Handling Procrastination in Mobile Learning Environment
Proposal of Reminder Application for Mobile Devices

Aneta Bartuskova and Ondrej Krejcar
Dept. of Information Technologies, Faculty of Informatics and management, University of Hradec Kralove, Rokitanskeho 62, Hradec Kralove, Czech Republic

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Abstract: This paper deals with the issue of procrastination in e-learning. Suggested approach is based on compensating e-learning shortcomings and applying principles of forming a habit. Technical implementation is possible through use of mobile devices, incorporated in e-learning strategy. Respective habit loop would consist of immediate trigger (delivered by a reminder application), desired behavior (engagement in learning session) and immediate reward. Requirements on learning strategy, software and hardware are discussed, as well as a reminder mechanism and relevant system of rewards. Data processing in the reminder application is outlined for computing initial settings of the application.

1 INTRODUCTION

Procrastination is known as a tendency to delay performance of important tasks, followed by feeling of distress (Solomon and Rothblum, 1984). This phenomenon is commonly found in the academic domain and there are many studies focused especially on undergraduate and graduate students. It was proven that many students procrastinate in relation to academic activities (Steel, 2007). This can be significant issue in e-learning, as e-learning courses tend to be mostly organized by student himself. Procrastination in e-learning courses can also emerge because online learning tasks can quickly overwhelm students, as well as existence of too much data and information to read and to respond to (Roberts, 2003). Procrastination not only causes discomfort or anxiety but also often results in unsatisfactory performance (Solomon and Rothblum, 1984).

M-learning or mobile learning brings many opportunities for learning and e-learning as well. Smart phones, tablets and other devices can be used for enhancing learning experience for students and teachers as well, therefore increase productivity and learning results (Dittmar, 2013). Opportunities offered by these mobile devices can be roughly defined as:

- opportunity in the sense of mobility - it is possible to bring the device along all the time
- opportunity in immediate use, trigger and response - it is possible to use the device anytime, the device can react according to its pre-set functions without previous interaction and user can respond immediately
- opportunity in form of a new platform for applications - for smart phones, tablets and other mobile devices with Android, iPhone and other operating systems
- opportunity in usage of current location - limited use for learning

Mobile learning as well as traditional web-based e-learning suffers from absence of face-to-face communication between teacher and student, and also communication between students themselves. Generally, e-learning in its online form lacks face-to-face educational experience (Garrison et al., 2003). Another issue of m-learning is the fact, that learners can be more easily distracted in mobile environment (Joo et al., 2013). Both e-learning and mobile learning allows for managing learning process solely by student, therefore increasing risk of procrastination.

This paper explores a possibility of handling procrastination in e-learning with use of mobile devices.

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2 PROPOSED APPROACH

Approach which is suggested in this paper for dealing with procrastination is based on compensating e-learning shortcomings and applying principles of forming a habit. Technical implementation is possible through use of mobile devices, incorporated in e-learning strategy. Such mobile learning would use advantage of both mobility of the device and custom application linked with existing e-learning system as well.

2.1 Need for a Reminder System

Challenges and opportunities, regarding responsibility and control in teaching and learning, are different from traditional learning. Crucial step in ensuring successful outcome in e-learning is having a learner accept responsibility for one´s learning, in both knowledge aspect and cognitive abilities which are needed for continuous learning (Garrison et al., 2003). Continuous or routine learning is more difficult for learner to maintain than in traditional learning, because there are no reminders in traditional face-to-face learning sessions. With no reminders (only e.g. deadlines in online e-learning platform, which has to be accessed first in order to reveal this reminder), students can easily put learning aside and engage in other activities, therefore suffer from procrastination. The opportunity of more effective reminder system lies in usage of mobile devices, which will be discussed further in section 3.4 Reminder Mechanism.

2.2 Forming a Habit

The ultimate goal of implementing a reminder application into e-learning strategy should be creation of a habit. With self-controlled learning such as e-learning, the amount and distribution of time dedicated to learning is usually not fixed and is likely to be postponed continuously, ending in procrastination. Solution to this problem can be creation of a habit loop, with help of reminder application. Duhigg specifies that we can create new neurological routines and therefore a new pattern, which will become automatic behavior. Forming a habit loop involves three phases (Duhigg, 2012):

- trigger / cue - this is to be delivered by the reminder application
- habit / routine - desired behavior (in this case generally participation in learning)
- reward - important is that a reward must be immediate after fulfilled learning session

This principle is similar to incentives and rewards in social computing, on workplaces and other areas. Reminders through mobile device would serve as immediate incentive, followed by a small but also immediate reward, e.g. gain of points towards a final score. The immediate nature would solve problem that effort level always drops following an evaluation if the agent views the time until the next evaluation as too long (Scekic et al., 2013). Figure 1 depicts suggested sequence of actions for habit loop in e- learning.

