, and student participation and perception in asynchronous online discussion activities in a college-level online class.

Theoretical Framework

EB refers to individual's beliefs about knowledge and knowing (Hofer & Pintrich, 2002). Studies on EB generally focus on five dimensions: the *structure of knowledge* (ranging from the belief that knowledge can be described as isolated pieces to the belief that knowledge structure is complex and highly interrelated), the *certainty of knowledge* (ranging from the belief that knowledge is certain and unchanging to the belief that knowledge is tentative and evolving), the *nature of ability to learn* (ranging from the belief that ability to learn is innate to the belief that learning ability can be acquired with effort), the *speed of learning* (ranging from the belief that learning takes place quickly or not at all to the belief that learning is a gradual process), and the *source of knowledge* (ranging from the belief that knowledge comes from omniscient authorities to the belief that knowledge emerges from personal construction) (Schommer, 1990; Schraw, Bendixen & Dunkle, 2002; Braten & Stromso, 2005). Past research suggested that EB could influence academic performance (e.g., Qian & Alvermann, 1995; Schommer-Aikins, Duell, & Hutter, 2005; Schommer-Aikins & Easter, 2006; Schommer, 1993; Windschitl, 1997), cognitive engagement (e.g., DeBacker & Crowson, 2006; Ravindran, Greene, & DeBacker, 2005), and study strategies (e.g., Kardash & Howell, 2000; Schommer, Crouse, & Rhodes, 1992).

Students' motivation in achievement settings is often examined through the lens of goal orientations, which focus on the reasons for students' engagement in academic activities. According to achievement motivation theories, there are three types of goals: mastery goals, performance-approach goals, and performance-avoidance goals (A. Elliot, 1999; A. Elliot & Church, 1997; E. Elliot & Harackiewicz, 1996). Studies have reliably shown the connection between achievement goals and learning. For example, individuals with mastery goals are likely to choose challenging tasks, show interest, persistence and effort, demonstrate self-regulated learning, adopt meaningful study strategies, and achieve better learning outcomes (A. Elliot, McGregor, & Gable, 1999; E. Elliot & Dweck, 1988; Eppler & Harju, 1997; Graham & Golan, 1991; Licht & Dweck, 1984). Self-efficacy is another theory that examines students' motivation. Defined as "the conviction that one can successfully execute the behavior required to produce the outcomes," (Bandura, 1977, p. 193), self-efficacy is a person's inter belief of his or her own competency. Compared with individuals with low self-efficacy, those with higher levels of self-efficacy are likely to initiate effort when faced with challenging tasks, show more persistence and effort, adopt meaningful learning strategies, and achieve better academic learning outcomes (Greene & Miller, 1996; Pajares & Miller, 1994; Walker, Greene, & Mansell, 2006; Zeldin & Pajares, 2000; Zimmerman & Bandura, 1994). Recent studies investigated the relationship between EB and students' motivation in classroom settings. The findings generally suggested that students who held less mature beliefs were less likely to adopt mastery goals but more likely to adopt performance goals, and those who held more mature beliefs were on the contrary (e.g., Braten & Strømsø, 2004; DeBacker & Crowson, 2006; Schutz, Pintrich, & Young, 1993).

While studies have demonstrated the individual relationships between EB, motivation and learning, there is a need to understand how these variables interact with each other within a broader network. Existing

few attempts examined these networked relationships in classroom settings (Chen & Pajares, 2010; Kizilgunes, Tekkaya, & Sungur, 2009; Ravindran, et al., 2005). As today's learning environment is shifting from classroom to online settings, it becomes necessary to investigate the interrelationships among these constructs in an online learning environment.

Further, recent research indicated that students' actual participation and learning behavior can greatly reflect their motivation (Fredricks, Blumenfeld, & Paris, 2004; Reeve, 2006). However, studies on the relationship between EB and learning have been mainly relying on students' self-reported cognitive engagement (e.g., DeBacker & Crowson, 2006; Ravindran, et al., 2005) or study strategies (e.g., Kardash & Howell, 2000; Schommer, et al., 1992), while the relationship between EB and students' learning behaviors is largely unknown. Technologies like learning management systems (e.g., WebCT©) make it possible to track a variety of students' participation records in online learning activities (Xie, 2012), which is a challenging tasks in face-to-face settings (Dennen, 2008). The online participation data enable researchers to develop better insights into students' online learning behaviors and their relationship with motivation.

