Students' Perspectives on Utility of Mobile Applications in Higher Education

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Abstract. Use of Information and Communication Technologies (ICT) in pedagogy and learning in higher education supports the concept of Technology Enhanced Learning (TEL). Mobile devices and applications with educational purposes are part of using online ICT and facilitate autonomous learning in education. Using mobile applications for education has significantly improved in the last few years. However, there is still a gap, in which this concept is still not widely known and frequently experienced by learners. As a part of supporting TEL in higher education and filling this gap, the department of Computer and System Sciences at Stockholm University in Sweden is planning to develop a mobile application for the SciPro system. SciPro is the computer-mediated communication platform to support enhancement of thesis quality and facilitate autonomous learning in higher education, at both Bachelor and Master levels. This study aims to investigate and evaluate learners' perspectives about utility of mobile applications in higher education and specifically to support SciPro functionalities. Almost 95% of the respondents use mobile applications for higher education and believe in the utility of mobile applications for supporting learning in higher education. This is while there are a few respondents (less than 5%), who do not fully share this opinion. More than 70% of the respondents think that a SciPro mobile application will add value to their thesis process. Even though it may not directly affect the speed and quality of the thesis, it will increase mobility, availability, and flexibility of accessing information and resources in SciPro.

Keywords: Technology Enhanced Learning (TEL), Information and Communication Technologies (ICT), Mobile Application, Applications, Learning, Higher Education, Thesis Process.

1 Introduction

Technology Enhanced Learning (TEL) is a concept formed and developed from using Information and Communication Technologies (ICT) in pedagogy and learning. Appropriate use of online ICT for mobile devices and applications facilitates autonomous learning in education. Most of the applications, which are software programs for smart phones, tablets, and other hand-held devices, are designed narrowly for specific

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purposes. There are several applications with educational purposes, which are developed to facilitate autonomous learning in higher education. However, this number of applications in comparison to the total number of existing applications for mobile devices is still too low. Furthermore, with the intuitive nature of application development for mobile devices, applications are mostly developed toward parent-child anticipations for children rather than educational purposes for learners.

On the challenge of using ICTs to support TEL, a better connection between 'technological' and 'pedagogical' perspectives is required [1]. As a part of supporting TEL, the Department of Computer and System Sciences (DSV) at Stockholm University, in Sweden, has developed a computer-mediated communication (CMC) platform called SciPro [2-8]. SciPro is developed to support the enhancement of thesis quality and to facilitate autonomous learning in higher education. As a complementary tool for improvement of learners' interactions, learner-learner, learner-content, and learner-instructor interactions, as defined by Moore [9], a mobile application will be developed for SciPro to provide further support for learners.

In learning style, there is a big transformation from traditional courses to graduation work for students, from focusing on information processing in courses, students are in the graduation work expected to focus on knowledge creation. This new learning style includes mastering independent thinking, test and redo, defending and in-depth argument for the work conducted [10, 11]. The student who is working on a thesis is in many respect facing the same opportunities and threats as a distance student, with similar barriers from completing the studies [12]. Therefore the experience of successful strategies for distance learning may be successful also in thesis work. Utilizing the successful solutions of on and off campus settings [13] the proposed system support in this work may reduce these barriers for the students.

1.1 Mobile Computing in Educational Context

In order to propose the priority for developing mobile applications to support the thesis process, there is a need to investigate the role of mobile computing in education. A study of the use of mobile learning Kukulska-Hulme [14] lists some 18 uses, from motivating to strengthening ownership of learning, that are particularly suitable for mobile use. From this list we find five that would be of special interest to pursue as candidates for the first version: alerting, rapid response, information gathering on the go, improved accessibility and personal learning management. The study arrives at three keywords for user benefits: portability, connectivity and convenience [14]. When discussing *usability*, it is often focused on a task the user intends to perform. Transformed to the educational context, this would be equivalent to tasks like studying a material, taking notes, writing a report, communicating with teachers and students. In the educational setting the act of learning may not be as easily broken down in tasks, as each of these may consist of several different actions that are highly individual and dependent on the specific context [15].

