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Using the ePortfolio System to Foster Student Self-regulated Learning

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Abstract: This research explores the effects of using ePortfolio systems on student self-regulated learning. An ePortfolio system was developed based on self-regulated learning models and the relations among ePortfolio, competency, and self-regulated learning models. Then, the ePortfolio system was used for designing a learning model for self-regulated learning. The first experiments of the model were conducted in software engineering courses at the Hoa Sen University, Vietnam. The surveys with the Motivated Strategies for Learning Questionnaire (MSLQ) were conducted at the beginning and at the end of the courses. The differences in MSLQ scales between pre- and post-tests, and between control and experimental groups were evaluated. In addition, the trace data of learning was also analyzed in order to evaluate the effects of the learning model on student self-regulated learning. The results show that students could implement and link self-regulated learning processes in the ePortfolio system. In addition, the scores of MSLQ scales improved after applying the ePortfolio-based learning model in the courses. In conclusion, the ePortfolio system and the proposed learning model had positive effects on students' self-regulated learning skills.

Keywords: Self-regulated learning, ePortfolio system, competency measuring

1. Introduction

Self-regulated learning (SRL) is defined as a process by which learners self-regulated their learning. SRL has positive effects on learners' achievement in and beyond school (Winne, 2005; Zimmerman, 2002). SRL skills relate to the core competencies for the 21st century (Wolters, 2010). Self-regulated learners are aware of what knowledge and skills they have and proactive in learning; they view learning as a controllable process and accept more responsibility for the results of this process (Zimmerman, 1990). Thus, fostering SRL helps students improve academic achievement and to prepare for workplace learning.

Winne (2005, 2010) claimed that learners need significant support to make SRL productive. In addition, SRL skills are teachable (Zimmerman, 2002) and may be fostered by technology enhanced learning environments (Bartolomé and Steffens, 2011; Zimmerman and Tsikalas, 2005; Devolder, Braak, and Tondeur, 2012), for example, ePortfolio platform.

In order to self-regulate learning, the learners have to know their knowledge and skills and observe learning processes. Thus, learners need support in competency assessment and performance. Research shows that ePortfolio environments provide us a potential approach to competency assessment (Gadbury-Amyot, et al., 2003; Rao, et al., 2012). Indeed, ePortfolios store learners' achievements and the processes of reaching the achievements (JISC, 2008). In other words, ePortfolios contain and show students' competencies and the evidence of the competencies. Thus, ePortfolios can improve the reliability and accuracy of competency assessment. In addition, instructors and learners also need environments that can support users in modeling and sharing SRL principles and implementing SRL processes.

In this research, we propose, implement, and evaluate an ePortfolio-based learning model for scaffolding student self-regulated learning in university. An ePortfolio system was developed based on SRL models and background knowledge about fostering SRL. This paper focuses on the evaluation of the use of the ePortfolio system for enhancing SRL in university.

In the next section, we summarize the research background and related work. Next, we introduce the use of the ePortfolio system for learning and study design. Then, the results of the study are represented. In the last section, we make conclusions about the effects of the system, limitations and future work.

2. Research background

2.1 Self-regulated learning (SRL)

From the process perspective, self-regulation is a self-directive process in which students convert their mental abilities to academic skills. Learning is a proactive process in which students actively participate with major responsibility and motivation (Zimmerman, 2002). Zimmerman (1998) expressed the structure and function of self-regulatory processes in terms of three cyclical phases: forethought, performance, and self-reflection. In addition, an integrated model was introduced in (Pintrich, 2004), which consists of four phases of SRL: task definition and planning, monitoring, control, and reaction and reflection; and four areas for regulation: cognition, motivation, behavior, and context.

Self-regulated learners have some skills, such as setting goals, planning strategies, monitoring performance, changing the context, managing time, evaluating methods, attributing causation results, and adapting future methods (Zimmerman, 2002). They tend to have high motivation and confidence for learning and use productive problem solving skills. These characteristics lead to relevant behavior and also a high level of achievement (Perry and Winne, 2013).

2.2 Fostering self-regulated learning

Self-regulated learning may be taught and fostered (Winne, 2005; Bartolomé and Steffens, 2011). According to Zimmerman (1998), SRL emerges from two essential sources: social and self-directed experiences. The "self" in SRL implies that learners regulate learning, however, self-regulation does not mean solo (Perry and Winne, 2013). Learners' development of SRL depends on support from the others, for example, teachers or peers.

