A MOBILE CONTEXT-AWARE FRAMEWORK FOR SUPPORTING SELF-REGULATED LEARNERS

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ABSTRACT

We have previously developed a mobile context-aware learning schedule (mCALS) framework, which provides a potential effective learning approach for supporting self-regulated students. This framework uses the learner's learning schedule to retrieve their location and available time contexts in order to suggest appropriate materials to them based on these, at the time of usage. The user's learning styles and knowledge level contexts are also considered. A suggestion mechanism selects appropriate learning objects to students from a learning object repository. Our interview study has been conducted and the purpose of this paper is to present the data analysis relating to participants' learner characteristics and their usage of learning schedules for supporting time management of studies as well as their views regarding m-learning. Results showed that 1) participants who closely followed their learning schedules were learners with self-regulated learning characteristics, 2) the act of planning study-related events had helped self-regulated participants to motivate their studies, and 3) a strong significant positive correlation was obtained between participants who were more enthusiastic to m-learning and those who enjoyed studies more. The results corroborate that the learning schedule within our mCALS framework can be used successfully as a motivating learning approach for supporting self-regulated learners.

KEYWORDS

Context-aware, self-regulated learning, mobile learning

1. INTRODUCTION

The components of self-regulated learning theories include deployment of motivational strategies such as self-talk, elaborative planning, processing and monitoring. Code *et al.* (2006) argued that instructional designers of e-learning environments can use cognitive tools to promote motivational strategies and enhance learners' self-efficacy. Self-efficacy is related to the self-regulated theory, which is the belief that one is capable of performing certain tasks in order to attain their goals. Self-Determination Theory (Deci and Ryan, 1985) describes motivational strategies (from two perspectives – intrinsic and extrinsic) based on the various reasons or goals a learner sets to complete a certain task. Common amongst models of self-regulated learning theories are goal-setting and the comparison of such goals against the effort put in by learners and their achieved performances. Both goal theory and motivation consist of the *orientation* component, which relates to the goal-setting reasons and the motivation for achieving (or failing) to achieve these goals. There are two main goal orientations – *mastery goal orientation* and *performance-goal orientation*, which can be used to identify students' various approaches in regulating their learning to complete a particular task. The design of learning environments can be enhanced by obtaining a deeper understanding of the relationships between individual differences in learning attitudes, motivation, goals-setting and achievement.

Mobile learning (hereafter abbreviated as m-learning), which is learning with mobile devices and/or in non-fixed (i.e. mobile) environments, can be seen as a more difficult method of learning. However, benefits of this include that learners can perform anytime anywhere learning, given that they have the motivation to do so. The aims of our mCALS framework is to 1) eliminate the use of context-aware technologies for detecting the learners' location and available time contexts, in order to suggest appropriate materials to them based on these contexts values; and 2) provide the use of a learning schedule for students to plan their study

related and unrelated events, which is a potential self-regulatory time management technique for self-regulated students. This framework was described in Yau and Joy (2008). Justifications for why learning styles and knowledge levels are considered in our framework are included in Yau and Joy (2009).

An interview study, participated by 37 volunteers, was conducted and the results of this study were presented in Yau and Joy (2009). Additional results were obtained relating to participants' learner characteristics, and these form the focus of this paper. We use these results to ascertain 1) which type of learner characteristics correlate with which type of diary usage, and 2) whether the participants with more self-regulatory characteristics tend to follow their study-related events more closely than others. The paper is structured as follows. In section 2, we provide a literature review of self-regulatory e-learning applications/systems. In section 3, we discuss the interview study research methodology and present the qualitative and quantitative data analysis. In section 4, we present the conclusions and future work.

2. LITERATURE REVIEW

The following are representative of self-regulated e-learning systems. We are currently not aware of any m-learning systems, which specifically incorporated components to facilitate self-regulated learning.

- *gStudy*, an e-learning software application, uses self-regulated learning strategies to support active knowledge construction. A Goal Setting Kit (GSK) was developed for students to set, search and manage their goals and learning objectives (Winnie *et al.*, 2006).
- A personalized e-learning system with self-regulated learning assisted mechanisms can help learners to enhance their self-regulated learning abilities to become lifelong learners (Chen *et al.*, 2007).
- An individualized and self-regulated e-learning multi-agent system converts learners' learning goals into learning strategies, and these are applied to fulfil their learning goals (Hwang *et al.*, 2006).
- A self-regulated e-/m-learning system has six sub-systems – content accessibility, learning scheduler, self-evaluation, analysis, learning & monitor, and synchronization (Shih *et al.*, 2007).

3. INTERVIEW STUDY AND DATA ANALYSIS

A brief description of the research methodology is provided in 3.1. This was detailed in Yau and Joy (2009). In the sub-sections that follow, we present the data analysis relating to a) participants' learner characteristics and the use of learning schedules, b) the types of self-regulated learning strategies participants used in order to motivate themselves regarding their studies, and c) the relationship between learners' characteristics and their enthusiasm for m-learning.

3.1 Research Methodology

37 university students participated in our study, on a one-to-one basis, with a single researcher. The interviews were recorded and then transcribed for data analysis. The average duration of each interview was approximately 27 minutes. Responses from participants had started to recur after we had conducted around 30 interviews. We decided that further interviews would not assist us in obtaining much further information, and the study ended after the interview with the 37th participant. We had employed the content data analysis method (Cohen *et al.*, 2007) for the qualitative analysis due to the pedagogical and exploratory nature of the study. We employed statistical correlation tests to obtain whether there were significant correlations between a) how closely participants follow their diaries and their learner characteristics, and b) their views on m-learning and their learner characteristics.