One of the objectives of the SciPro system is to reduce barriers for students in completing their theses. There is also the assumption that working with your thesis project

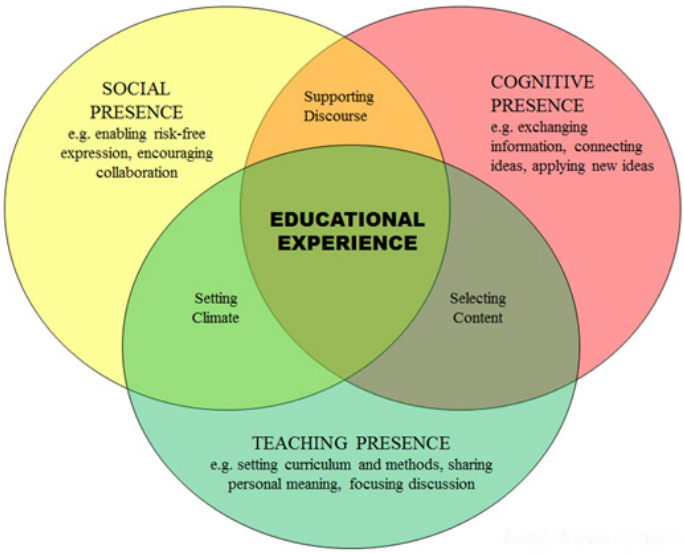

Fig. 1. The Community of Inquiry Model (Source: Garrison, Anderson & Archer [16])

course is in several aspects similar to being a student in a distance course. The Community of Inquiry Model in Figure 1 above proposes some areas that can be utilized to improve the education experiences for students and thus reduce the barriers to study. Anderson takes the approach that social presence is an appropriate way of improving the experience [17]. One of the features mentioned by Anderson is notifications, as this enhances feedback and presence. This is what is specifically taken into consideration in this study to investigate students' perspectives toward *utility* of mobile application notifications. When discussing "*utility*", it refers to serviceability, applicability, appropriateness, and advantage of using mobile applications, to investigate students' perspectives for using applications in higher educations. It may not be obvious what device to use for mobile learning, as most learning activities seems to take place on devices that are not designed with learning in mind [15]. What seems to be important is that the learning content must meet a minimum standard and function adequately [18].

1.2 Aim

The SciPro system is a web-based system to improve the supervision and management of graduation work as well as support the student in completing the thesis work. Some students have expressed a need for a mobile application for some core parts of the system. Our aim with this study is to ascertain if this need is perceived by a larger group of students and, if so, what would be the appropriate functions to include in the first release. The study is intended to gather information on *what* to do rather than *how* to implement the functions, which would require further investigation to get specific data on the preferred design of the specific application. Part of the investigation is to propose one or more suitable models for describing *what* to do and by a survey establish *why* this would

be of use for the students. The function of notifications in the form of e-mail is already part of the system; this study is not about finding new notifications, but to provide insight into what notifications are suitable for inclusion in a mobile application.

The significant criterion for devices and applications in education is the values they add to the learning process. Evaluation of learners' perspectives provides valuable information about what matters, which help institutes gain better understanding about requirements and useful services [19, 20]. Hence, this study aims to investigate two main scopes by evaluating students' perspectives: 1) utility of mobile applications in higher education, 2) utility of specific information and notification for SciPro mobile application to provide further support for Bachelor and Master students' thesis work.

Moreover, the objective of this study is connected to different presences of educational experiences, illustrated in Figure 1. As illustrated in the left-hand side's boxes in Figure 2, SciPro provides different functionalities to support the thesis process and