This study investigated the interplay among EB, motivation, and student participation and perception in asynchronous online learning. Based on the existing literature, we hypothesized that EB would influence students' motivation (i.e., achievement goals and self-efficacy), which in turn affected students' participation in as well as perception of online learning. We further hypothesized that EB not only influence online learning indirectly through motivation, but also had direct impact on online learning.

Methodology

Participants

124 students (33 males and 91 females) from an online instructional technology class at a large Southeast university participated in this study. The course focused on... The ages were ranged from 19 to 61. One of the major assignments in this course was online discussions on selected topics of instructional technology. The online discussions were facilitated by iDiscuss, a system that is capable of tracking students' participation record. 116 participants (94%) rated their confidence level as high in the use of technology to complete the coursework.

Measurement

Five groups of variables were measured in this study (1) EB, (2) goal orientation, (3) perceived competence, (4) perceived learning performance, and (5) online participation.

Epistemological beliefs inventory (EBI) was used to assess students' EB (32 items) (Schraw, Bendixen & Dunkle, 2002). The EBI has five subscales: (1) simple knowledge, (2) certain knowledge, (3) fixed ability, (4) quick learning and (5) omniscient authority. A recent validation study documented that the subscale α of those measuring variables ranged from 0.50–0.60s across two administrations, and test–retest correlations ranged from 0.62 to 0.81 (see Schraw et al, 2002). Questionnaire on approaches to learning was used to assess students' three achievement goal orientations: (1) mastery, (2) performance-approach, and (3) performance-avoidance. The subscale α 's typically ranging from 0.60–0.90s (see Greene, Dillon & Crynes, 2003; Miller, Greene, Montalvo, Ravindran & Nichols, 1996). Perceived competence scale is composed of 6 questions asking students to rate their perceived learning competence in online discussions. Perceived learning scale has 10 questions measuring students' perceptions of their learning. Students' online participation was measured by the quantitative data collected from the iDiscuss system, which includes students' posting behaviors (total number of posts) and non-posting behaviors (total topics read, number of times logged in).

Procedure

Students worked in small groups of 8-10 to participate daily in online discussion activities in a 16-week session. Each student moderated a chapter discussion for a designated week within his or her own group. During the course, student peers were invited to share information and contribute to knowledge constructions in the chapter discussions. The instructor monitored students' discussion activities and supported the discussion when needed. Participants were invited to complete the above-mentioned set of instruments during the semester.

Results

To test the relationships among EB, perceived competence, achievement goals, and learning performance (including perceived learning performance and actual online participations) in a CSCL setting, three steps of analyses were performed. The first step analyzed the sample items, descriptive statistics, and reliability coefficient for the items measuring each of the variables. The second step generated a correlation matrix to examine the relationships among variables of interest. The third step involved the utilization of Structural Equation Modeling (SEM), using maximum likelihood techniques with AMOS version 18. SEM allows

researchers to identify the latent variables and explore the pattern of inter-relationships between variables in a structured framework.

Table 1 shows the sample items of measured variables, their descriptive statistics, and the reliability coefficient among the items within each of the variables. As can be found in Table 1, students scored higher in the *mastery goals* (mean = 5.96) and *perceived learning* (mean = 5.26). They scored lower in two of the EB variables: *quick learning* (mean = 2.46) and *certain knowledge* (mean = 3.07).

Table 1. Sample items, descriptive statistics, and reliability coefficient.

Variable: Sample Item	Mean	SD	Min-Max	α
Omniscient authority: People who question authority are troublemakers.	4.91	.91	2.40-6.80	.61
Quick learning: Students who learn things quickly are the most successful.	2.46	.95	1.00-5.40	.69
Simple knowledge: Too many theories just complicate things.	4.09	.75	1.86-6.14	.62
Fixed ability: How well you do in school depends on how smart you are.	3.80	.92	1.71-6.00	.71
Certain knowledge: What is true today will be true tomorrow.	3.07	.82	1.50-5.25	.58
Mastery goals: I want to learn as much as possible from this class.	5.96	.90	2.50-7.00	.88
Performance-approach goals: It is important for me to do better than the other students.	4.38	1.49	1.00-7.00	.91
Performance-avoidance goals: My goal for this class is to avoid performing poorly.	4.61	1.24	1.00-7.00	.82
Self-efficacy: I feel that I am pretty competent in the online discussions.	5.20	1.03	1.67-7.00	.86
Perceived learning: The discussions helped me to think more deeply.	5.26	1.31	1.00-7.00	.95

Note. SD – standard deviation; α – Cronbach α coefficient.

