

DISCOVERING AND USING THE CONTEXT OF DISTANCE LEARNING ACTIVITIES FOR THE DEVELOPMENT OF PERVASIVE LEARNING TOOLS

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Abstract

Over the last few years, there is increasing adoption of distance learning methods in various aspects of education. As part of our research in digital distance learning platforms, we conducted longitudinal observations and a survey on the use of web 2.0 tools in adult education and found that 32% of the students who used such technology, were doing so through mobile devices. Motivated by the students' use of mobile platforms as learning tools, the aim of this paper is to explore the context under which studying takes place for distance learning students, in order to gain a better understanding of existing practices, with a view of supporting and improving learning experiences through pervasive computing. For this, we started a process of collecting qualitative and quantitative data in order to find out more information about their study context. Our findings from the collected data are paired with post-collection period interviews, providing a quantitative and qualitative description of the context under which distance learning takes place.

Keywords: e-Learning, Pervasive Learning Tools, Distance Learning

1 INTRODUCTION

Over the last decade, the Internet has made an indelible impact on higher education by enabling the phenomenal growth of online education. The transformation from the traditional Face-to-Face classroom mode to new delivery methods and platforms (correspondence, Internet-online, one-way, two-way audio and video) collectively known as Distance Education, led some experts so far as to predict that the 'residential based model,' that is, students attending classes at prearranged times and locations, will disappear in the near future [1]. It is beyond doubt that distance education has progressed in concept and practice (to encompass where applicable) from an "anywhere" to an "anytime" to an "any pace" delivery method [2]. The advent of these highly technological methods was not easily accepted by the academic and training communities, which continuously examined, assessed, criticized, hallowed and demonized them. The major concern about Distance Education programs was and is its quality relative to Face-to-Face classroom education in four domains of coursework delivery: student attitude and satisfaction, interactions of students and faculty, student learning outcomes and faculty satisfaction [16]

The platforms used for distance learning, created with web-based technologies, not only eliminate barriers of time, space and learning styles, providing increased access to higher education, they challenge our traditional styles of teaching and learning [3]. One of the most important aspects of online education is how the student themselves perceive the online learning experience [4]. Hence our study was designed to explore how students perceive their online learning experiences with internet-based environments in distance learning.

Our study focuses on Greece and its educational system, as an application domain. As in many European countries, the Hellenic Open University (HoU) was established in Greece in 1992, began offering courses in 1997 and is the only University that formally offers distance education. However, there is an increasing pressure for better support for distance learning tools in traditional courses, partly because of the country's economic situation which has forced many students to take up part-time or full-time employment and even to return to their home cities. As a consequence, distance learning ICT in Greece is shifting from a secondary educational tool to the foreground of education in the last few years.

2 MOBILE AND PERVASIVE LEARNING

Recent developments in wireless technologies and miniaturisation of components have led to the emergence of pervasive computing devices that are embedded everywhere in the environments surrounding us. Most of these devices are interconnected, thus forming a single context-aware system. Examples of pervasive computing applications in everyday lives include smart buildings, smart homes, smart cars and smart cities [10]. Today, pervasive computing is a hot topic in many fields across various disciplines such as mobile computing, artificial intelligence, distributed and embedded systems, agent technologies, communication technologies and human-computer interaction [11].

Recent research in the field of ICT – based education, referred to the use of collaborative web 2.0 tools [5], [6]. However, the evolution of technology is heading towards the use of pervasive computing and mobile devices [7], [9]. Student and teachers increasingly use mobile devices in their daily routine, thus, it is timely to explore the use of pervasive computing as a learning tool that supplements traditional web 2.0 based tools.

