DESIGNING FOR SELF-REGULATION: THE DEVELOPMENT OF A WEB-BASED DIGITAL PORTFOLIO FOR ADULT LEARNERS

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Abstract

The Centre for the Study of Learning and Performance (CSLP) has developed an electronic portfolio, called ePEARL, which is predominantly based on self-regulated learning (SRL) models. ePEARL is a bilingual, evidence-based, learner-centred digital portfolio that is available free of charge on the world-wide-web. Zimmerman’s (2000) cyclical, socio-cognitive model incorporates both metacognitive and motivational elements, and provides a life-long foundation for learning and skill development that is driven and sustained by the learner. The process is divided into three main phases: Forethought, Volitional Control (Performance), and Self-Reflection. The three phases are represented in ePEARL as Planning, Doing and Reflecting, and are supported with relevant tasks. They include features such as setting long-term and task goals, selecting strategies, evaluating personal motivation, creating and sharing work, providing and incorporating meaningful feedback, and reflecting on performance and the outcome. ePEARL currently has three developmentally appropriate levels, intended for K-12 students. It promotes several SRL processes in learners, such as goal-setting, using teacher, peer, and parent comments to improve, and reviewing the criteria that will be used to evaluate work. In 2009, the CSLP undertook the development of a new ePEARL level for more mature users, primarily to support pre-service and in-service teachers, as well as late secondary and post-secondary students, in becoming self-regulated learners. Initial analyses revealed several important differences in the needs of this particular project. This paper will explore these challenges and the way they were addressed in the design of ePEARL for adult learners.

Keywords: ePortfolios, self-regulation, adult learners, educational technology, pre-service teachers, post-secondary, instructional design.

1 INTRODUCTION

The Centre for the Study of Learning and Performance (CSLP) at Concordia University has developed an electronic portfolio that is not only a multimedia container for learning artifacts but is also based on the Self-Regulated Learning model of Barry J. Zimmerman [1]. This cyclical, socio-cognitive model revolves around a triadic definition of self-regulation, which involves the interaction of personal, behavioral, and environmental processes that together provide a life-long foundation for learning and skill development that is driven and sustained by the learner. The model consists of a cycle of three phase comprised of Forethought, Volitional Control (Performance), and Self-Reflection, each with its own subprocesses.

Developed in collaboration with teachers, as well as literacy and technology consultants working in the educational field, the CSLP’s Electronic Portfolio Encouraging Active Reflective Learning, or ePEARL, is a bilingual, web-based, student-centred digital portfolio that incorporates the model of self-regulation. The three phases translate in ePEARL into Planning, Doing and Reflecting. All three are supported with relevant tasks and age-appropriate, easily accessible assistance that aids students and teachers in understanding the phases and applying their principles to their work process. Prior to the latest development, ePEARL had three developmentally appropriate levels, intended for K-12 students. Each level is progressively more complex in its handling of the self-regulation phases.

Recently, the CSLP undertook the development of a new ePEARL level designed for adult learners, primarily in the education field, as a means to support them in becoming self-regulated professionals. Initial analysis of the target audience and tasks revealed that we could address the more complex and nuanced aspects of the self-regulation model and integrate them into an innovative ePEARL level 4 software. As such, rather than make superficial modifications to the existing ePEARL interface, the environment was redesigned in a way that would better address the audience and the expected performance.
2 SELF-REGULATION THEORY

Zimmerman defines self-regulation as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals." [1]. This implies not only behavioral skill-management and subject knowledge but also metacognitive awareness, social influences and motivational beliefs about personal agency. Zimmerman structures the self-regulation process in three phases: Forethought, Performance, and Self-Reflection. The forethought phase includes task analysis in the form of goal setting and strategic planning, and self-motivation beliefs in the form of self-efficacy, outcome expectations, intrinsic interest and goal orientation. The performance phase is divided into self-control, which includes self-instruction, imagery, attention focusing and task strategies, and self-observation, which includes self-recording and self-experimentation. The last, but not final phase is self-reflection. It includes self-judgment, comprised of self-evaluation and causal attribution, as well as self-reaction, which involves self-satisfaction and adaptive/defensive responses (Fig. 1). The process is described as cyclical because successful self-regulation depends on the constant revision of goals, and monitoring and correction of performance based on feedback about recent efforts.