Correlation among variables

An examination of zero-order correlations, shown in Table 2, provides the validity of composite variables in EB, perceived competence, goals, perceived learning performance and online participation.

Table 2. Pearson correlation among epistemological beliefs, goals, online behavior, perception variables.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Omniscient authority	1.00	.08	.24**	.22*	.33**	.16	.06	.22*	-.13	.13	.05	.09
2. Quick learning		1.00	.33**	.55**	.26**	-.22*	.15	.22*	-.05	-.11	-.08	-.11
3. Simple knowledge			1.00	.32**	.18*	-.01	.21*	.22*	-.04	-.06	-.13	.01
4. Fixed ability				1.00	.18*	-.04	.16	.16	-.15	-.12	-.15	-.09
5. Certain knowledge					1.00	-.11	-.00	.12	-.35**	-.06	-.05	-.06
6. Mastery goals						1.00	.21*	-.05	.42**	.25**	.23*	.35**
7. Performance-approach goals							1.00	.24**	.18*	-.05	-.02	.11
8. Performance-avoidance goals								1.00	-.27**	-.12	-.17	-.04
9. Self-efficacy									1.00	.25**	.27**	.21*
10. Posting participation										1.00	.62**	.29**
11. Non-posting participation											1.00	.22**
12. Perceived learning												1.00

* $p < .05$ level (two-tailed).

** $p < .01$ level (two-tailed).

Zero-order correlation analysis results (Table 2) suggested that EB variables are correlated with each other, except for the relationship between *authority* and *quick learning*. Among the goal variables, *mastery goal* has a significant correlation with *performance-approach goal*, which significantly correlates with *performance-avoidance goal*. The effects of EB on achievement goals are partially supported by the correlation between them. In addition, *self-efficacy* has a positive correlation with *mastery goal*, *performance-approach goal*, and all of online learning variables. However, it has a negative correlation with *performance-avoidance goal*.

Structural Equation Models

For the purpose of this study, one hypothetical model was built representing EB's direct influence on learning performance, as well as indirect influence through the mediation of motivation variables. In the final model,

Structural Equation Modeling did not find significant direct relationship between EB and learning performance, suggesting that EB did not have direct effects on online learning performance. The results corresponded to the correlation results in Table 2, which suggested no significant correlation between EB and learning performance. The significant relationships among variables in the final model supported EB's significant influence on online learning through the mediation of motivation variables. The model had a good fit of the data as indicated by the Chi-square goodness-of-fit indices ($\chi^2 = 2828$, $\chi^2/df = 1.693$) being less than 2, indices GFI (.911) being greater than 0.9, and the RMSEA (.049) falling below 0.05.

Out of the five EB variables, both omniscient authority ($\beta = -.33$, $p = .009$) and quick learning ($\beta = -.51$, $p = .026$) had significantly negative effects on mastery goal. Fixed ability significantly predicted both performance-approach goal ($\beta = .28$, $p = .043$) and performance-avoidance goal ($\beta = .12$, $p = .029$). No other relationship between EB and goals was detected.

The relationships between self-efficacy and goals were significant in the final model. Self-efficacy had significant positive effects on both mastery goal ($\beta = .39$, $p < .001$) and performance-approach goal ($\beta = .23$, $p = .041$). It also negatively influenced performance-avoidance goal ($\beta = -.42$, $p < .001$). The results were echoed by the correlation results, which denoted that self-efficacy was positively correlated with mastery goal and performance-approach goal while negatively correlated with performance-avoidance goal. The relationships between self-efficacy and online learning participation were also significant. Self-efficacy had significantly positive effects on both posting participation ($\beta = .36$, $p = .05$) and non-posting participation ($\beta = .50$, $p = .018$). Self-efficacy did not show significant relationship with perceived learning and class engagement.

With respect to the relationships between goals and online learning, several significant paths were found in the resulted model. Mastery goal significantly influenced all of the online learning variables: perceived learning ($\beta = .43$, $p < .001$), online posting participation ($\beta = .51$, $p = .004$), and online non-posting participation ($\beta = .46$, $p = .020$). All the effects were positive. In addition, performance-avoidance goal had a significantly negative relationship with perceived learning ($\beta = -.14$, $p = .041$) and non-posting behavior ($\beta = -.22$, $p = .044$).

Discussions and Implications

In this study, we investigated the influence of EB on students' learning and motivation in online settings. SEM method was used to examine the relationships among these variables.