Mobile learning, or m-learning, is one of the application areas where pervasive computing has become popular and is currently being intensively researched. Networked mobile devices allow learners to perform cooperative learning tasks in groups. The emergence of embedded intelligence (e.g. smart tags, sensors) has brought forth new forms of learning that have roots in m-learning, namely pervasive learning [13] and ubiquitous learning [14]. Fig. 1 illustrates the different types of learning in the domains of mobility and embeddedness. In pervasive learning the roles of intelligent environment and context sensitiveness are emphasized. The physical environment has a central role as it provides context for learning, content for learning, as well as system resources [15]. In contrast to ubiquitous learning, pervasive learning is less mobile and more connected to a specific context. Compared with other learning environments such as classrooms or field trips, pervasive learning spaces (PLSs) (also known as pervasive learning environments) provide personal interaction between the learners, the environment and the relevant educational content. Furthermore, in properly designed PLSs, learning materials are delivered in a correct format at the right place in right time. PLSs can be deployed not only in traditional learning contexts but also for example in corporate training settings, museums, exhibitions and tourist attractions.

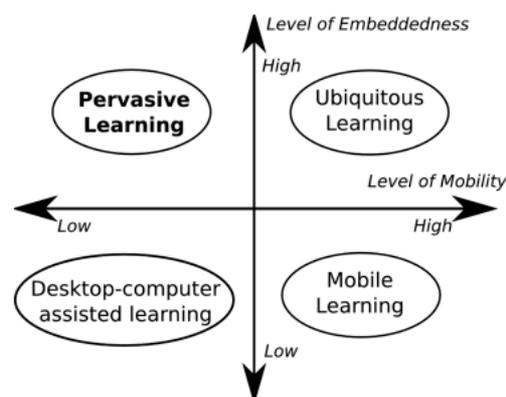


Figure 1. Types of learning [21]

The primary aim of m-learning is to provide the users with access to learning environment regardless of time and location. However to do so, it is imperative to investigate the context under which distance learning activities take place, in order to be better able to support the ad-hoc formation of PLSs for students. In this paper, we attempt to gain insight to the context (environment, location etc.) in which distance learning students choose or prefer to study. The rest of this paper is organized as follows: Section 3 discusses the findings from our initial research in digital learning platform use by Greek students and provides the motivation for our research. Section 4 discusses our methodology for obtaining information on the context of distance learning and also presents the findings from our pre-collection and post-collection interviews, as well as the quantitative results of the data collection. Finally Section 5 presents a discussion of our findings and future directions for our work.

3 PRELIMINARY STUDY

As a basis for our research, we conducted longitudinal observations and a survey on the use of web 2.0 tools in adult education. We developed and deployed a learning platform, which combines web 2.0 tools, and is suitable for the educational process. The platform (named e-kpaideusi) was based on the Open eClass platform, a complete Learning Management System (LMS). Open eClass is an open-source solution offered by the Greek Academic Network (GUnet) to support Asynchronous e-Learning services.

Our platform was deployed for the second semester, in the lessons of the “Technician of Computer and Office Machine” in Public Institute of Vocational Training, in which 16 students were enrolled. These students were aged between 18-29 years old and 31% of them were female. The platform contained the following tools which were used to promote distance learning practices:

- Blogspot
- Wiki
- Bookmarks – Links
- Announcements
- Exchange Files
- Chat
- Exercises
- Projects

Out of all the students, a significant proportion (10) engaged with the platform and made active use of its tools. Although “e-kpaideusi” was not developed for mobile devices, we found that 5 of the students who used it, did so through mobile devices. Amongst other questions, we asked whether students would like to have an application specifically designed for mobile devices and 10 of them responded positively (4 Agree, 6 totally Agree). We also asked them about the tools and functionalities that they would find useful and would like to use with a mobile device. The students’ responses were “Announcements, File exchange, Exercises (short tests for self-evaluation), Blog, Chat, Bookmarks (Links)”.

Content on the platform, such as exercises, materials etc. was provided by 11 tutors who were responsible for delivering the module. We also surveyed these tutors for their opinion. Nine of them think that the platform was useful in the teaching process, but only two used mobile devices to engage with it. In our question on which tools they believe will be useful if the platform did specifically consider use from mobile devices, they answered “Announcements, File exchange, Exercises, Projects, Blog, Links, Wiki, Chat”.

Thus we note that there is significant overlap in the type of tools that both students and tutors believed could be useful for distance learning with the use of mobile devices and considered these findings as a motivation for a deeper investigation in how these might be used.