Figure 1: Phases and subprocesses in self-regulation [1]

However, as described above, the self-regulation model is a socio-cognitive model that puts great emphasis on social, environmental and personal influences in the efforts to self-regulate effectively. In this model, ignoring the value of social resources (such as peer or teacher feedback, modeling and emulation of expert behavior) or environmental support (such as self-rewarding achievement with an enjoyable activity) will result in unsuccessful self-regulation.

Although ePEARL is an electronic portfolio, the software design, and the theory behind it, was not intended to be used in isolation. It is still important to maintain the social framework of a classroom or study group, and to empower the teacher to create the highly motivating conditions within the group. Fostering an environment that values sincere effort, meaningful reflection and respectful criticism, is part-and-parcel of successfully working in ePEARL.

Another important aspect of self-regulation is motivation. Perceptions of the possibility for success, or self-efficacy, influence the level of goal challenge learners set for themselves, their resistance to distractions or adversities, and the effort they are willing to invest in performing the task [2]. This was another challenge in designing a software that encourages self-regulated practices in learning. Motivation in general, and self-efficacy beliefs in particular, are not something that can be easily achieved with the click of a button on a computer screen. Many elements must be in place to create a motivating environment and a sustained self-motivating attitude in learners. Again, the social aspects of learning are essential - such as outside help in perceiving erroneous self-efficacy beliefs, supportive and respectful personal relationships in the learning community, and a culture that models and encourages interest and involvement [3].
3 SELF-REGULATION AND THE ELECTRONIC PORTFOLIO

ePEARL was designed initially to adhere to the principles of the self-regulated learning model. It was also designed to be used in an academic setting by students throughout their school life. This provides quite a large and varied audience, with different developmental and cognitive capabilities as well as differing task characteristics. To address this, we initially designed three "levels" of ePEARL.

Level 1 is geared towards students in grades 1-2 and focuses primarily on emerging reading skills. The interface design, as well as the type of interaction, are simplified and specially tailored for young learners. An embedded audio recorder allows students to record themselves reading at different points throughout the year. Before starting a new recording, students are asked to identify what their goal is for this recorded reading. This is a one sentence answer and is a simple way to get students to consider goals as part of their practice. Examples of goals at this level include: to read smoothly, to improve pronunciation, or to read one whole page without making a mistake. Once a reading has been saved, students answer specific questions regarding the literature read (Responses) and their own reading skills and strategies (Reflection). They can answer on their own using a simple text editor, or can use one of several questions or sentence-starters to focus the answers. Responses to literature involve questions such as "What do you think will happen next?" or "This story tells about...", which promote comprehension skills [4]. Reflection, in this context, functions much the same way, but the questions focus on students' reflection on their own performance. Prompts such as "What did you do when you got stuck on a word?" or "I make fewer mistakes when I..." lead students to be aware of their learning strategies and developing skills. Another important feature is the ability for teachers to provide feedback on each entry. Teachers have access to view and comment on all his/her students' entries, and the comment is visible to the student. Encouragement, prompting and adjustments are an important part of the self-regulated learning process, and even at a young age students benefit from the input. Students may also link image files to any of these phases in each entry, such as an illustration of their making, their attempt at writing the title and author, or an alternate ending to the story. This encourages students to develop their early literacy skills even as their computer skills are improving as well as to express their understanding in more than one medium. As students advance, they can also make use of a simple writing module. Once again, the student can reflect on his/her writing skills and or strategies, and link images to the entry. Level 1 of ePEARL encourages students to begin to adopt basic self-regulated learning practices; primarily goal setting, and reflection on process and on the strategies.

Level 2 is designed for students in grades 3-6. The design is more mature, but more importantly, the self-regulation features are more complex and the portfolio possibilities are greater. Students can manage their files, customize their ePEARL, and allow peers to view and comment on their entries. At this level, students are led through a step-by-step process that introduces them to different subprocesses in "Planning", "Doing" and "Reflecting". In "Planning", students are encouraged to set general goals for the term (distal outcome goals), specific goals for each entry (proximal goals) and strategies for achieving their goals (strategic planning). They are also asked to self-assess their motivational beliefs, by rating their response to several questions, such as their self-efficacy belief and their level of intrinsic interest in the task. In "Doing", they are reminded to monitor their progress against their plan as they work (self-observation and self-control). In the "Reflecting" phase, students are encouraged to reflect on the achievement of their goals (self-evaluation) and the efficacy of their strategies (causal attribution) and possible improvements for future tasks (adaptive behaviors). They are also encouraged to provide meaningful feedback on their peers' work and to evaluate and incorporate feedback from peers in their own work. At all times, navigation back-and-forth between phases in the entry is possible and even encouraged. There is also a "Parent Mode" that allows parents and students to browse through ePEARL together while enabling parents to make comments in designated places or on the entire portfolio. The step-by-step process presents students with small chunks of manageable tasks as well as detailed instruction about the tasks at hand. However, once they feel more confident, a one-page layout of the same process is available for a more fluid view of the process.