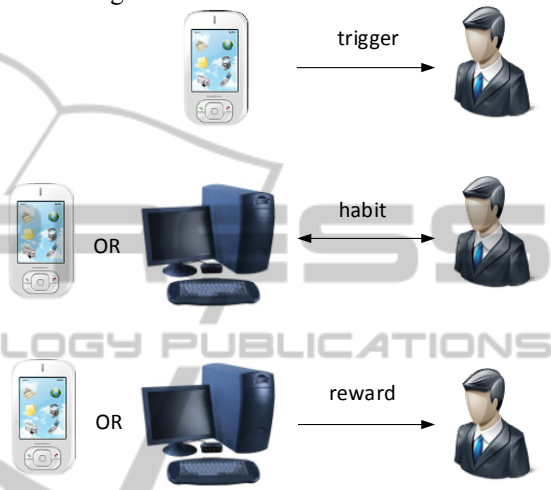

Figure 1: Suggested habit loop for e- learning with use of a mobile device as a reminder.

2.3 Adjusting e-Learning Strategy

There are three components of e-learning - enabling technology, learning content and learning design. Good e-learning is then a combination of technology that works, meaningful content and effective learning design (Fee, 2009). Incorporating reminder system into e-learning strategy would:

- pertain into learning design
- be conditioned by learning content
- take an advantage of mobile technology

Integration into learning design would require careful planning regarding time management, estimated difficulty of learning sections and system of rewards. It would be conditioned by amount, diversity and structure of learning content. The organization of content could be inappropriate for immediate implementation of reminder system and could need restructuring. Mobile technology is a requirement for successful interference into learner´s awareness without need of entering online course or even without internet connection. This is an advantage of application for mobile devices in comparison with web-based application.

3 OVERVIEW OF CONDITIONS

This section includes overview of basic conditions, which are necessary for implementing mobile reminder system to e-learning course. The reminder application is primarily aimed at learners, with a goal to engage them in learning process, but can also be modified for active usage by instructors, e.g. for inspiring them to continuous improvement of learning content. Basic scenario discussed in this article is concerned with only learners as users.

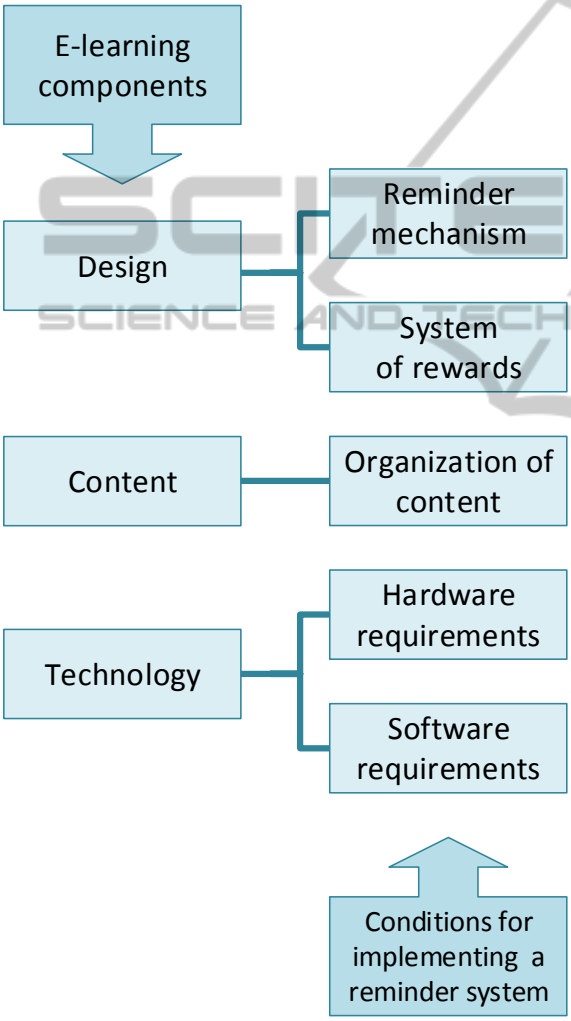

Figure 2: Requirements for implementing mobile reminder system in relation to three components of e-learning.