The data analysis presented in this paper is focused on the data obtained from the first two interview topics – *learning preferences* and *use of learning schedules*. In the *learning preferences* topic, participants were asked to describe their personality as a student, and to provide information about their character relating to *how hard-working they are, whether they enjoy their studies, how conscientious they are, when they complete their work, how self-disciplined they are, how organize they are* and *how routine-structured they are.* A learner characteristics scale was created and participants were asked to choose between these to select one which, in their own opinion, described them best.

There were limitations of the interview study. The sample size of 37 university students may not be represented of university students in general. Participants should have a sufficient level and maturity of understanding, reflection and ability in order to convey their learning preferences and experiences to us, but this level and maturity may vary between different participants. Although the data collected were sufficient for effective qualitative data analysis, they may not be sufficient for effective quantitative analysis, hence we used a combined qualitative and quantitative analysis method to analyze and explain our findings. Finally, the collection of learners' characteristics is subjective and students may not tell the truth about their true opinions of their characteristics so as to portray themselves in a better light. However, given the nature of the study, the prior consent given by volunteers, and the impersonal nature of the characteristics, we have no reason to believe that any of the participants' opinions were conveyed to us dishonestly.

3.2 Learner Characteristics and Learning Schedules

Data analysis showed that learners who closely followed their diaries were those who regarded their studies as more important, prioritized their studies amongst other activities and were generally more hard-working. Whether they enjoy their studies is sometimes arbitrary and may not have a positive correlation to how hard-working they are, and this may be because they are working hard to achieve their goals and not necessarily because they enjoy their studies. Both intrinsically-motivated and extrinsically-motivated students were observed in the interviews, and both groups of students described a number of self-regulated strategies for motivating themselves regarding their studies. Some of these strategies relate to the use of learning schedules whereas others relate to the choice of study locations, or general goal-setting and persistence in studying mentality. As described by many participants, the act of planning their study-related and study-unrelated events can be 1) helpful for general time-management, 2) used as a motivating technique when they persist themselves with performing/continuing study activities that they have assigned a time slot for these activities, and 3) used as a self-satisfying or rewarding mechanism when they 'tick off' completed tasks in their diaries. Participants who noted such learning strategies were seen to have the following learner characteristics – *conscientious, self-disciplined, organised* and *routine-structured*.

Pearson correlation coefficient tests were applied to the learner characteristics, to discover how closely students followed their diaries. Most of the statistical correlations obtained were insignificant, except for the strong significant positive correlation obtained for the *hard-working* characteristic ($r = 0.2917$, $p = < 0.5$). This finding suggests that the more hard-working a student is, the more likely that they are to closely follow the entries in their diary.

3.3 Learner Strategies for Self-regulation

Most of our participants were able to describe techniques (such as planning techniques) to motivate their studies as well as to carry out their studies, and identified study locations which best suit their learning requirements. Planning is an important component of self-directed learning and can be a useful, sometimes essential, technique for students to plan and manage their learning or studies. This is so that they have the feeling that they are in control of their activities and not forget important events, deadlines etc. Planning is a necessary component because at any one time a learner may have a number of complex and/or novel tasks to complete, and without a plan or learning schedule to assign time slots to complete each task the learner may forget to complete some of them. Some of the interview participants also informed us that the use of a learning schedule can alleviate stress as they know that their important tasks are assigned a time slot for completion and that they will not forget about these tasks/events. Planning behaviour can also be seen as a goal and the act of planning is goal-setting for completing the planned task(s). Learning with mobile devices and/or in mobile environments can be prone to more distractions and interruptions. A set of self-regulating strategies to support mobile learners with their tasks may be effective in increasing 1) the motivation of learners studying in such situations/environments and 2) the learning productivity/effectiveness of students.

3.4 Learner Characteristics and m-learning

Correlations were obtained using the Pearson correlation coefficient tests between each of the learner characteristics and their enthusiasm about m-learning. Most of the statistical correlations obtained were

insignificant, except for the strong significant positive correlation obtained for the *enjoy studies* characteristic ($r = 0.4327$, $p = < 0.1$). This finding suggests that the more a student enjoy their studies, the more likely that they are to be enthusiastic about the use of mobile devices for learning/studying. The qualitative data analysis supports this finding as some of the participants whose opinions were that mobile devices would not be useful for learning or that they had no need for this learning approach were because they did not want to learn/study outside dedicated studying hours. Whether a learner is enthusiastic regarding m-learning is highly related to their study-related and study-unrelated routines. For example, a learner who spends most of their studying time in the library, and has access to a personal laptop computer, Internet, and book and journal resources etc., is less likely to require the need of mobile devices for learning in other environments. However, a learner who may not like (or always like) to study in fixed environments, such as computer laboratories or libraries, and are usually 'on the move', may be more likely to require a small portable device for learning/studying tasks including browsing the internet and making and reading notes.

4. CONCLUSIONS AND FUTURE WORK

In this paper, we presented the results of our interview study. A significant strong positive correlation was obtained between the *hard-working* characteristic and how closely students follow their schedules. A significant strong correlation was obtained between the *enjoy studies* characteristic and their views on m-learning. This finding suggests that the more a student enjoys their studies, the more likely that they are enthusiastic about the use of mobile devices for learning/studying. Our mCALS framework uses a learning schedule to support learners to potentially manage and self-regulate their studies. Both qualitative and quantitative data analysis of the interview study show that the learning schedule can be used as a goals-setting tool for students to self-regulate and motivate themselves relating to their studies. Hence, the findings support that the mCALS framework can be potentially used as a self-regulated learning tool for supporting self-regulated learners. The contribution of our work includes the incorporation of a learning theory into an m-learning framework, such that the learning needs of specific learners can be potentially met using current modern mobile technologies. Our future work includes ascertaining self-regulated techniques with which to motivate non-self-regulated learners to perform learning/studying in different environments, with or without the use of mobile devices.

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