The use of mobile communication technology for tutoring

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Introduction

This paper looks at how mobile technology can be used for tutoring in a mobile learning environment. It is divided into three sections; the first section looks at existing research to determine what the role of a tutor is in a mobile learning environment. We then ask what tasks a tutor should perform, that is, what a tutor should do to improve the quality of mlearning There is no set list of these requirements, so general functions are suggested based on existing research and projects. Once these functions have been identified, the second section examines the mobile enablers available to tutors. The final part of the chapter suggests how these services can be applied to become effective mobile learning tutoring aids. Finally, an existing mobile learning system is examined to see how a similar system could be used for tutoring mobile learning.

1. Role of the tutor in mobile learning

Although instructional models exist for distance or e-learning, a literature review revealed that in the field of mobile learning, there are not many widely used pedagogical models or principles that describe the facilitation of learners learning processes by tutoring interventions. Trainers and educators need to design learning materials for the growing use of mobile devices. However, the design of the materials must be based on sound learning theories and instructional design principles (Ally 2004). Clarifying the role of the tutor and establishing effective methods for supporting students' learning in a mobile environment must be included in this design. Psychologists gain a working knowledge of the basic cognitive processes underlying memory and learning - knowledge that is critical for promoting optimal learning in any educational setting. In his paper, Ally discusses the main cognitive learning theories and concludes that mLearning materials need to use multimedia strategies that are information-rich rather than textual strategies. This will result, Ally states, in developers' greater use of visuals, photographs, videos and audio. Multimedia content is used to a great extent today in e-learning. The introduction of General Packet Radio Service (GPRS) gave mobile devices access to the internet via Wireless Access Protocol (WAP). It also enabled the evolution of short messages (or SMS) into picture messaging (also called multimedia messaging or MMS). Video telephony has more recently available and also mobile TV. It would seem like the convergence of news and entertainment, mobile networks and the Internet is almost complete. So if multimedia strategies are to be used more extensively in mobile learning, the question of how can mobile multimedia be used effectively to scaffold the learning progress of mobile learning students must be addressed.

1.1 Pedagogical Model for Mobile Tutoring

Ally examines mLearning design models from the perspective of the learner. It makes sense, therefore, to examine mLearning from the tutor's perspective if designing a mobile tutoring system. To differentiate Information Technology (IT, also known as Information and communication(s) technology or ICT**)** based learning from traditional forms of learning, the term e-learning was coined. Following this, learning in a mobile context

was termed mLearning. A literature review shows that different terms such as online tutor, online moderator, e-moderator, distance education tutor, e-tutor are used to refer to the roles of a tutor in e-Learning. In this chapter, the term mTutor is suggested for the tutor in a mLearning environment. We must define the tasks that an mTutor must perform to fulfil that role before designing an mTutoring system. As mentioned above, there is no widely tried and tested pedagogy that defines what an mTutor should do. Inventing the phrase mPedagogy is probably stretching this mobile vocabulary too far but Googling the word mPedagogy revealed that it is in use, albeit not very much. The search retrieved three results, one of which was a paper by Silander and Rytkönen. In this paper, they proposed a theoretically constructed pedagogical model for mTutoring called AEFIRIP. AEFIRIP is based on the contemporary learning theories and pedagogical models of eLearning, but it is focused on the characteristics of mobile learning. This was the basis for the development of a semi-automatic tool for mobile tutoring. AEFIRIP is an acronym for the phases of the pedagogical model designed for facilitating mobile tutoring of learning taking place in a mobile environment. It stands for **A**ctivation, **E**xternalization, **F**ocusing, **I**nterpretations, **R**eflection and **I**nformation **P**rocessing.

Phase Description of activity	
1. Activation	Activating student's prior knowledge and cognitive strategies by context creation or e.g. presenting so called activating Questions
2. Externalization	Externalization of student's prior knowledge and thinking models. Students become aware of their prior knowledge by making it visible and exposing it to reflection.
3. Focusing	Focusing students perception and cognitive processing in a mobile learning environment according the objectives of the learning situation (e.g. by focusing questions or assignments)
4. Interpretations	Explicit interpretations done by student based on perception and prior knowledge/cognitive strategies as well as situational factors.
5. Reflection	Reflection of own interpretations and situational factors.
6. Information Processing	Information Processing consist of sub

	learning processes (cognitive processes) such as problem solving, classification, comparison, elaboration etc.