3.1 Hardware Requirements

In order to use advantage of mobile device, student has to own such device. This should be less and less pressing issue, as an adoption of mobile devices such as smart phones or tablets increases. In year 2011 was surveyed that 35 percent of Americans own a smart phone (Pew Internet & American Life Project, 2011). However, implementation of reminder system into e-learning still has to be unobtrusive. The student must be able to perform the course without reminder application and rewards, which should be compensated in other form. Web-based reminder system could be proxy for mobile reminder system in a case of its absence.

3.2 Software Requirements

New software is needed for implementing mobile reminder system into e-learning design. Android and iOS applications for mobile devices are not compatible, therefore two version of the same application should be created, one for Android platform and other for iPhone. The application should cooperate with existing e-learning system / platform / portal, so it can gather and update required information for correct functionality of mobile reminder application.

The application should be able to use this data along with custom data added by user, in order to manage its user´s schedule of learning sessions and provide suitable reminders. These reminders should be both visual and audible on mobile device.

In order to connect reminder application to particular user´s account in e-learning system, a connection needs to be established. Parameters of this connection should arise from implementation details, user should be prompted to provide these parameters and of course security issues need to be taken care of. Transfer of data from e-learning system to reminder application could proceed by wireless network without user´s intervention.

3.3 Organization of Content

The course organization should be adapted for use by the reminder system. Ideally, proportional distribution of learning content should be ensured. This includes especially:

- consistent form of individual learning sections
- approximately equal estimated time required for individual learning sections
- approximately equal difficulty of individual learning sections

Proportional distribution of learning content should provide for equally distributed rewards and also easier evaluation of learners. More importantly, structuring learning content into equal sections makes planning of learning process much easier. This arrangement also justifies usage of reminder

mechanism. This is because equally time-demanding and effort-demanding sections can be included into schedule as the same activity and can create a habit.

3.4 The Reminder Mechanism

Reminder should be activated according to preferred initial schedule settings. If user does not enter learning course in defined time interval, reminder should be activated repeatedly. There should be also possibility for user to deactivate repeating reminder, but only if he provides alternative time for it. In this action the learner creates a commitment, which he should try to fulfill.

Initial settings of reminder application would be defined by user, allowing for user´s individual time schedule. Furthermore, reminder application should be able to analyze user data concerning time schedule, which are expected to be developing continuously, and adapt its reminders appropriately. Adaptation can be carried out in reaction to start of previous learning session. As previous appropriate learning session can be taken:

- learning session performed on previous day
- learning session performed on previous working day (in working days) or weekend (on weekends)
- learning session on previous day of the week

Preference of individual methods is dependent on existing weekly schedule of learner, and therefore should be part of initial settings. More complex algorithm is also possible, which would decide most suitable method on the basis of continuous development regarding starts of sessions.

There should be also mechanism for deciding successful fulfillment of learning session, and deactivating current reminder. Frequency of reminders is expected to be on daily basis, but could be also adjusted in initial settings or automatically generated based on previous successfully performed learning sessions.

3.5 System of Rewards

System of rewards refers to the third phase of habit loop. Rewards have to be immediate and satisfying. Immediate rewards are usually much simpler to implement in online environment than in traditional environment. When learner interacts with e-learning course, he can get immediate response from server, based on performed activities. If learner accomplishes desirable activity, e-learning system can immediately deliver reward.

While implementing reminder application, reminder should lead to desirable activity, and this activity should result in appropriate reward delivered to learner. This activity can be specified by:

- generally amount of time actively spent in learning session (technique for measuring activity must be further specified)
- fulfilling a daily quota, specified by learner earlier (technique for measuring activity must be further specified)
- completed learning section or tasks (conditions for completion must be specified)
- accomplishing required learning sessions and tasks before defined deadline

Immediate rewards can have various forms, e.g.:

- gain of points towards a final score, which has influence on learner´s evaluation
- accomplishment badges, which can be visible to other participants of the course, therefore supporting competition

If learning content is proportionally distributed among learning sessions and appropriately designed and structuralized, rewards can be also proportional and expectations therefore stable. This consistency also contributes to creation of a habit.

4 DATA PROCESSING

Several ideas from previous section will be explored in greater depth here, regarding especially data and its processing. This relates also to communication with e-learning system and gathering data from learner in the reminder application.

4.1 Data from an e-Learning System

The mobile reminder application should be able to gather data from relevant e-learning system in order to function properly. This data includes:

- currently enrolled e-learning courses
- available learning sections (and subsections) in each course
- estimated required time for individual learning sections (and subsections)
- deadlines scheduled by e-learning system

The list contains only essential components and can be further developed in case of extended cooperation of the application and e-learning system.