ePEARL level 3 is designed for Secondary school students (Grades 7-12). The features are similar to those in level 2, but the style and language are more mature. ePEARL fosters constant revision and modification of goals based on lessons learned through current work. Students are also encouraged to track their learning process with logs and rubrics that they attach to the work, to reflect on their progress in different areas, and to organize their work by renaming folders according to their needs and tagging items with customizable colour codes. They can ask peers to comment on their work, and provide their own comments when they are invited to do so by other students. As in all levels, we
aimed to design a student-centered portfolio which students could take ownership over and consider a safe and conducive environment. In this spirit, students must give permission to peers to view all or some of their work. While teachers have access to all the students’ portfolios, he/she cannot modify any content created by the student or his/her peers. Parent access is also restricted, by requiring the student to “chaperone” the parent as they navigate and discuss the portfolio together.

We have also undertaken a series of investigations to validate the impact of the use of ePEARL on students and teachers. Two longitudinal studies, Meyer et al [5] and Abrami et al.[6] document the learning gains attributable to ePEARL use, changes in students’ SRL strategies, and modifications to teachers’ classroom practices.

3.1 ePEARL level 4: objectives and audience

ePEARL level 4 was a project undertaken by the CSLP in 2009 as a way to support pre-service and in-service teachers, as well as late secondary students and post-secondary students as they become self-regulated learners and eventually, professionals. Instead of simply altering the look-and-feel of our existing level 3 of ePEARL we chose to recreate the online environment in a way that would tackle the particular challenges and opportunities presented by more mature learners and the tasks they face. This allowed us to investigate the more complex aspects of Zimmerman’s self-regulation model.

Our end-users for this project are adult students and professionals, primarily in the field of education, who may use ePEARL first as an academic tool, but may also choose to continue using it as a professional development portfolio once they are employed. The work with ePEARL is never really complete: Zimmerman [1] makes the case that learning and performance efforts must be constantly adjusted, because the personal, behavioral and environmental elements are continuously changing. This fuels the cyclical nature of the self-regulation process as adaptations are made to current performance based on the lessons learned from previous ones. We hope that in leading the learners through a directed path the self-regulated practices and the cyclical process will become engrained in the learners’ practice, so that eventually they will be self-regulating successfully even without the scaffold ePEARL provides.

Adult users, in our experience, can more easily grasp the variety of elements influencing their learning experience once they are made aware of them, and are therefore better equipped to correctly assess their influence. And, although they might not be conscious of recurring patterns, they are also more familiar with their own learning behaviours thanks to many more years of accumulated learning experiences. Task characteristics may also differ at this level; from our experience, post-secondary students are often required to carry out tasks that are more complex, ill structured and lengthier than younger students. Tasks like these require finer planning and more precise monitoring, as well as more sophisticated reflection and adaptive inferences. These types of tasks also demand that motivation be sustained for a longer period of time, as the final reward of achieving the goal may be substantially delayed. For this reason, many learners may feel frustrated and disinterested if they are not aware of the progress they are making towards their final goal. The motivation of adult students may differ from that of school-aged learners since, at the post-secondary or professional level, they are often studying, presumably, topics of their own choosing. They may have well defined distal goals (such as: “to become a teacher at the end of my studies”) that provide powerful momentum and great influence over their intrinsic interest and performance [3].

Zimmerman describes two major dysfunctions in self-regulation that may affect adult learners: lack of social learning experiences (models) and apathy and disinterest (motivation) [1]. Reactive self-regulation behaviors tend to lead to post-hoc correction rather than rely on proper planning and subsequent monitoring and control in the performance phase. Learners with this tendency usually do not have the necessary goal structure, the strategic plans nor the sense of agency needed to self-regulate effectively. They have no baseline information or process goals to orient their efforts. They use criteria that are not objective, but rather comparative, to assess their success and are therefore frequently disappointed. This leads to a loss of intrinsic motivation, a loss of self-efficacy beliefs for achievement and, eventually, avoidance of all similar tasks in the future.