First, the results indicated that achievement goals serve as mediators to bridge the relationship between EB and students' learning performance in CSCL settings. The SEM results indicated no direct relationship between EB and online learning variables, but suggested that EB had an indirect effect on online learning participation and perception which was channeled via achievement goals. These results were supported by previous studies, which suggested that EB may function as implicit theories that influence the adoption of goals for learning, and these goals can also mediate the relations between EB and cognition and learning performance (Hofer & Pintrich, 1997), as well as learning approach and achievement (Kizilgunes, et al., 2009).

Second, the results indicated that different EB systems and students' perceived competence predicted students' goal orientations in CSCL settings. Particularly, students' beliefs about the speed of learning and omniscient authority appeared to affect students' mastery goal adoption. The model suggested that students who believed that learning occurs quickly were less likely to adopt mastery goals, which is inline with previous studies that found beliefs in quick learning negatively predict mastery goals (e.g., Bråten & Strømsø, 2004). On the other hand, the model also indicated that those who believed that knowledge came from authority were more likely to adopt mastery goals. This result contradicts the finding of Bråten and Strømsø's (2004) study, which found that students who conceived of knowledge as stable and given were less likely to adopt mastery goals. Besides omniscient authority and quick learning, this study found that perceived competence might function as an antecedent for all three achievement goals. Furthermore, the results indicated that students' beliefs about fixed ability to learn influenced their performance goal adoption. Those who believe that the ability to learn was fixed at birth were more likely to adopt performance goals. Specifically, when students believe their learning ability is innate and stable, they will be less likely to emphasize competence development and less likely to foster mastery goals. This finding is in agreement with achievement motivation theories, which suggest that a mastery goal is characterized by the belief that academic effort will result in an achievement, and in contrast, a performance goal reflects the belief that ability alone leads to success (Topping & Ehly, 1998). As a result, if students' perceived competence is high, they tend to adopt performance approach goals and demonstrate their competence in front of others; if their perceived competence is low, they tend to adopt performance avoidance goals try to avoid the demonstration of their incompetency in front of others.

Another result in this study shows that achievement goals played a significant role in predicting students' perceived learning and their actual learning behaviors in CSCL settings. Mastery goals positively predicted all the learning behavior and perception variables, showing that students with mastery goals are motivated to learn and engage in CSCL. Performance avoidance goals, however, negatively predicted students' non-posting behavior and perceived learning in CSCL setting. This is because students with performance avoidance goals tend to avoid failure rather than acquire competence. Instead, they focused more on completing

the minimum class requirements and were less likely to participate in those non-posting online learning activities (e.g., reading, evaluation, etc.) that cannot be observed by teachers and peers.

This study makes contributions to the literature by moving beyond the self-reported measures traditionally adopted in motivation research and incorporating students' actual participation data in the modeling. This study also makes contributions to the literature by moving beyond the face-to-face setting and investigating the relationship among these critical constructs in online learning settings.

The findings of this study can help education practitioners to understand the lacuna of their current teaching activities through proper understanding of the effects of EB on students' motivation and online learning participation and perception. In addition, the mediating effects of goals between EB and learning performance can provide insights to educators that different teaching strategies or technologies should be developed to facilitate the study of students with different learning goals.