4.2 Data Obtained from User

In order to adapt the reminder application to individual time schedule of learners, another set of data is needed from learner. Learner is a sole user of

this application in context of this paper. This data are to be obtained in the mobile application settings. Learner should be prompted to provide this data before using the application. This data can include:

- preferred time of the day for the reminder (can be same for every day, different for working days and weekends, or different for every day)
- enabling only particular days of the week for reminders, therefore establishing expected frequency for learning sessions
- possibility of dividing daily learning session into more parts (and reminders)
- preferred time quota for learning per day / week, in other words length of daily / weekly session, in single number or range
- custom deadlines defined by learner

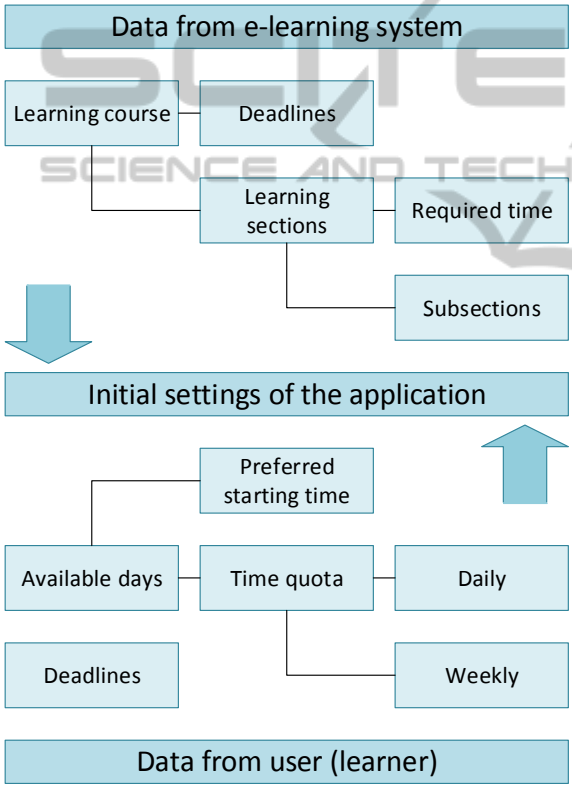

Figure 3: Initial settings of the application.

4.3 Initial Settings of the Application

Data acquired automatically from e-learning system and manually from learner should form initial settings of the reminder application. The application should have then implemented algorithms for suggesting individual learning plan with relevant distribution of reminders. Based on available data, learner could choose between different learning plans with relevant algorithms.

These learning plans can be changed or adjusted later either automatically or customized by user. Automatically e.g. in case of diversion from expected values in time spent in learning sessions or in case of change in available learning days. Customized e.g. by choosing another algorithm or inserting a new deadline. Two types of learning plans are proposed as an example.

4.3.1 Minimum Quota with Deadline

This learning plan is based on proportional distribution of learning sessions in every day available till deadline. Proportional implies that approximately the same amount of learning content should be covered in every day. Every day available means every day enabled by learner for learning sessions. Deadline can be official from e-learning system or custom defined by learner. Required values for this plan are: number of learning session and their estimated required time, days available for learning and deadline (official or custom).

4.3.2 Maximum Quota in Minimum Time

This learning plan is suitable for quick learning - for covering the most material in minimum time possible. Required values for computing this plan are: number of learning session and their estimated required time, days available for learning and defined quota for learning per day and per week.

4.4 Runtime Adaptation

At starting the learning session and at ending the session, feedback should be sent to the reminder application from e-learning system. This way, the reminder application can be up-to-date and deliver accurate performance. Information about starting the session would deactivate current reminder and information about ending it would allow computing data about session length and fulfilled learning sections. Information about performed learning would continuously update distribution of learning sessions and also reminders in the learning plan.

More sophisticated version of the mobile reminder application could also recommend alteration of the learning plan. This can be done according to development of learning sessions, preferred starting time of sessions and usual duration of sessions. The application then needs to store user data about past sessions. With data storage and appropriate functions, more complex analyses can be made, which would help learner to distribute reminders more fittingly into one´s schedule.

5 CONCLUSIONS

This paper presented idea of the mobile reminder application for dealing with procrastination in e-learning. Underlying principle for implementing the mobile reminder application was the principle of habit loop, which was chosen as an ideal instrument for dealing with long-term procrastination.

Presented application of habit loop is possible due to pervasiveness of mobile devices and its immediate possibility of interaction. Ideas and possibilities were discussed in relation to this approach. Fundamental requirements were outlined and substantial part of this section was devoted to reminder mechanism and system of rewards. The paper also considers basic schema of data processing in the application. Implementation details were not covered in this article, this will be subject of future studies, as well as refinement of suggested ideas.

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