Finally, the effortful and purposive use of ePEARL is not designed for learning challenges which are viewed by the learner as easy to accomplish, already well-learned, unimportant, or not sufficiently demanding of one’s time or personal resources. ePEARL is best used when the task the learner has to accomplish is moderately difficult, has an element of novelty, and is perceived as valuable to achieve, among other things. From our experience, learners can develop resistance to the process of
self-regulation and to using ePEARL in particular - if they do not see the added value it has on their learning process. If the amount of time and effort invested is seen as unequal to the progress, learners become demotivated and unenthusiastic. Since intrinsic motivation is a critical element in successful self-regulation, this is something we want to avoid.

The design of ePEARL level 4 kept the features from levels 1-3 described above, and adapted and added to the existing structure to create a new environment. This environment will support this new group of learners in effectively engaging with the SRL model and avoiding the above-mentioned pitfalls.

3.2 New features

3.2.1 Visual Representations

Zimmerman stresses the importance of having an organized hierarchical system of goals “…such that process goals operate as proximal regulators of more distal outcome goals.” [1]. ePEARL level 4 supports this idea by allowing the breakdown of work into tasks and supporting tasks that are linked to each other and to distal goals in a hierarchical manner. This system of goals is shown as a graphic “map” that presents the learner with an overview of the self-planned forethought phase. This visual hierarchy allows learners to both easily identify where in the system of goals he/she is currently working, as well as to understand the importance of completing the proximal goal as a step to achieving the final goal. In Fig. 2, one of the task goals in writing a term-paper for a seminar is “Research”. This task is broken down into supporting tasks named “Online Search” and “Library Search”. Each one outlines the plan for achieving the supporting task (the proximal regulators), and is linked to clearly show that performing these supporting tasks is valuable for completing the research component of this task (achieving the task goal) and, eventually, the writing of the term-paper (achieving the final goal of the work). Learners can even link to broader long-term distal goals called “general goals” in ePEARL, that do not have to do with individual tasks and are defined usually at the beginning of the term. The task of writing a term-paper may, for example, be linked to a general goal that has to do with improving one’s writing skills.

Figure 2: A visual view of a system of goals in the ‘Planning’ phase.
ePEARL level 4 also compiles and displays certain information from individual work into a cumulative visual graph. This view provides a novel cross-section of the learning behaviors and inspires new insight into one's own learning practice. For example, learners use and subsequently rate strategies during their continued use of ePEARL. One of the graphs presents the strategies based on an average of how successful the learner has deemed each strategy to be. Another graph presents the number of works that the learner has associated with each distal goal, allowing him/her to realize which goals are being neglected [Fig. 3].

![Use of General Goal Connections](image)

**Figure 3:** A visual view of a system of goals in the ‘Planning’ phase.

Presenting visual representations of accumulated data this way will help learners focus on patterns in their behaviors in a timely manner, and take steps to correct unsuccessful practices.

### 3.2.2 Sidebar design

Another critical aspect of self-regulation that we have re-addressed in ePEARL level 4 is the cyclical nature of the practice. Constant monitoring, evaluation and adjustment of various aspects are necessary in Zimmerman’s self-regulation model [1]. In ePEARL level 4 we have tried to reinforce this through our interface design. While the main area of the screen is dedicated to working on the current task, a right-hand column constantly displays pertinent supporting information. Through textual instructions, pedagogical explanations, or display of other parts of the work, the sidebar promotes consideration of elements that may have otherwise been overlooked. In Zimmerman’s model, planning and selecting strategies requires cyclical adjustments because of changing circumstances - whether due to the task, the skill level of the learner, or the environmental conditions[1]. For example, while the main area in the “Doing” phase focuses on the performance of the task, we encourage simultaneous performance, monitoring and modification by using the sidebar. We know that the temporal proximity of feedback makes an observation more effective [1], and the sidebar allows learners to immediately record their impressions or be reminded of their plan without interrupting their progress. In the sidebar, the learner is constantly encouraged to monitor the effectiveness of the plan (through self-reporting, checklist completion, and rating scales) and to modify those aspects that are not effective (by removing unsuccessful strategies and selecting new ones if necessary). For example, in Fig. 4, a learner is doing his/her work, and at the same time has access to the strategies selected for the task. In addition to reminding the learner about the strategies at the moment he/she may need them, a note can be added to each one with comments on the effectiveness of the strategy. This comment will be saved with the strategy, so that the next time the learner selects this strategy he/she will also have access to the comments made during previous experience.
Figure 4: The Sidebar “Checklist” allows monitoring of strategy use while in the performance phase. Viewing different aspects of the work at the same time can help draw learners’ attention to links that can inspire new conclusions about their own learning habits. For example, reflecting on motivational beliefs, such as perceived self-efficacy as it was reported at the start of the task, may bring the learner to reach the conclusion that they are over- or under-confident in their capabilities and adjust goals and expectations accordingly [2]. This is crucial because attributing failure or success to the effort or the process rather than to fixed ability influences the way learners view their agency in their learning process. Attributing poor performance to innate ability will discourage a learner who could easily improve, from approaching the same kind of task again [1].