4 METHODOLOGY OF OUR RESEARCH

4.1 Motivation

Based on our previous findings, we decided to explore distance learning using mobile devices. Distance Learning technologies are expanding at an extremely rapid rate. Too often, instructional designers and curriculum developers have become enamored of the latest technologies without dealing first with the underlying issues of learner characteristics and needs and the new roles of teacher and student in the distance learning process. Little theoretical development or empirical research has examined teaching effectiveness in distance learning. Particularly for mobile device use, which is not well understood under a learning context, we cannot build tools for distance learning without understanding the users’ needs first. To do so, we decided to begin with a group interview of students at the Hellenic Open University.

4.2 Initial Distance Learning Student Interviews

As mentioned above, we chose to interview students, evaluate their experience and gather information about their study habits. To do so we recruited three students of a postgraduate course in the “Engineering of Pervasive Computing Systems”, at the Hellenic Open University. We elected to recruit

from this course, since its students were familiar with the concepts of Pervasive Computing and would be able to provide more detailed commentary in their current experience, versus a projected experience that involved the use of mobile learning tools for distance learning. The interview was in person, lasted 40 minutes and it was recorded.

Formally, each module of the course spans two semesters. Students are provided with the core text books and other related reading material, such as key papers, reports and study guides. They are also given a recommended schedule for studying the course material, which includes submission dates for their assignments. The students can attend 5 class meetings in the academic year, so that they can meet with their course instructor. In these meetings, the instructor discusses aspects that concern the course and gives solutions and answers to questions that arise from the reading materials or the assignments. At all other times, students are provided with access to a web-platform, which contains the study schedule, all digital reading material, an assignment and grading and a forum to communicate with the students and the professors.

The main goals of this interview were to understand how distance learning students perform studying activities. Hence our questions focused on the time schedule, the digital device they used, the location they prefer to study, the cooperation and the meetings they have.

First, we asked them if they follow the recommended time schedule for their study and if that was helping them to organize their time, in light of the lack of weekly contact with the course instructor. Below we list the participant's replies:

"The time schedule does not help a lot. According to this schedule, we have to study a lot during the day. Personally, I spend most of my studying time on the course projects. I am trying to have aims throughout the academic year, depending on my free time."

"The time schedule is very helpful and I am trying to follow it, but it's not that easy because of daily obligations such as family and work. Unfortunately the time is limited during the delivery period of the projects, so I cannot follow it all the time."

"I agree with my colleagues. I am using the time schedule as a guide, but most of the time I cannot succeed. Mostly I am trying to focus on personal goals, hoping I won't stay back and fail in the exams."

As we can observe from the responses that we received, the proposed time schedule has not proved so helpful. Firstly, most of the students choose to have personal aims (since the structure of the course does not provide learning objectives), hoping to pass their exams. Furthermore, the students are frustrated and not certain about their progress in the courses, thus they rely on the assignment grades as an indicator of progress during the year. Of course, assignments cover just parts of the reading material and not the whole course, hence a tool that allows students to see learning objectives and monitor their progress could be helpful.

In our second question we tried to find out whether engagement in the course through social networks could provide extra help in communication and information. We suggested for example a Facebook Page to post news and to exchange their opinions, or follow big companies in their field. All of the participants responded negatively, believing that the portal they use now, provides all the help they need on communication. One of them, also said, that he do not want his social life involved with his professional life.

In our third research question, we sought to find out whether the students are using electronic devices or not, while they are studying. The replies we got from this question were:

"I print whatever I need, because I write down comments. Rarely I use the book that the university provided and if the material (e.g. book) is digital, I use my tablet."

"I don't print, I download from the internet the material I need. I read it on my computer and highlight or create comments on the document using the document editor tools."

"I am printing everything I need and writing my comments there. If I use an electronic device that would be my computer."

These answers were somewhat obscure, thus we focused our conversation further on the use of specific device such as mobiles and tablets. We found out that participants believed the use of such devices is difficult for studying. Furthermore, most of the students prefer to print their material and not use a digital device for that purpose, despite the fact that these participants are all Computer Science graduates, who should have been more inclined towards using technological aids. Some mixed use of

mobile and desktop computing was mentioned, so we believe that a responsive tool that can be deployed on a computer and a mobile device is desirable. This tool should provide all the main functions they need in order to study easily, depending on the platform that is being used to access it.