Table 1 Phases of the AEFIRIP pedagogical model for mobile learning and tutoring

1.2 What does an mTutor do?

Based on reading articles in this area, some tasks that a tutor performs are suggested below:

- Guiding students throughout knowledge the building process
- Setting exercises
- Marking exercises
- Attaching handouts to marked assignments
- Availability for questioning
- Suggesting reading/research areas.
- Motivating students
- Encouraging debate and reflection through online discussion (this differs from the email mentality, which lends itself to providing answers to direct questions)
- Reducing the students perceived isolation
- Interfacing between the students and the learning institution
- Synchronous working using videoconferencing
- Asynchronous working through text messaging or blogs
- Collaborative working through shared applications and workspaces eg. shared whiteboard

Probably there is no single way to tutor in the mobile environment. It is likely that the tutoring methods should be context specific, and may need to be adapted to the students (age, background, environment etc) and to the nature of the course being taken. The role of the tutor is not a new one, but traditional educational models have limited value since they rely on face-to-face interaction between students and tutor. Nonetheless, in trying to ascertain what tasks an mTutor must perform, it is worth examining what is to learn from face-to-face and online pedagogy. Much in the same way that e-Learning looked to traditional forms of learning for cues as to how to design a learning methodology, so mobile learning looks to E-learning to see how its adaptation may be done. For example, the Leonardo project 'From e-learning to m-Learning' looked at e-learning to see what could be learned in the development of learning materials for mobile learning materials. So, in examining the role of the tutor in a mobile learning environment, it is worthwhile looking at the way online tutoring is performed. In the Online Tutoring e-Book (Carol A. Higgison 2000) it is stated that, in online tutoring "above all the tutor should be flexible". It is appropriate to apply this to mobile tutoring also.

By way of combining the above approaches of gaining information from tutoring in a face-to-face learning environment and in e-learning, Silander and Rytkönen interviewed 52 teachers who had previous experience in web-based teaching. The authors posed the question: How can advanced mobile technology facilitate the teacher's work like tutoring

and guiding the students' learning processes? Answers were focused, not on the technology, but on the educational practices that it enables. This is very relevant to what we are trying to establish in this section of the chapter which is 'What should an mTutor do?

Based on the Silander and Rytkönen's questionnaire, they drew up the table below of the educational practices that mobile technology may be used for:

1. Tutoring and guidance of the learning process:	Tutoring by SMSs Blogs (an abbreviation of web logs, like an online diary) Student's inquiries Receiving and answering student's acute questions in problem situations Reaching students rapidly Tutoring by video phone calls Providing help by SMSs if needed Maintaining tutoring dialogue Getting students answers to learning tasks / assignments Getting material like pictures and text gather by a student in an authentic environment Easy access to students learning diaries / learning log books
2. Receiving students products:	Easy access to students observation logs and reports Chat One-to-many communication
3. Communication:	Real-time Interaction Student's portfolio Gathering continuous evaluation information on students learning
4. Evaluation / assessment:	Gathering evaluation information from authentic learning situations
6. Positioning of students (GPS)	
7. Simulations	

Table 2 Educational practices for which mobile technology may be used

Clearly, section 1 Tutoring and guidance of the learning process relates to mobile tutoring. Taking the activities listed in this section as the desired mobile tutoring practices that teachers would like to perform using mobile devices, section 3 will re-examine these practices and suggest other mobile services that could be used to perform them.

It is worth bearing in mind that Silander and Rytkönen's research was conducted a) among teachers, not necessarily those aware of all mobile telecom services. There could be activities not listed here that they felt could not be addressed by mobile technology and b) the paper was given in 2005, since then many developments have been made. The continual evolution of telecom core networks to an All-IP environment enables many more services than before.

1.3 Automated mobile tutoring

Automated or semi-automated tutoring, if designed carefully, could be ideal for large numbers of learners. The knowledge, strategy and experience of the expert could be performed with the automatic delivery of the mTutor's own tutorials. The advantage for the tutor is that once a tutorial is developed, it can be delivered again and again to new students. Any automatic mobile tutoring system should support easy creation of new tutorials thereby reducing the time it takes to create a tutorial, maximising use of resources. Most existing mobile learning environments use a mobile Learning Management System to track and manage a students progress through a mobile or blended learning curriculum. It is likely that an automated tutoring application would be integrated with the mLMS, providing and using information in a back-end database.

