

# Factors Affecting Students' Performance in a Supportive E-learning System — eCIS: An Exploratory Study

Ching-Huei Chen, I-Chia Wu, Graduate Institute of e-Learning, National Changhua University of Education  
Email: chhchen@cc.ncue.edu.tw, wu\_1225@yahoo.com.tw

**Abstract:** This study examined predictive relationships among high school student characteristics that influence their performance in eCIS. Correlations, analysis of variance, and path analyses were conducted. Findings indicated that individual differences on learning goals and cognitive preferences predicted their metacognitive strategy use, and later influenced the performance. Discussions on how to accommodate the different needs of students with varying levels of prior knowledge, goal orientation, and cognitive preference are provided based on the results.

## Introduction

Students bring personal characteristics to the learning contexts, such as goals and varying degrees of motivation. Achievement goal orientations are normally divided into three types: learning (or mastery) and performance approach, and performance avoidance (Elliott & Church, 1997). Learning goals describe a learner engaging out of a personal desire to know and understand the content and master the skills (Ames, 1992). Performance approach goals describe a learner trying to outperform others, to look good in the face of external, social pressure and comparisons (Church, Elliot, & Gable, 2001; Greene & Miller, 1996). Performance avoidance goals describe a learner evading work or public performance to avoid embarrassment or looking incompetent to others. Learning goals are a productive, positive orientation promoting effort for all students, while performance goals have demonstrated mixed outcomes (Pintrich, Conley, & Kempler, 2003). Just as achievement goals is important to student motivation, so are students' cognitive preference. Students' cognitive preferences also influence their reception of and responses to teachers' and peers' messages regarding self-determination and goals (Reeve, 1996). One important preference is the need for cognition, which refers to a student's inclination for deep and thoughtful engagement and ill-structured problems (versus simple questions with "right" or easy answers) (Forsterlee & Ho, 1999). Students' need for cognition can influence both motivational and achievement outcomes (Greene et al., 2004).

There is a paucity of research examining these multivariate relationships, and there is still a need for more empirical evidence-based research into how individual's goal orientation influences online performance. Integrating theory from research on cognition and motivation, this research validated a model of three factors (prior knowledge, learning/performance goals, and need for cognition) that contribute to online learning and one factor (metacognitive strategy) that mediate the relationship between aforementioned factors and performance. If students are lacking one or more of these critical cognitive or motivational characteristics, they are in danger of being less than optimally motivated and engaged in the learning task (Pintrich & Schunk, 1996). Both cognition and motivation are internal processes with non-continuous behavioral indicators, it can be difficult to address. If we can better identify students' cognitive motivational needs and address them, students can learn more effectively (Hidi & Harackiewicz, 2000). However, among a vast number of studies demonstrating the importance of motivation in students' learning in both traditional and online learning environment, only a few have included high school students samples explicitly, and analyzed for cognitive and motivational differences. Fewer have focused on the outcome of these differences on actual performance as a result of e-Learning in particular, rather than students' self-report or perceived effect and none we could locate have examined differences between students' cognitive and motivational profiles on their metacognitive strategy use.

## Method

Participants were 157 tenth-grade students enrolled in a physics course at a high school in a traditional vocational school in central of Taiwan. There were 138 males and 19 females with a mean age of 16.4 years. Participation in the experiment was considered a course requirement, but subjects' level of performance was not counted in determining course grades. eCIS, an electronic-based Collaborative Inquiry System, with embedded scaffolds (i.e., simulations, courseware, and instructional prompts) to support physics learning was created. eCIS database server is built using MS-SQL Server 2005, which serves as a rational database for storing users' personal and background information, courseware, testing items, simulations, inquiry prompts, and questionnaires, among others. A 14-item multiple-choice test was used to assess students' understanding of scientific concepts on percentile motion. This test has been revised numerous times according to science teacher's suggestions and pilot testing results using similar samples. Since no direct teaching was involved in this study, a gain in the performance scores would indicate that the student has acquired a good understanding of the scientific concepts after being exposed to eCIS learning system. Students' goal orientation was measured by