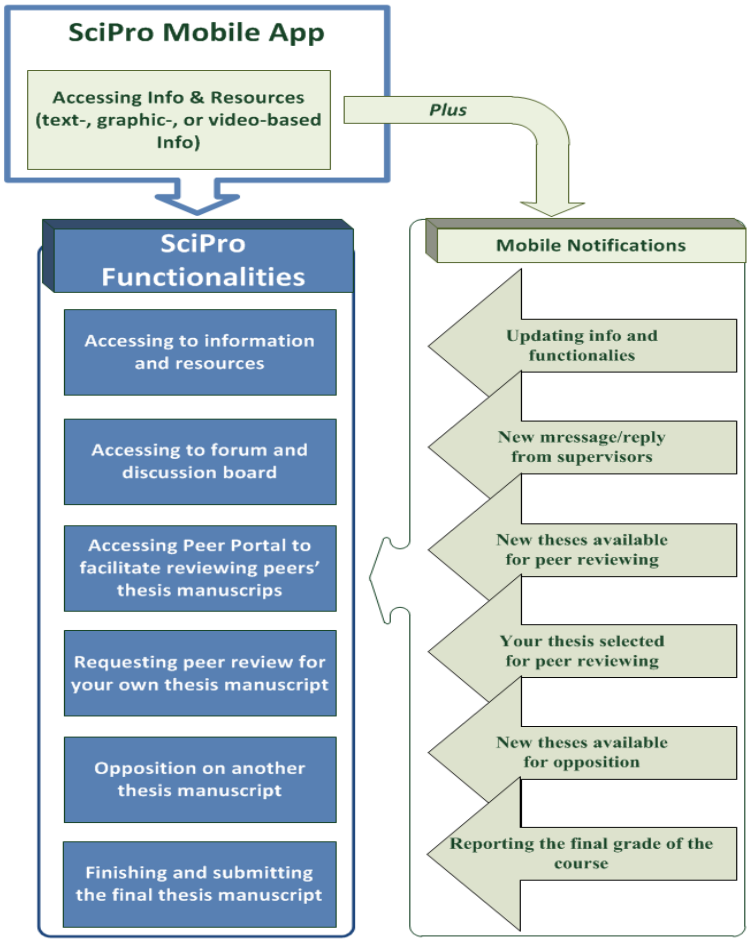

Fig. 2. SciPro functionalities and possible SciPro mobile Application support

enhance the quality of theses. SciPro mobile application would increase mobility, availability and flexibility of accessing existing information and resources in SciPro. Moreover, as illustrated in the right-hand side of the figure, providing notifications in SciPro mobile application would be connected to different SciPro functionalities as additional support for learning and communication.

The question on what environment to implement the mobile application in is important as the first version should reach as many students as possible. Worldwide and in Europe the iOS and Android are the leading environments for mobile applications with approximately 40% market share each. In Sweden there is a different situation where iOS has approximately 65% market share, almost double the android environment according to StatCounter (http://gs.statcounter.com/#mobile_os-SE-monthly-201205-201305-bar). In the targeted age group around 80% own a smart phone in Sweden, after the age of 45 the penetration falls sharply, which is significantly more than the penetration of tablet computers for the target group[21].

More specifically, in this study, the utility of the issues illustrated in Figure 2 are investigated from learners' perspectives, besides connecting them to the Community of Inquiry Model described by Garrison et al. [16].

2 Methodology

Survey is a data collecting instrument, which facilitates collecting respondents' reflections to shed light on a specific case [11]. Typically, conducting a survey entails collecting data at a particular time interval with the aim of describing the existing conditions, developing new conditions to compare to the existing one, or determining the relationships between events [11]. Conducting surveys by using questionnaires may be differentiated in terms of the scope of the study. In this study, the purpose of using a questionnaire (see Table 1 below) is to evaluate users' perspectives regarding the utility of mobile applications in general, as well as utility of SciPro mobile application for the thesis process. The target group is students at DSV, at both Bachelor and Master level, who are working on their theses by using SciPro as a CMC platform in their thesis process.

The questionnaire includes 12 questions in English, either Yes/No questions or multiple-choice questions with three alternatives: Yes, absolutely; Doubtful; No, not at all. Additionally, motivation boxes are added to five questions, for voluntary explanations about the selected options in which respondents have the possibility of motivating their choices. This option is given in order to get further reflections on the questioned issues by enabling respondents to write about the details of what they think, in their own words. The questionnaire is developed by considering the following criteria discussed by Cohen, et al. [11]:

- Using concise rather than long questions to prevent confusion. However, sufficient information and required explanation needs to be provided to make it easy to understand the points.
- Using familiar words helps increase relevance of the answers and helps respondents answer the questions correctly.
- Refraining from leading respondents' mind in a way that suggests an ideal answer to choose.
- Being simple and avoid complex and ambiguous words and sentences to prevent misinterpretations.

The twelve questions (Table 1 below) are developed based on the criteria above, in addition to what Anderson discusses about notifications [15] and what Garrison et al. describe in the Community of Inquiry Model [16]. Furthermore, motivation boxes are complimentary data collection techniques for eliciting detailed information, social objections and further suggestions. This will increase the validity of the study, since there will be reasoning behind the chosen options by the respondents.

