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Learning Motivation, Performance and Metacognition within a Problem-based Gaming: Relations among Learners' Self-regulated Learning, Cognition Processing and Achievement

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Abstract: This present study is to investigate the relations among learners' self-regulation, cognition processing and achievement in problem-based gaming. Problem-based gaming is used as a mind tool to foster learners' motivation and cognition. And self-regulated learning regarded as a support and scaffolding motivationally, metacognitively, and behaviorally helps learners engage in their own learning cognitive process. Thus, the goal of this study is to test the conceptual model of the relations among learners' self-regulation, cognition processing and achievement.

Keywords: computer programming, problem-based gaming, self-regulated learning, motivation, cognitive processing, performance

Introduction

Computer programming is significant but abstract and complex domain knowledge for learners to apply logic, algorithm, or even problem solving in their daily life. For the knowledge and skills of it have little link to learners' prior knowledge and learning experience, it is not easy to thrill learners' motivation and interest and anchor the knowledge between what they had learned and what they are going to learn [1, 13, 14]. On the other hand, problem solving in computer programming has been regarded as an essential and critical skill for learners. That is the reason why well-designed educational games can be used to meet these needs [4]. Problem-based gaming seems to be a solution for learners to enhance their knowledge construction and cognitive understanding [3, 4] and engage in problem solving while entertaining [4].

In problem-based gaming, motivation and cognition as two main factors are frequently investigated in many studies [5, 7, 12] because self-regulated learning primarily focuses on these two elements of learning showing how goal orientation and learning expectancies affect learners' use of cognitive processes [8, 10, 11].

Accordingly, the goal of this study is to explore the relations among learners' self-regulation, cognition processing and achievement. Problem-based gaming is used as a mind tool to foster learners' motivation and cognition. And self-regulated learning regarded as a support and scaffolding motivationally, metacognitively, and behaviorally helps

learners engage in their own learning cognitive process to fulfill their learning achievement. Thus, the conceptual model will be provide and tested to investigate the relations among these factors.

1. Conceptual Model Design

1.1 Learning Computer Programming in Problem-based Gaming

Computer science in school education mainly focuses on the learning of conceptual, strategic and even problem-solving knowledge and skills [14]. Computer programming instruction has been shown to enhance a variety of specific problem-solving skills [6] and is abstract and complex for learners to hardly organize their own knowledge construction and learning experience with the lack of motivation and interest [2, 14]. Games are generally viewed equally as having fun, but the fun factor is not the magic bullet in educational game design [3]. The essence of educational games is to engage and motivate learners through direct experiences within the game world [3, 4]. Thus, problem-based gaming is treated as a mind tool for learners to foster learners' both motivational and cognitive factors for integrating educational games and problem solving these two significant elements into learning computer programming.

1.2 Factors among Self-regulated Learning, Cognition Processing and Achievement

Self-regulated learning mainly investigate two elements – motivation and cognition of learning, to explore how these two elements affect learners' use of cognitive processing [8, 10, 11]. And in self-regulated learning, learners are generally regarded as metacognitively, motivationally, and behaviorally active participants in their own learning process [16, 17] to enhance their motivation and their immediate environment, as well as their cognitive processing [15]. Moreover, they also judge and direct their performances and achievement, enlist self-reactive influences to guide and motivate one's efforts, and employ appropriate strategies to achieve success [18].

And to qualify specifically as self-regulated learning, learners' learning must involve the use of specified cognitive and metacognitive strategies to achieve academic goals on the basis of self-efficacy perceptions [17].

Thus, the conceptual model of the relations among learners' self-regulated learning shown as Figure 1 investigates the relation between motivation and cognitive aspect. The former is consisted of three parts: value components (intrinsic and extrinsic goal orientation and task value), expectancy components (control of learning beliefs, self-efficacy, and expectancy for success), and affective components (learning anxiety) [9]. And the later is consisted of two parts: cognitive strategies and metacognitive strategies [9].

And Conceptual model of the relations among learners' self-regulated learning, cognition processing and achievement is shown as Figure 2. The goal of the present study is to investigate the factors among self-regulated learning, cognition processing and learning achievement.