Beside the type of the preferred device, we asked them about the environment they like or prefer to study in. All of the students answered that they only study at home. They excluded the possibility of studying outdoors or in public transport. We asked them why they do not prefer outdoors places. They insist that they do not have the tools to be easy. Also they said that most of the literature is in English therefore they cannot study outside because of loss of their concentration.

We were also interested to know if they cooperate with each other and how they communicate with their instructor, what tools they used and if they have any problems.

“With our professor, we communicate through e-mail. About the collaboration we have a forum, which allow us to discuss some issues.”

“With each other we do not have the intimacy to communicate beyond the forum, like Skype or directly by phone. We are limited to the forum for our collaboration.”

“The lessons and the meeting are organized in a format that do not allow the development of interpersonal relations between us, so as to acquire the intimacy and to communicate synchronously. The meetings through the year last four hours each and require constant attention, we do not have the time to get to know each other. Thus the only tool we can use is the forum.”

We note here that the students highlight a significant issue in distance learning, the lack of opportunities to form social bonds with other students and to engage in learning activities which would be mutually beneficial. This problem is attributable partly to the structure of the group meetings, but in general, this issue is endemic in distance learning institutions because of the lack of co-location opportunities. A lack of social interaction is playing a significant role in such shortcomings [20]. Online learners complain of the psychological distance they have to overcome [17]. Isolation, disconnectedness and loneliness they feel hinder them from engaging in the class activities [18] and as a result they lose their academic interest and motivation to continue to study, leaving only minimum number who completes the course [19]. They feel satisfied by the level of communication with their instructor through e-mail but could benefit from more collaboration with their colleagues. The forum is a necessary tool but does not allow for direct interaction and because it is seen by everyone, communication is limited to formal language and focused comments, inhibiting the formation of social bonds.

Finally we asked them about the meetings they have during the year. The meeting is a chance to meet the professor and the colleagues, to discuss with them, to exchange aspects and to solve any issues. In particular, we wanted to know how they organized the questions they have before the meeting, the answers and all the information they gather during the meeting, and the conclusions and notes they have after the meeting. They told us, that a tool to help them with these would be very much appreciated. They do not have a way to exchange their opinion and the feedback they gather with the other students. They believe that the perspective of each person is different and a tool to combine and permit the discussion about the issues that showed up in the meeting would be helpful. Such a tool for online communication and collective note-taking during the meeting would help not only the students in, but also the students that they do not manage to attend a meeting.

The interview provided some useful feedback on the experience and needs for distance learning students. In summary, we found that students needed further support in understand the learning objectives and progress in the course, tools that provide them with better communication and social bonding opportunities and finally tools that allow them to annotate digital or other material and share these notes and thoughts with the rest of the class. We were unable to get better insights into their studying environment and factors that inhibit the use of mobile devices, so to address the first issue, we proceeded to collect more data about the environments that students actually do their studying in.

4.3 Second step: Real-time Data Collection

We started a process of collecting data in order to find out more information about the study environment for the distance learning students. To collect this information, used the Sensr platform to provide participants with a mobile data collection interface that uploads data to a central database. We asked our participants to report on four basic types of information: The main electronic device used to aid study (Desktop, including laptops or Mobile, including tablet), any other study material they used

(free text entry) the mode of study (alone or in collaboration with others), their location (Home, Work, Other) and duration of the study period (<30 mins, 30-60 mins, >60 mins). We also asked them to upload a photo showing their studying environment. We sent emails to several HoU instructors and asked them to forward our call for participation in the study to their students, however we were only able to attract 3 students (2 female). The collection period was 30 days. In total, we managed to collect 34 entries.