Scaffolding SRL includes interactions between humans and the use of technological tools, resources, and environments. SRL skills may be fostered by technology enhanced learning environments (Bartolomé and Steffens, 2011; Devolder, Braak, and Tondeur, 2012; Steffens, 2001). Zimmerman and Tsikalas (2005) argued that a key to developing self-regulated learners is linking the processes of the forethought, performance, and self-reflect phases. Thus, computer-based learning environments that support self-regulatory processes in the all three phases are more likely to support SRL better.

Bartolomé and Steffens (2011) argued that ePortfolios have a potential to foster SRL. ePortfolios allow learners to think critically and become active, independent and self-regulated learners (Abrami, et al., 2008). In addition, ePortfolio environments are tools for gathering data about events that constitute self-regulation, which are needed for fostering SRL (Winne, 2005; Zimmerman, 2008).

2.3 ePortfolios and self-regulated learning

An ePortfolio is defined as the product, created by the learner, a collection of digital artifacts articulating experiences, achievements and learning (JISC, 2008). The literature shows that ePortfolios, competency, and self-regulated learning are related to each other. For example, competency measuring affects self-regulated learning (Voorhees, 2001; Zimmerman, 2002, 2008), ePortfolios improve competency measuring (Gadbury-Amyot et al., 2003; Rao et al., 2012), and ePortfolios provide a relevant environment for practicing self-regulated learning skills (Abrami et al., 2008; Hadwin et al., 2010; Perry and Winne, 2013; Ryan and Ryan, 2012). Thus, ePortfolios improve competency measuring, demonstrating that both ePortfolios and competency measuring can foster self-regulated learning.

Competencies are the learning outcomes or the prerequisites of learning activities (Voorhees, 2001). In SRL, learners are required to self-evaluate their competencies and performances in order to

regulate their learning (Zimmerman, 2002). In addition, competency assessment allows learners to set goals, judge efficacy, and plan time and effort based on their conditions; it enhances awareness of cognition, motivation, behavior, and context; finally, it is used for self-reflection.

ePortfolios store achievements and the processes of reaching these achievements (Rao, et al., 2012). They are used to document competencies and examine how students reflected on their competency development process (Zawacki-Richter and Hanft, 2011). ePortfolios contain evidence of competencies, which includes artifacts and processes. ePortfolios help learners and external evaluators to better understand competency, and improve their ability to evaluate it.

ePortfolio systems are relevant environments for reflection and collaboration (Ryan & Ryan, 2012). Thus, an ePortfolio system is used as a platform for practicing SRL processes, which is a key to fostering SRL (Hadwin, Oshige, Gress, and Winne, 2010; Perry and Winne, 2013). With the ability to trace learning processes, ePortfolio systems allow learners to monitor learning, reflect on their learning, and make changes in learning strategies to reach the goals. Learners also can show their results to the others and cooperate with others in ePortfolio systems. These functions can promote the intrinsic motivation of learners (Vockell, 2008), which is an important factor of SRL (Pintrich, 2004; Zimmerman, 2002).

There are some issues concerning ePortfolios for self-regulated learning. Currently, no ePortfolio models for self-regulated learning are available. The literature also does not explore the relations among ePortfolios, competency, and self-regulated learning explicitly. In addition, there is a lack of reports about the impacts of such ePortfolio models on self-regulated learning. More knowledge about if or how ePortfolio systems affect student self-regulated learning is needed.

3. ePortfolio-based learning model for fostering self-regulated learning

3.1 Using the ePortfolio system for learning

Based on the above analyses and self-regulated learning models, an ePortfolio system was developed. The focus was on improving ePortfolios' capacity for measuring competencies, capturing and sharing self-regulated learning principles, and practicing self-regulated learning processes. The system helps instructors to design programs, create program plans, observe learning activities, evaluate learning outcomes, give feedback, and hold discussions with students. Students can use the system to create learning plans, manage artifacts, monitor learning processes, evaluate task progresses and learning outcomes, and reflect on feedback and results. The system is as a platform for interactions between students and instructor and among students

The ePortfolio system is used to design learning. ePortfolio-based learning is integrated into courses, and is used as a supplement that supports formal class activities in order to foster students' self-regulated learning skills. An evaluation form for an activity is used by students and instructors. This form appears after evaluators select a student and an activity in the plan. The first part of this form contains information about the time period, time passed, and progress of the activity. The second part lists all artifacts that are the outputs of the current activity. The goal competencies of the activity are shown in the next part, in which evaluators can check the evidence and update the levels of competencies. The last part contains the discussions that are related to the activity type of the selected activity.