References

- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.
- Braten, I., & Strømsø, H. (2004). Epistemological beliefs and implicit theories of intelligence as predictors of achievement goals. *Contemporary Educational Psychology*, 29(3), 371-388.
- Chen, J., & Pajares, F. (2010). Implicit theories of ability of Grade 6 science students: Relation to epistemological beliefs and academic motivation and achievement in science. *Contemporary Educational Psychology*, 35, 75-87.
- DeBacker, T., & Crowson, M. (2006). Influences on cognitive engagement: Epistemological beliefs and need for closure. *British Journal of Educational Psychology*, 76, 535-551.
- Dennen, V. P. (2008). Looking for evidence of learning: Assessment and analysis methods for online discourse. *Computers in Human Behavior*, 24(2), 205-219.
- Dweck, C. S. (1999). *Self-Theories: Their role in motivation, personality, and development*. Philadelphia, PA: The Psychology Press.
- Elliot, A. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist*, 34(3), 169-189.
- Elliot, A., & Church, M. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology*, 72(1), 218-232.
- Elliot, A., McGregor, H., & Gable, S. (1999). Achievement goals, study strategies, and exam performance: A mediational analysis. *Journal of Educational Psychology*, 91(3), 549-563.
- Elliot, E., & Dweck, C. (1988). Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology*, 54(1), 5-12.
- Elliot, E., & Harackiewicz, J. (1996). Approach and avoidance achievement goals and intrinsic motivation: A mediational analysis. *Journal of Personality and Social Psychology*, 70, 461-475.
- Eppler, M., & Harju, B. (1997). Achievement motivation goals in relation to academic performance in traditional and nontraditional college students. *Research in Higher Education*, 38(5), 557-573.
- Fredericks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74, 59-109.
- Graham, S., & Golan, S. (1991). Motivational influences on cognition: Task involvement, ego involvement, and depth of information processing. *Journal of Educational Psychology*, 83, 187-194.
- Greene, B., & Miller, R. (1996). Influences on achievement: Goals, perceived ability, and cognitive engagement. *Contemporary Educational Psychology*, 21, 181-192.
- Hofer, B., & Pintrich, P. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research*, 67(1), 88-140.
- Hofer, B., & Pintrich, P. (2002). *Personal epistemology: The psychology of beliefs about knowledge and knowing*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Kardash, C., & Howell, K. (2000). Effects of epistemological beliefs and topic-specific beliefs on undergraduates' cognitive and strategic processing of dual-positional text. *Journal of Educational Psychology*, 92(3), 524-535.
- Kizilgunes, B., Tekkaya, C., & Sungur, S. (2009). Modeling the relations among students' epistemological beliefs, motivation, learning approach, and achievement. *The Journal of Educational Research*, 102(4), 243-255.
- Licht, B., & Dweck, C. (1984). Determinants of academic achievement: The interaction of children's achievement orientations with skill area. *Developmental Psychology*, 20, 628-636.
- Pajares, F., & Miller, D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology*, 86, 193-203.
- Qian, G., & Alvermann, D. (1995). Role of epistemological beliefs and learned helplessness in secondary school students' learning science concepts from text. *Journal of Educational Psychology*, 87(2), 282-292.

- Ravindran, B., Greene, B., & DeBacker, T. (2005). Predicting preservice teachers' cognitive engagement with goals and epistemological beliefs. *The Journal of Educational Research*, 98(4), 222-232.
- Reeve, J. (2006). Extrinsic rewards and inner motivation. In C. M. Evertson & C. S. Weinstein (Eds.), *Handbook of classroom management: Research, practice, and contemporary issues* (pp. 645-664). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Schommer-Aikins, M., Duell, O., & Hutter, R. (2005). Epistemological beliefs, mathematical problem-solving beliefs, and academic performance of middle school students. *The Elementary School Journal*, 105(3), 289-303.
- Schommer-Aikins, M., & Easter, M. (2006). Ways of knowing and epistemological beliefs: Combined effect on academic performance. *Educational Psychology*, 26(3), 411-423.
- Schommer, M. (1993). Epistemological development and academic performance among secondary students. *Journal of Educational Psychology*, 85, 406-411.
- Schommer, M., Crouse, A., & Rhodes, N. (1992). Epistemological beliefs and mathematical text comprehension: Believing it is simple does not make it so. *Journal of Educational Psychology*, 84(4), 435-443.
- Schraw, G., Bendixen, L. D., & Dunkle, M. E. (2002). Development and validation of the Epistemic Belief Inventory. In B. K. Hofer & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 103-118). Mahwah, NJ: Erlbaum.
- Schutz, P. A., Pintrich, P., & Young, A. J. (1993). *Epistemological beliefs, motivation, and student learning*. Paper presented at the annual meeting of the American Educational Research Association.
- Walker, C., Greene, B., & Mansell, R. (2006). Identification with academics, intrinsic/extrinsic motivation, and self-efficacy as predictors of cognitive engagement. *Learning and Individual Differences*, 16, 1-12.
- Windschitl, M. (1997). Student epistemological beliefs and conceptual change activities: How do pair members affect each other? *Journal of Science Education and Technology*, 6(1), 37-47.
- Wu, D., & Hiltz, S. R. (2004). Predicting learning from asynchronous online discussions. *Journal of Asynchronous Learning Networks*, 8(2), 139-152.
- Zeldin, A., & Pajares, F. (2000). Against the odds: Self-efficacy beliefs of women in mathematical, scientific, and technological careers. *American Educational Research Journal*, 37(1), 215-246.
- Zimmerman, B., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal*, 31, 845-862.
- Xie, K. (2012). What do the numbers say? The influence of motivation and peer feedback on students' behavior in online discussions. *British Journal of Educational Technology*. DOI: 10.1111/j.1467-8535.2012.01291.x