the Achievement Goal Orientation Inventory (Elliott & Church, 1997). The measurement comprised of three subscales of learning, performance-approach, and performance-avoidance goals, with 6 items for each goal orientation, for a total of 18 items. The 18 items utilize a 5-point scale from: 1 (strongly disagree), to 5 (strongly agree). The subscale reliabilities coefficients were as follows: learning goals ( $\alpha = .85$ ), performance-approach goals ( $\alpha = .74$ ), and performance-avoidance goals ( $\alpha = .71$ ). The Need for Cognition scale was used to assess individual preference for deep thinking and ill-structured problems (versus simple questions with right answers) (18 items on a 5-point scale from Forsterlee & Ho, 1999). Sample items include: "I would prefer complex to simple problems" and "I only think as hard as I have to" ( $\alpha = .84$ ). Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1991) was selected for use in this study as a primary assessment tool as it was the most widely used in many contexts, particularly those of online learning (Matuga, 2009). For this study, a modified version of the MSLQ contained 10 items from the learning strategies subscales utilizing a 5-point scale from: 1 (strongly disagree), to 5 (strongly agree). Reliability coefficients for metacognitive strategies scales were  $\alpha = .82$ .

## Results

Based on our proposed conceptual model, we concluded with two major findings. First, goal orientation is an important motivational component for metacognitive strategy use is consistent with the results from previous studies. In that we found having learning goals was found to adopt metacognitive strategies compared to having performance goals. In terms of performance, the results did not show difference on either having learning or performance goals. Some goal theorists agreed that learning goals are beneficial for most learning-related outcomes including motivational outcomes such as efficacy, interest, and value, whereas performance goals are beneficial for achievement. Second, need for cognition is an important motivational component for metacognitive strategy use. We found that high need for cognition students performed significantly higher than low need for cognition students. We speculate that there may exist a threshold or level of intensity at which students' cognitive preference and their uses of metacognitive strategies during learning, may combine by the students to support the later performance. The findings of this study provide practical implications for how instructional designers or teachers can promote student learning, performance, and motivation in e-learning. With regard to goal orientation and need for cognition, e-learning system should provide timely supports that focus on how much students can learn and help them see that making mistakes is part of the learning process. Our exploratory study suggests that further research is needed to examine how individual differences in prior knowledge, goal orientation, and need for cognition affect students' uses of learning strategies and their response/reaction to teaching strategies. The replication of current study with students of other age groups to see if the results hold true is also necessary.

## References

- Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, 84, 261–271.
- Ames, C., & Archer, J. (1988). Achievement goals in the classroom students' learning strategies and motivation processes. *Journal of Educational Psychology*, 80, 260–267.
- Church, M. A., Elliot, A. J., & Gable, S. L. (2001). Perceptions of classroom environment, achievement goals, and achievement outcomes. *Journal of Educational Psychology*, 93, 43–54.
- Elliott, J., & Church, M. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality & Social Psychology*, 72(1), 218–232.
- Forsterlee, R., & Ho, R. (1999). An examination of the short form of the need for cognition scale applied in an Australian sample. *Educational and Psychological Measurement*, 59, 471–480.
- Greene, B. A., & Miller, R. B. (1996). Influences on achievement: Goals, perceived ability, and cognitive engagement. *Contemporary Educational Psychology*, 21(2), 181.
- Greene, B. A., Miller, R. B., Crowson, H. M., Duke, B. L., & Akey, K. L. (2004). Predicting high school students' cognitive engagement and achievement: Contributions of classroom perceptions and motivation. *Contemporary Educational Psychology*, 29, 462–482.
- Hidi, S., & Harackiewicz, J. M. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of Educational Research*, 70, 151–179.
- Matuga, J. M. (2009). Self-regulation, goal orientation, and academic achievement of secondary students in online university courses. *Journal of Educational Technology & Society*, 12(3), 4–11.
- Pintrich, P., Conley, A., & Kempler, T. M. (2003). Current issues in achievement goal theory and research. *International Journal of Educational Research*, 39 319–337.
- Pintrich, P., & Schunk, D. H. (1996). *Motivation in education: Theory, research, and applications*. Englewood Cliffs, NJ: Prentice-Hall.
- Reeve, J. (1996). *Motivating others*. Boston: Allyn & Bacon.