Table 1. The questions respondents where asked to respond to

Q nbr	Question	Answer options
1	Do you use any mobile devices (i.e., smart phone, tablet), which support online applications?	Yes/No
2	Do you use one or more application regularly on your mobile device?	Yes/No
3	Have you ever used any application for educational purposes?	Yes/No
	If so, which application?	Open
4	Do you think mobile applications are useful for supporting learning in higher education?	Yes, absolutely/ Doubtful/ No, not at all
	Please motivate your answer (voluntary)	Open
5	Would an online mobile application for SciPro help you to speed up your thesis process?	Yes, absolutely/ Doubtful/ No, not at all
	Please motivate your answer (voluntary)	Open
6	Would an online mobile application motivate you to have more communication with your supervisor, ex., to get notifications from them when they post messages in Forum?	Yes, absolutely/ Doubtful/ No, not at all
	Please motivate your answer (voluntary)	Open
7	Would an online mobile application motivate you to have more peer communications with your fellows, ex., via forum, chat or email functions?	Yes, absolutely/ Doubtful/ No, not at all
	Please motivate your answer (voluntary)	Open
	Would an online mobile application be useful for you to get notice of ...	
8	... when your supervisor post a new message or answers your questions in the forum?	Yes, absolutely/ Doubtful/ No, not at all
9	... when a new thesis manuscript is uploaded and available for peer reviewing in SciPro peer portal?	Yes, absolutely/ Doubtful/ No, not at all
10	… when your thesis manuscripts has been selected by another student to be peer reviewed?	Yes, absolutely/ Doubtful/ No, not at all
11	… when there is a new thesis manuscript uploaded and available for opposition?	Yes, absolutely/ Doubtful/ No, not at all
12	… when there is an update about SciPro resources or a new functionality available for SciPro?	Yes, absolutely/ Doubtful/ No, not at all

3 Findings

Survey Procedure and Background Data. The questionnaire is sent to the DSV students with active thesis projects during the time interval of January 1, 2012 and April 1, 2013. The questionnaire was open for receiving answers between April 12 and 19, 2013. There might always be additional info by more respondents. Nevertheless, the result of the survey was quite similar with no radical changes after a certain number of responses. Even the named applications used by the users were mainly repeated. The age interval of the respondents is between 21 and 50, with 58% male and 42% female. Based on question one and two, 95% of respondents use mobile devices (i.e., smart phone, tablet), which support online applications, and they use one or more applications regularly on their mobile devices. Based on question three and four, more than half of the respondents have used at least one application for educational purposes. Below, there is a list of applications that respondents report that they have used for educational purposes. Some of these applications have been mentioned by more than 20 respondents.

- Various internet browser applications, such as Safari.
- Various language support applications, such as dictionaries, word translators, languages learning applications, Kindle language, and Babbel.
- Google applications, such as Google translate, Google drive, Google droid (Scholar Droid), YouTube for watching lectures.
- Specific DSV applications, such as First Class and webmail.
- Applications for information/file saving/transferring, such as various E-mail client services, Dropbox, Notes/memo, Voice memo, ToDo, Evernote, Photos as a note taking tool in the lectures and seminars, calendar for daily scheduling and academic appointments.
- Additional applications, such as Wikipedia, GRE Preparation, 1Password, GoodReader, Adobe Acrobat Reader (PDF reader), video player (for DSV or other recorded lectures), iTunes U (for university lectures).

Mobile Application Utility (based on question five to twelve): more than 80% of respondents think that mobile applications are useful for supporting learning in higher education. Many respondents believe that the SciPro application would be very useful. This is while only one third of them think that SciPro mobile application would help speed up the thesis process, or support student-supervisor or peer-peer communication. The following issues are what they mentioned as significant benefits of using mobile applications, in general, as well as specifically for SciPro in the thesis process. As mentioned by a respondent, "*a major advantage of mobile applications is its mobility and the possibility to access data at any time and any place*". In the thesis process in higher education, this could mean that students can use mobile applications to check their studies' status and information on the way from or to campus. Mobile devices are often carried by users, which makes it easier for them to engage in learning everywhere they go. The applications would provide great opportunities by providing access to schedules, course information, library indices, etc.

Using applications for educational purposes supports learners to have universal access to the existing information, save time or using their time efficiently, collaborate with their fellows, and enhance communications. Mobile devices and applications can be useful for higher education to the same degree as for basic education. Its flexibility makes the process of learning and updating faster for the learners. The mobile applications help getting information faster besides having all data with you all the time and being accessible any time as long as the device is with you, which is the case with mobile phones. These factors are useful to facilitate an increased educational experience as they can be used to increase the various forms of presence as discussed by Garrison et al [16] in the Community of Inquiry Model for education, see Figure 1. As mentioned by many respondents, some applications are excellent to facilitate reviewing, updating, modifying, responding and communicating in critical situations, when immediate intervention is needed.