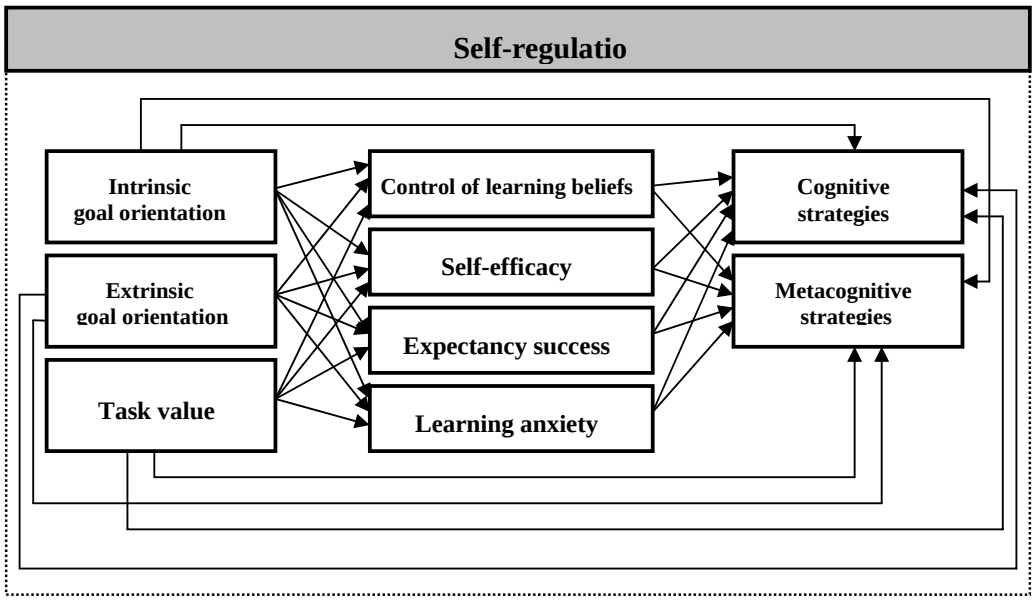

Figure 1. Conceptual model of the relations among learners' self-regulated learning