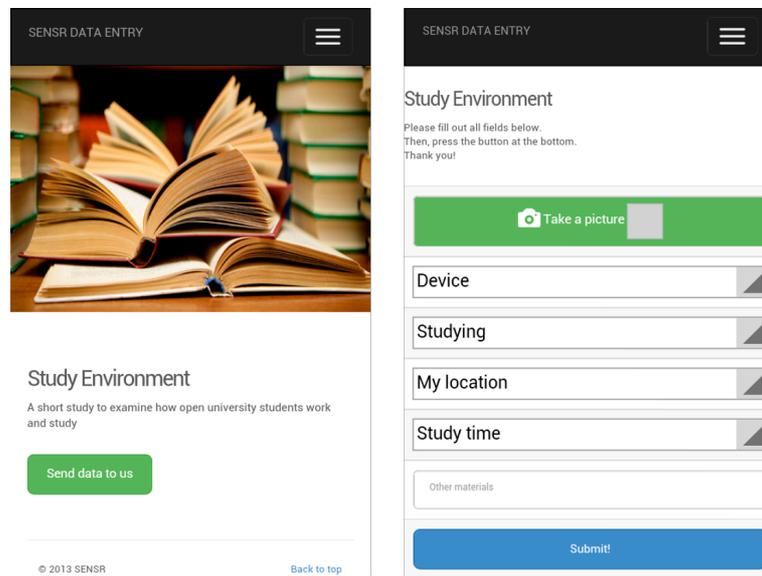


Figure 2. Screenshot of the first page and the data students have to send its time

The following section describes our findings from these collected data. Firstly, we look at the type of device used during the study session. Fig. 3a shows that participants seemed to use their Personal Computer quite often (65% of the sessions) while only 6% of the sessions included use of a mobile device. A significant number of sessions (29%) did not involve any of the options and participants relied on textbooks or other printed material.

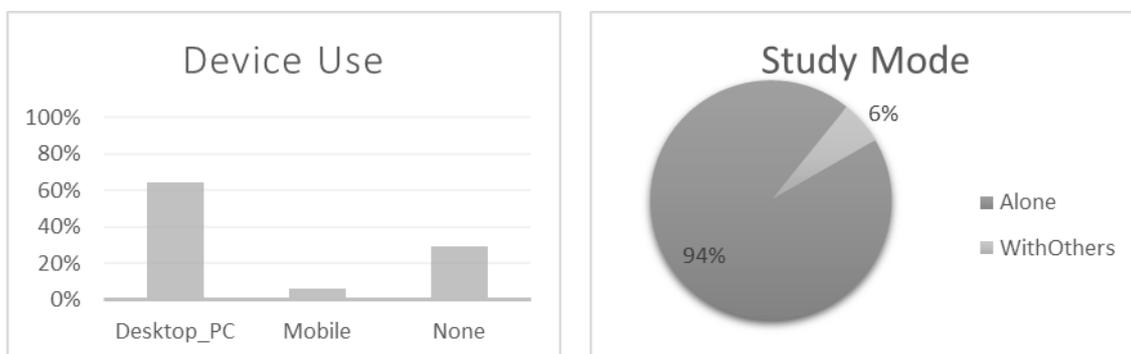


Figure 3. a) Type of device b) Cooperation

Participants also indicated that the large majority of their study sessions were solitary and did not involve collaboration (either in person or remote) with another student, verifying the comments obtained from the pre-data collection interviews. Another data type we collected was the location where study sessions took place. As can be seen in Fig. 4a the majority of the sessions took place in the home environment of the students (94%), but there was some activity that took place at work (6%). None of the participants indicated studying in “Other” locations (e.g. libraries, cafes, parks etc).

In terms of the duration of their study sessions, (Fig. 4b), we see most of the participants prefer medium (32%) and long sessions (56%) to study, while only 12% of their sessions were indicated as short in duration.

Finally, we provided a text area where participants could freely enter a description of the type of learning materials they used during the session e.g. the course textbook, research papers etc. (Fig. 5). The most common answers were Book (55%), Papers (40%) and their own notes (4%).