Like any other useful mobile applications, SciPro application would also support accessing important school information, effectively replacing PCs. This is while another learner mentions "*Possibly useful as a supplement, but not as a substitute*". Most likely as any other ICT in TEL, this application would also have significant features for enhancing the learning process. "*It provides the easiness to access Scipro, anytime, even when travelling and you can access the forum and other related information while you are mobile*". The mobility and interaction when using mobile devices are different than desktop computers. As long as the mobile device is on, it enables the user to have access to the data and get any updates on time.

SciPro mobile application may speed up the communication, but would not directly affect the actual work process speed. It makes getting updates easier and faster, especially for finding a thesis for opposition or active participation, since it is sometimes so hard to find one and students need to log in to SciPro every day and keep checking. Students can read supervisors' feedback through the SciPro mobile application, but not so much more to enhance communications. Communication might be easier and faster when it comes to student-supervisor or peer discussions, but not for transferring files. More than half of the respondents agree that the SciPro application would be useful for getting different kinds of notifications. The percentages of respondents for each issue vary, as shown in the Table 1.

Table 2. Mobile application types of notifications

Would an online mobile application be useful for you to get notice of …	**% of respondents**	**Type of presence in fig 1**
… when your supervisor post a new message or answers your questions in the forum?	79%	Teaching presence
… when your thesis manuscripts has been selected by another student to be peer reviewed?	70%	Social presence
… when there is a new thesis manuscript uploaded and available for opposition?	63%	Cognitive presence
… when a new thesis manuscript is uploaded and available for peer reviewing in SciPro peer portal?	62%	Social presence
… when there is an update about SciPro resources or a new functionality available for SciPro?	57%	Teaching presence

This is while there are two other much smaller groups of respondents, who do not share the same opinion as the ones in the first group. The learners in the second group are doubtful about the necessity and usability of the online applications in higher education. They think that there might not be a need for working on school tasks and thesis everywhere, such as in the subway. "*People should focus more on real work on real computers. Smart phones are usually more of a distraction that blurs reality/work/fun/rest*". Students who write their thesis have mainly access to desktop computers; so there would not be much difference by having a mobile application for SciPro. They also mentioned that almost all students, at least at DSV, use computers for working on their theses; hence a mobile application would not be necessary. This group is quite skeptical about the usability and utility of mobile applications for learning and educational purposes. In addition, the last group encompasses very few respondents (5%), who have not yet used mobile applications, so they are not sure how it works and whether online mobile applications would be supporting education in general or thesis process specifically.

4 Discussion

The respondents in the first group see a great potential for education, based on three most significant advantages of mobile applications for higher education purposes, which are: accessibility, availability and flexibility. They believe using applications makes availability of and accessibility to information 24/7, in an easier and more efficient way. Mobile applications could be very useful for education as long as the focus is put both on educational aspects and the application's functionalities for supporting users' needs. The value that the mobile applications would add to the users is a significant issue that is mentioned by several learners.

Having a concrete and focused application for supporting SciPro functionalities, in order to reduce the need of using several additional applications would be a valuable support for learners. SciPro application could be useful for accessing info, getting notifications, getting the final thesis grade, which are so much of interest for learners. However, part of the respondents were doubtful about the value SciPro application may add to speed up the process or support learner-supervisor or peers-peer communication directly. As discussed by Anderson, notifications are important and useful to enhance feedback and presence. As shown in Table 1, more than 50% of the respondents think that notifications would be useful for the SciPro application. The respondents believe in the use of notifications for communication purposes rather than getting updated about available information and resources. Almost 80% of the respondents are positive about using SciPro application for getting notifications to speed up the communications with their supervisors or peers through students' forum and discussion boards. However, they mainly believe that this should not involve attached documents or more complicated tasks through mobile applications.

Having all thesis related info and getting direct notification from SciPro application, rather than through email, would definitely be useful and help save time. Sometimes, students have to wait for a while to find a peer reviewer or opponent for their

thesis manuscripts. As shown in Table 1, more than two-thirds of the students agree that the SciPro mobile application would be useful to make this process faster and easier. Moreover, in order to find a specific notification or forum message, learners can save time to use the mobile application instead of searching through all email's inbox and other folders. Many of the learners believe that SciPro might provide further support for communications and make the process more convenient, but probably not directly influence the quality of the thesis or help speed up the process of writing the thesis.