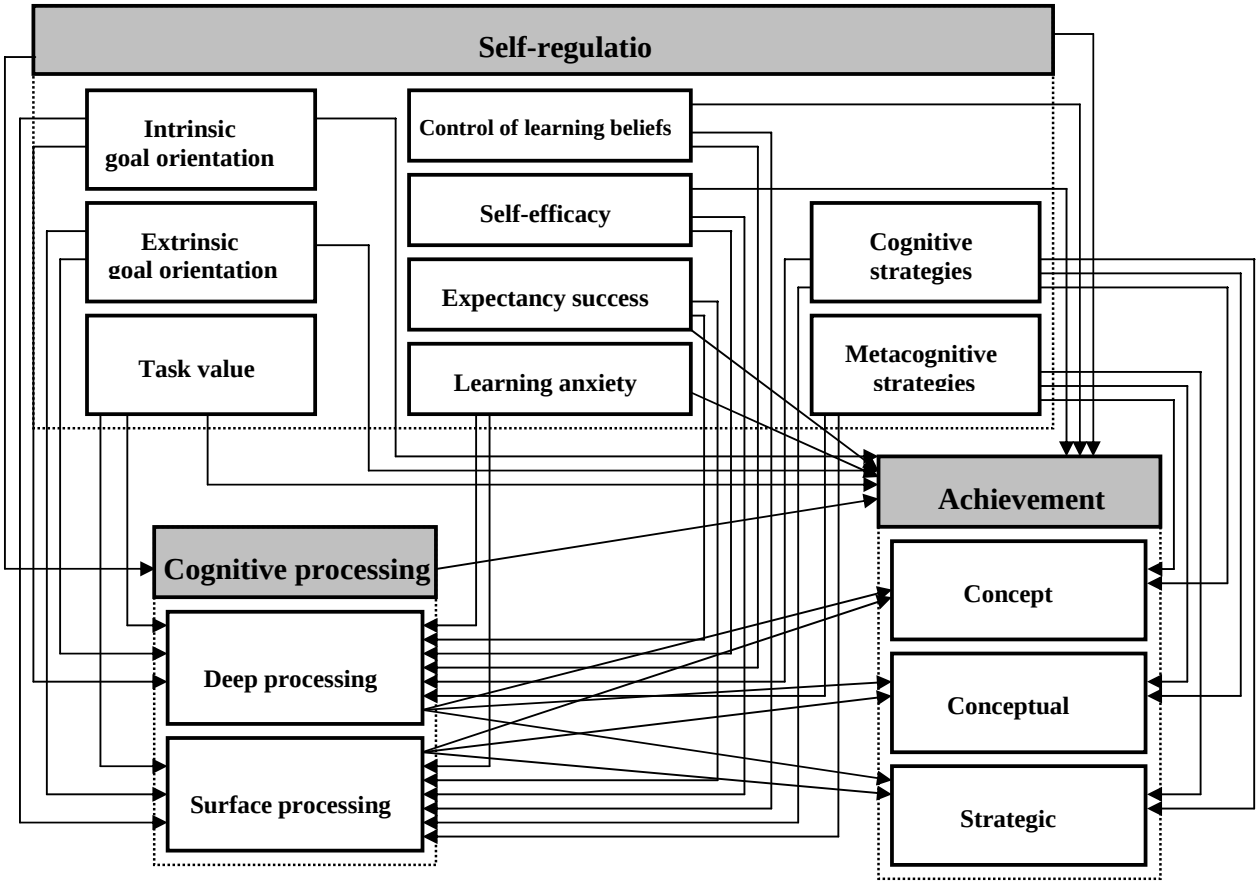

Figure 2. Conceptual model of the relations among learners' self-regulated learning, cognition processing and achievement

References

[1] Chen, Wu, Chiu, Lee, & Chen, 2009 Crews, T., & Butterfield, J. (2002). Using technology to bring abstract concepts into focus: A programming case study. *Journal of Computing in Higher Education, 13*(2), 25-50.

[2] de Freitas, S., & Griffiths, M. (2008). The Convergence of Gaming Practices with Other Media Forms: What Potential for Learning? A Review of the Literature. *Learning, Media and Technology, 33*(1), 11-20.

[3] Kiili, K. (2005). Digital game-based learning: towards an experiential gaming model. *The Internet and Higher Education, 8*(1), 13-24.

[4] Kiili, K. (2007). Foundation for problem-based gaming. *British Journal of Educational Technology, 38*(3), 394-404.

[5] Kim, B., Park, H., & Baek, Y. (2009). Not just fun, but serious strategies: Using meta-cognitive strategies in game-based learning. *Computers & Education, 52*(4), 800-810.

[6] Palumbo, D. B. (1990). Programming Language/Problem-Solving Research: A Review of Relevant Issues. *Review of Educational Research, 60*(1), 65-89.

[7] Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & Education, 52*(1), 1-12.

[8] Pintrich, P. R. (2003). A Motivational Science Perspective on the Role of Student Motivation in Learning and Teaching Contexts. *Journal of Educational Psychology, 95*(4), 667-686.

[9] Pintrich, P. R., Smith, D. A. F., & Mckeachie, W. J. (1989), *A Manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ),* Ann Arbor, Michigian: National Center for Research to Improve Teaching and Learning, School of Education, The university Michigan.

[10] Schunk, D. H. (2005). Self-regulated learning: the educational legacy of Paul P. Pintrich. *Educational*Psychologist, *40*(2), 85–94.

[11] Schunk, D. H., & Zimmerman, B. J. (2001). *Self-regulated learning and academic achievement: theoretical perspectives* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum.

[12] Tüzün, H., Yilmaz-Soylu, M., Karakus, T. k., Inal, Y., & KizIlkaya, G. (2009). The effects of computer games on primary school students' achievement and motivation in geography learning. *Computers & Education, 52*(1), 68-77.

[13] West, M., & Ross, S. (2002). Retaining females in computer science: A new look at a persistent problem. *JCSC*, *17*(5), 1-7.

[14] Yuen, A. H. K. (2006). Learning to program through interactive simulation. *Educational Media International, 43*(3), 251-268.

[15] Zimmerman, B. J. & Martinez-Pons, M. (1988). Construct validation of a strategy model of student self-regulated learning. *Journal of Educational Psychology, 80*(3), 284-290.

[16] Zimmerman, B. J. (1986). Becoming a self-regulated learner: Which are the key subprocesses? *Contemporary Educational Psychology, 11*(4), 307-313.

[17] Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81*(3), 329-339.

[18] Zimmerman, B. J. (1994). Dimensions of academic self-regulation: A conceptual framework for education.In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational applications* (pp. 3–21). Hillsdale, NJ: Erlbaum, Inc.