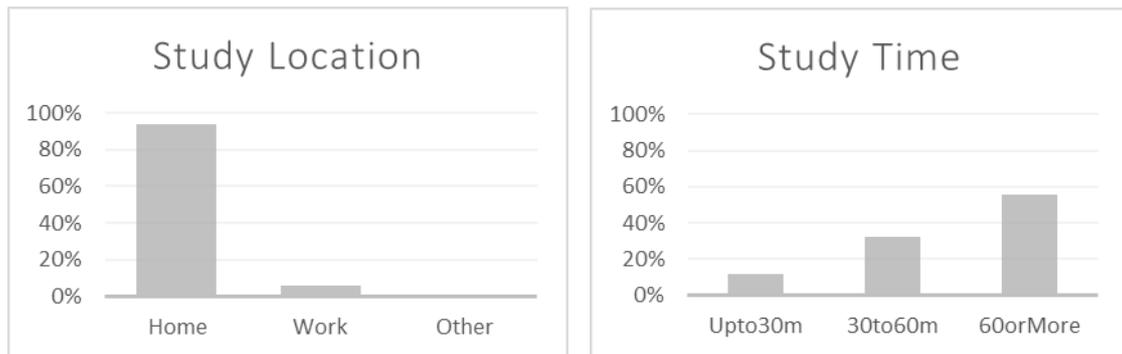


Figure 4. a) Study Location b) Study time



Figure 5. Learning material they use

4.4 Last Step: Interview the participants of data collection

To delve deeper into our research, after the data collection has finished, we examined the results and we decided to pair them with post – collection interviews, providing a quantitative and qualitative description of the context under which distance learning takes place. We invited all of the students that took part in the data collection for an interview. Three students responded. This time, the interviews were done on a one-to-one basis over Skype and lasted 45 minutes each. Our questions focused on the four basic vectors of the data collection (device, cooperation, location and time) but there was also time provided for an unstructured discussion.

Device

We asked participants if they selected the mobile device option during the data collection process. Depending on the answer, if it was positive, we asked them for which type of learning material they used a mobile device. Below, we list the participants' replies.

"I have used the tablet a lot of times. I use the digital version of the book and papers in pdf format."

"I did not choose mobile device, because I have presbyopia and I can't read in a small screen display."

"I prefer to use my mobile device mostly for emails and to communicate with my colleagues."

After that, we asked if they thought that the use of mobile devices in their education is a good idea. All of them answered positively. We then continued with further questions about mobile devices, as outlined in Table 1.

Table 1. Specific questions for hypothetical use of mobile devices.

1. Which format do you believe that course material in mobile devices should be?

"I think an application designed for mobile devices, should display the course material in pdf format and also give the option to the user to select what to view. For instance, if there is an image in the content, the user can toggle its appearance."

"I believe pdf and text are the appropriate type of content that a mobile device should use. Maybe some videos from our professors"

"Beyond pdf format I think we can have information about the course and updates about the course material. I can't think of something else."

2. How long do you think that an activity done through mobile device should take?

"If the activity has to be done only through mobile device, then definitely I don't want it to take too much time."

"I prefer small sessions."

"Definitely I prefer small sessions. I can't use mobile devices for long time."

3. Do you think that a mobile platform is more suitable for providing course material or as a study management tool (e.g. following your progress, communication etc)?

"Is suitable for both but if I have to choose, I think for course material."

"I think a mobile device is suitable for communication and not course material."

"Both, but if I have to choose I think it is more suitable to provide communication with other colleagues or with our professor."

We observe that all students exhibit a general positive attitude towards the use of mobile devices while they are studying, provided that there will be an application specifically designed for mobile devices and will provide all the necessary tools they need in order to study properly. Furthermore, we found that they do not prefer to use mobiles for course material, but to communicate and help them to organize their courses. They believe that a mobile learning application might not be a crucial tool for their studies but they could see it adding value as an additional tool.

Cooperation

As stated by the participants, students usually do not collaborate with others for during their study sessions. All three students told us that they found it too difficult to cooperate, not only because of the distance but also because they don't know each other. Specifically one of them told us that the only communication he has with others is about assignments, but even then it is very difficult. Another student told us that she does not prefer to collaborate because she is afraid that collaboration might be considered as plagiarism, so she prefers to do it alone. Furthermore, a factor that hinders collaboration is that because of the varying personal lives of students, their free time slots do not often coincide. This is a reasonable explanation but we believe that a tool that facilitates cooperation synchronous or not, would add further value to the student experience.