However, the second and third groups of learners, which are much smaller groups (in total less than 20% of the respondents), do not share these opinions. The respondents in the second group do not see the necessity of working on school tasks and specifically the thesis everywhere. And the third group is still a bit away from using TEL through ICT and mobile technologies, both in their life and education. Hence, they have no idea whether it might support education or not.

Useful Functions for SciPro Mobile Application. Based on more than 70% of respondents, information and notifications would be useful to have access everywhere through the SciPro mobile application. Receiving notifications would be helpful if it is regarding: 1) SciPro info/resources update, 2) when here is a new thesis manuscript for peer review or opposition, 3) a new reviewer is assigned to students' own thesis, and 4) when students get posts from supervisors or fellow students on the forum, chat, or discussion board. Reminders could be another useful function in order to prevent missing deadlines, seminars or supervision appointments. It would also be useful to access available information resources, like design science material, thesis process, templates, available videos etc. Moreover, besides the forum and discussion boards, a chat client or a way to facilitate synchronous communication with supervisors or peers when they are online may be of big use to the learners. Accessing the checklists and reading the instructions, guidelines, comments or even watching online related videos through the application would be convenient and helpful. Availability to the tips, videos, and forums, like a mini social networking site for students discussing and motivating each other with similar topics may be useful.

The functionalities of the application need to be clear and user friendly. Possibility of choosing type of notifications the users would like to receive is an important issue for designing the application. It may be useful for getting the study results, in which students are interested in knowing when it comes. What some learners mentioned is that supervisors probably also need to have a similar application, so that they can access information, as well as get reminders and notifications when students need them or want to ask for help.

Potential Problems. The screens of mobile devices are too small so that users have to scroll up and down to read something thoroughly, which may lead to missing important data. The mobile device is normally moving so much for instance on the train or subway. Therefore, it may influence negatively on the concentration, besides having some negative effects on body and eyes. Moreover, the application may support making little mental to-do-lists after looking over the thesis progress in SciPro, but file

compatibility may be an issue. To send ".docx" files and open it in iOS application might cause much trouble and cause some file damages and loss of data. Moreover, temporary application, such as an application only for supporting the thesis work, which will be used for one semester, may not attract many users. It may not be worth learning how to work with it, installing it and using it for a short while.

5 Conclusion

Mobile applications are mostly welcome and appreciated for the computer generation learners. As mentioned in theory, three keywords for user benefits are portability, connectivity and convenience. These are almost the same as what was mentioned by most of the respondents in this study to use mobile applications in higher education: accessibility and availability, flexibility, and mobility in time and geographical places. In this study, respondents belong to three groups: very positive towards the usability and utility of mobile applications in general as well as specifically for SciPro (approximately 80%); doubtful about the usability and utility of applications in education, especially for SciPro (approximately 15%); and the last group encompasses respondents (approximately 5%), who have not used mobile applications and have no idea whether it would be beneficial for education and for SciPro.

According to the theory and empirical data of this study, alerting (notifications), rapid response (support communication), information gathering on the go (availability of accessing info and getting updated info 24/7), and improved accessibility and personal learning management (flexibility and availability of info and notifications whenever needed and wished) are five values that most of the learners think mobile applications, including the SciPro applications, would add to higher education. These five important issues are mentioned as added values by mobile applications in education by more than 70% of the respondents. Moreover, mobile applications in education, such as the SciPro application, would facilitate learners' mobility and accessibility to info and resources, as well as provide support for communications in different presences of educational experiences, mainly through the use of notifications.

In conclusion, based on learners' perspectives, most learners believe in the utility of mobile application in higher education, in which they make it faster, easier and more flexible. According to the result of the study, the SciPro app, would also sufficiently add the specified values (illustrated in Figure 2) as additional support to the SciPro system, in Bachelor's and Master's thesis process. However, this may not directly affect the thesis quality and increase the speed of the thesis writing process, but it supports learners' interactions in all three phases of learner-learner, learner-content, and learner-instructor interactions. We also recommend that the work on developing notifications for the first version focuses on the top five list in Table 1, as these are the most favored by students as useful in the thesis process. These five types also enhance all types of presence in the Community of Inquiry Model, described in Figure 1.

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