3.2 Study design

The first experiments were conducted at the Hoa Sen University, Vietnam. The ePortfolio system was used in two courses: Data Structure and Algorithms (DSA), and Software Development Processes and Tools (SDPT). The DSA class had 48 first-year students, who were split into two groups (for computer lab room section), randomly one group was selected, and in the selected group voluntary students were called to use the ePortfolio system for learning. In the SDPT class, all 18 fourth year students were recommended to use the ePortfolio system for this course. The students used the ePortfolio system for learning for eight weeks.

To measure self-regulated learning, a self-reporting method with the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991) was used. MSLQ allows us to measure different

motivational components and the use of learning strategies in a given course. The MSLQ consists of 6 motivational and 9 learning strategies subscales. The 6 motivation subscales measure intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy, and test anxiety. The 9 learning strategy sub scales measure rehearsal, elaboration, organization, critical thinking, metacognitive self-regulation, effort regulation, peer learning, and help seeking. The MSLQ consists of 81 questions, which the students rated using a Likert scale from ‘‘1 not at all true of me’’ to ‘‘7 very true of me.’’

MSLQ surveys were conducted in DSA and SDPT classes in the first and the last weeks of the semester. All students were told before the survey that their participation was voluntary and not related in any way to their grades in the course. With self-report scores, to examine how the ePortfolio system affected students' learning, the mean differences between groups were evaluated by using 2-tailed t-test with p-values of <0.05 were considered significant (Cheang, 2009).

A trace method was used for measuring and exploring students' self-regulated learning skills by using the ePortfolio system. In previous studies (Hadwin et al., 2007; Perry and Winne, 2006; Zimmerman, 2008), the authors argued the benefits of using trace methodology to examine the dynamic perspective of self-regulated learning. The log file was analysed to examine the frequency and sequence of learning activities. Time-based analysis was used to evaluate the changes in learning over time.

3.3 Results

With the SDPT class 18 responses were collected for both the pre- and post-tests. In the DSA class, 27 responses for the pre-test and 39 responses for the post-test were received. After the post test, based on the logged data, a control group with 25 students and an experimental group with 14 students were determined. The students who did not use the ePortfolio system comprised the control group. In the control group, 13 students responded to both pre- and post-tests, while experimental group had 10 students who responded to both tests. All “reversed” items in MSLQ were reversed before scores were computed.

In the study with the SDPT course, all 18 students used the ePortfolio system. In order to evaluate the effects of the ePortfolio system on motivation and learning strategy subscales, a paired 2-tailed t-test was used to examine the differences between pre-test and post-test. The effects of the ePortfolio system on students' motivation and use of learning strategies are now summarized. Data described in this and the remaining parts of the results section can be obtained from the authors. Positive effects were reported in thirteen scales. The data shows that the use of the ePortfolio system might contribute to significant improvement in some scales, such as metacognitive self-regulation (p=0.001), critical thinking (p=0.002), elaboration (p=0.004), and rehearsal (p=0.028). These scales relate directly to self-regulated learning (Pintrich, 2004); hence it is reasonable to argue that the system implemented had positive effects on students' self-regulated learning skills. Although not statistically significant, improvement was seen in task value (p=0.057), and intrinsic goal orientation (p=0.069). Two scales show negative effects, but neither are significant (help seeking, p=0.452; Time/study environment management, p=0.872). Overall, MSLQ scores indicate that the system affected students' learning in a positive manner. Therefore, the ePortfolio system promoted students' motivation, and learning strategies.