Location

We showed participants our statistical analysis result concerning studying location (Fig. 4a) and asked them to elaborate on reasons why they prefer to study mostly at home. With regard to outdoor environments, all the responses resulted in the same explanation, i.e. that they cannot focus on the work that should be done while they are outdoors. As far as studying in their work environment, all of them told us that they do not have the time required to study. One student noted that he uses his tablet while on a trip, e.g. during a flight, but he does not choose to study during that time. He explained that to use the tablet for studying, he has to transfer to it materials that he chooses from his personal computer. This material has to be compatible with the device's in-built applications, hence he is mostly restricted to PDF files or has to convert any other format to PDF before it can be used on the tablet. The other two, stated that if there was an application designed for mobile devices, they would use it in their trips or daily transportation. That again gives us the conclusion that an application designed for the courses in distance learning is necessary.

Time

Finally we asked them about the duration of the study sessions, again highlighting the fact that our collection analysis showed a strong tendency towards medium and longer study sessions. The replies we got were:

"The time I can study is limited. I have a schedule and the sessions I pick are long and mostly in weekends"

"The sessions I prefer to do for my study were 6 hours plus, due to the difficult field I have selected."

"We have big projects, so the sessions I choose are long. I want to work the project and have it ready before the deadline. My daily routine has short breaks throughout the day and it is not easy or helpful studying during these breaks."

It seems that study session duration is linked to the nature of studying activities and because our initial interviews showed that students tended to concentrate on assignments rather than directed reading, longer sessions are necessary in order for them to be able to accomplish significant chunks of work at a time. An opportunity seems to arise here in terms of helping students take advantage of small breaks or gaps in their daily schedule. A mobile learning assistant could help them access self-contained pieces of reading, or quick self-assessment exercises that do not require a long session, thus helping them to cover more aspects of the study schedule than they currently do.

5 CONCLUSIONS

To summarise, our work uncovered several issues that prevail in the context of distance learning studying sessions. Firstly, students note a lack of ability to monitor their own progress, particularly because their only indicator is performance during assignments and hence it is not clear to them how reading or engaging in other self-assessment activities advances their understanding or progress during the course. Students are also very solitary in their activities. Because of the lack of opportunities to meet up and socialise with other students, their experience is very personal and seldom shared with others. While this may work well for some, the exchange of ideas and experience with peers is a crucial part of learning, which is not currently addressed in distance education. We saw that students seldom engage in opportunistic learning activities, preferring to concentrate their study in longer sessions. This behaviour is partly attributable to the focus on assignment work and aggravated by the availability of material that could be consumed or engaged with in a mobile context (e.g. most of their reading is done from paper books). Because of this behaviour, students also tend to seldom employ mobile devices during their learning activities. They do, however, consider mobile devices to be useful as supplementary tools that help them organise their study or manage communications. They also see potential in the use of mobile devices for the delivery of learning material, which, however, they feel must be appropriately formatted for presentation using these devices.

Our work highlights several aspects for improvement in the domain of distance learning. Firstly, there is an obvious need for better semantic modelling of the course learning objectives and a mapping of how activities, materials, assignments and other related concepts that the student engages with, address the learning objectives. If such a semantic model was available, a pervasive learning assistant might be able to select appropriate activities for a student to carry out, given their current context. Such a system would also be able to monitor student progress and communicate it to them more clearly, as well as to provide an overview of the whole class progress to the instructor.

Naturally our findings present the result of a preliminary investigation into the issues involved with distance learning and the opportunity for pervasive learning space to address these. We are in the process of collecting further qualitative and quantitative data from distance students in various backgrounds and hope to be able to solidify our preliminary findings based on these. At the same time, we are also in the process of semantically modelling a real distance learning course and are developing a platform to accommodate these semantic models, so that we can provide an intelligent pervasive learning space for multiple platforms in the near future.

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