3.2.3 Drill-down structure

As mentioned earlier, tasks are expected to be more complex and to take longer to complete. They often include more procedures and more parts to be completed. ePEARL level 4 is a tool that supports the learner as he/she goes through the process of creating work in a self-regulated manner. This support is crucial since self-regulation might be entirely new and foreign to some learners. However, too much support delivered in an intrusive way may be distracting rather than helpful. Forcing learners through a lengthy and repetitive procedure does not allow for personal choice or a customized experience and thus fails to conform to the philosophy of SRL as the self-directive processes of a learner-driven practice [1]. Moreover, forcing learners to complete every part of an online interface without regard for the task or the level of support needed by the learner, and without giving the learner any sense of agency or choice, will probably result in frustration and a loss of motivation [3].

For this reason, the interface we developed for ePEARL level 4 allows for a flexible interaction with the tool. It allows learners to focus on the aspects in which they feel that they need most assistance by choosing to drill-down for more support at that point in the process, or alternatively, to simply reply to a generic question if they feel uncomfortable with more precise inquiry. For example, the Self-Reflection phase in ePEARL level 4 is comprised of a single general reflection question. However, there are also additional focused questions that may be accessed if a learner wants to tackle reflecting more deeply, or requests more scaffolding. The additional questions prompt the learner to relate specifically to a feature of self-regulation (such as task analysis or self-observation) or to examine his/her work in ePEARL (such as rating which professional skills were reinforced during the task) [Fig. 5].
In this manner, we not only avoid fatigue and avoidance of ePEARL but we also support learners’ evolving understanding and use of both the tool and of the SRL practice. While learners are familiarizing themselves with the process, a teacher might encourage students to focus on one phase and complete all tasks associated with that phase, while completing only the basic questions for others. Learners might use the general reflection question to initiate reflective thinking at the beginning of the year, and eventually feel comfortable and secure enough to answer one or more of the focused questions.

3.2.4 Other applications.

After two years of pilot research using ePEARL in Learning Through the Arts, we have begun an ambitious project with Queen’s University and The Royal Conservatory of Music to develop a customized version of ePEARL level 4, to be called iSCORE, for studio music teaching. iSCORE builds on the core features and structures of ePEARL level 4, and will have more sophisticated audio and video annotation features and a built in music composer called Virtual Music. Our goal is no less than to revolutionize the way music is taught to youngsters.

3.3 Challenges

The main instructional design challenge in this project is finding the balance of addressing the self-regulated learning components without creating animosity and apathy in the users, which would invariably lead to abandoning ePEARL altogether. We have put tremendous effort in designing a tool that will successfully support learners in following a self-regulated learning practice. However, because the social and environmental influences are so great, there must be a simultaneous effort to support teachers and mentors in creating the necessary environment and attitude that foster self-regulated learning. “Modeling and instruction serve as a primary vehicle through which parents, teachers, and communities socially convey self-regulatory skills, such as persistence, self-praise and adaptive self-reactions...” [1].

The online scaffolding and support the learner gets through ePEARL is only part of the self-regulation process. The social aspect of the model must also be experienced in the classroom or community, where learning is truly valued, errors are honestly examined and progress is considered personal success. Working collaboratively does not just mean sharing drafts of work and providing constructive comments on the work of peers, but also creating a community that values, models, and rewards self-regulatory practices. A computer, for example, cannot implement the motivational aspect of self-
regulation very effectively. The best we can do is solicit self-reported data about the motivational state of the learner and support the teacher in properly addressing the motivational issues. For this reason, work with teachers is essential and, in addition to our work on the electronic portfolio, much of our efforts are directed towards supporting teachers in fostering self-regulation classrooms.

REFERENCES