In the study with the DSA course, the means of scales of post-tests in two groups were compared by using unpaired 2-tailed t-test. The results show that the experimental group is dominant in all scales (control mean < experimental mean, except test anxiety scale, but it means that there is less worry in the experimental group). The experimental group's scores are significantly higher on some scales that relate to self-regulated learning, such as intrinsic goal orientation (p<0.001), effort regulation (p=0.002), self-efficacy for learning and performance (p=0.012), elaboration (p=0.023), metacognitive self-regulation (p=0.032), and task value (p= 0.036). In addition, the differences in control of learning beliefs (p=0.066), organization (p=0.07), and rehearsal (p=0.095) were considered also. This comparison supports the results of the previous study in the SDPT class.

Trace data was stored in XML files, each element containing information about a performed activity, such as participants, time, which activity, and which course. A log analyzer was developed to generate frequency counts, and transition statistics. From this information, transition matrices and

transition graphs were created. In this report, only the trace data of the SDPT course was examined because all students in this class used the ePortfolio system.

Results show that students performed 50/81 of possible transition types. 'Create plan' is the first activity; after that, students can update plan, create artifact, or review feedback. 'Review feedback' and 'evaluate activity' are not only the most frequent activities, but also the most central activities. 'Review feedback' connects to the other seven activities and can be the end points of transitions that begin with the other activities. 'Evaluate activity' links to the other six activities in both directions. This finding indicates that by using the system, 'review feedback' and 'evaluate activity' become the central tactics of learning strategies. Students usually review feedback (for example, observe discussions, evaluations, progress, and personal plan) and evaluate task progress before and after doing other activities. This pattern of learning aligns with reflection-based learning, and supports self-regulated learning.

A transition graph is formed by nodes and directional lines; each node is represented by a type of activity with its respective percentage. In general, the more active learners, the more nodes and transitions in the transition graph. A graph can demonstrate the general trend of the classes' use of learning strategies in a particular period. Thus, by comparing the graphs the changes in learning trends over time can be examined. The transition graph shows that the students learned quite actively because all nodes were connected to others with 50 patterns of transition. In addition, the activities and transitions in the graph are the elements that create or relate to the self-regulated learning processes (Pintrich, 2004; Zimmerman, 1998, 2002). Thus, it is argued that students' engagement in self-regulated learning with a variety of tactics.

The changes in time-based analysis indicate that the use of the ePortfolio system for self-regulated learning was improved. The students understood more about the system and learning tactics, and they used the system for practicing self-regulated learning skills better over time. For instance, the changes explained that the students not only reviewed the feedback, when the time of use increased, they also performed other types of activity, for example, self-evaluation.

4. Conclusions

In this research the relations among ePortfolios, competency, and self-regulated learning were analysed and synthesized. This knowledge played an important role in developing an ePortfolio model for self-regulated learning. From this model, an ePortfolio system was implemented that can handle the issues of fostering self-regulated learning, for example, self-regulated learning principles representation and sharing, or self-regulated learning process implementation. The model and implemented system help us to handle the main issues of fostering self-regulated learning (Winne, 2005; Zimmerman and Tsikalas, 2005). The results of this study suggest that the combination of self-regulated learning, ePortfolios, and competency promotes self-regulated learning. This combination leads to a unified platform, in which students can practice all self-regulated learning activities. In addition, these activities are logged for the assessment or modeling of self-regulated learning.

The MSLQ scores show that there were significant differences between pre-test and post-test scores, and between control and experimental groups. It is reasonable to infer the positive effects of the ePortfolio-based learning model on student-motivated strategies for learning scales. Consequently, the impact of the ePortfolio system on student self-regulated learning was recognized based on the framework for self-regulated learning assessment employed (Pintrich, 20014). In addition, the trace data shows that the students implemented and linked the self-regulated learning processes successfully in the ePortfolio environment. This is a key to developing self-regulated learners (Zimmerman and Tsikalas, 2005). The trace data also indicates that student self-regulated learning skills were improved over time by using the ePortfolio-based learning model.

There were some limitations in this research. The MSLQ surveys were conducted at the beginning and at the end of the semester. Thus, the changes of students' SRL may be due to the passage of time. The lack of time, courses, and students for experiment were other limitations of this study.

For future work, there is a need to conduct more experiments with students from different disciplines and contexts. It is necessary to design and implement evaluation with academic programs. Other types of analysis need to be used to explore ways in which the system affects students' learning and what needs to change in order to improve the impact of the system on students' learning, for example, individual level analyses, and artifact content based analyses.

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