A number of automated mobile tutoring systems have already been developed. Älykkö is an application that Silander and Rytkönen developed for tutoring students' learning processes based on the AEFIRIP model for both PC and mobile devices. Students can construct the individual content of learning in the form of portfolios and communicate with tutors by using the tutoring dialogue log. It is primarily a tutor's tool with automatic and semi-automatic tutoring . MTutor is a software package developed by PF Culverhouse and CJ Burton at the University of Plymouth. MTutor enables one-to-one tutorials over the web. Tutors pose a problem and provide resources and their own expert knowledge for the learner to find a solution. MTutor follows the model of traditional tutorials, where learners meet with their tutor to work through and discuss directed problems. MTutor provides a complete computer-based tutorial system with defined stages.

1.4 Peer tutoring

Research on peer tutoring indicates that the intervention is relatively effective in improving both tutee's and tutor's academic and social development. (Gartner & Frank 1993). So if the tutor role is so effective, why not build on this and give all students the opportunity to be a tutor? This model is different from usual tutoring approaches where more proficient students tutor the less proficient. What will tutees and tutors learn in the tutor-centred mode, Gartner and Frank ask. First, they will learn the subject matter that is

being tutored. Second, they will learn how to tutor. Third, they will learn how to listen and communicate effectively. Fourth, and perhaps most importantly, they will learn about learning.

1.5 Tutor training

Any research article on online tutoring notes that tutors need training and practice to learn to do it well. E-tutoring or m-tutoring differs so much from face-to-face tutoring that a specialised training is required for the results to be of benefit to the learner. It is important that the first experience a tutor has of m-tutoring technology is a good one, otherwise they may be reluctant to try it again.

2 Third Generation Technologies

With the current and forthcoming wealth of ways to communicate, there is a danger that educators may be over-eager to use this technology simply because they can, putting the cart before the horse; the solution before problem. Implementing a tutoring mechanism that has no perceivable benefits is a waste of the time it takes for students and tutors to learn how to use it in the first place. Just because the technology is available it does not mean that there is an overriding educational reason to use it (Lockitt, 2005). So the question is not how can mobile technology be used for mLearning, but rather, how can mobile technology be used effectively for mLearning? To answer this question, it is a good idea to have a look at the technology that is soon to become widely available on mobile handset. The next section looks at these possible tools for tutors of mobile learning, focusing on how Ericsson implements the solutions.

Third generation (3G) mobile networks will offer faster uplink and downlink speeds with more reliable connections and a Quality of Service across the radio access network. At the same time, mobile core network are migrating toward an all-IP backbone, furthering the convergence of fixed line and mobile networks. This evolution provides a basis for richer and more complex services than were available previously. 3G technology is standardised by the Third Generation Partnership Project (3GPP), defining standards in the radio access network, the core, the service layer and user equipment. Multimedia enablers will be discussed in this chapter, in particular the IP Multimedia Subsystem (IMS) and the applications it supports. Although mobile devices can be tools used during the whole knowledge building process, this section lists the features of 3G mobile devices that could be used to tutor the knowledge building process taking place on-site in a mobile environment. Section 4 will suggest how these features can be combined into an mLearning application.

2.1 IP MultiMedia Subsystem

The IP MultiMedia Subsystem (IMS) is an (Internet Protocol) IP standard specified by the Third Generation Partnership Project (3GPP). It is platform that supports many new and existing services. It is seen as the cornerstone of the evolution toward an all-IP network. Indeed, the word evolution is worth noting, as it is an evolution, not a

revolution of the service networks in mobile telephony. Data communication or Datacomms is, in principle, the communication of information between computer systems. This includes communication within a local environment (LAN) or where the systems are separated over some distance (WAN). Various methods for data communication have evolved over many years going well back through the 20th century. The phrase 'convergence technology' is often heard in relation to IMS. It is seen to enable this evolution, or convergence of the datacomm, telecom, entertainment and media networks into one service. The Ericsson implementation of IMS is called the IMS Common System (ICS).

ICS consists of components that are used in both wireline and wireless IMS system deployments and/or, components that are used to support different solutions in one domain. For example, the ICS contains a presence component and group list management component which may be used for a number of different applications, for example both are used for the Push To Talk and WeShare applications. The support of wireline and/or wireless applications could be very useful for the mobile tutor who is more likely to access the tutoring system from a PC in his office, whereas students will be more likely to be on the move, accessing from a PDA or a mobile phone. Device profile caching is a feature of many applications that sit on the ICS for example, the WeShare application. Storing the details of the device that a student last used to access the system allows the system to tailor the presentation of the material to the mobile device. This was found to be very successful in the Leonardo project entitled Mobile Learning: The Next Generation Of Learning. The NKI partner developed an in-house mobile Learning Content Management System called SESAM, that provides different types of material to different devices automatically. In their system, they used Cascading Style Sheet (CSS) to make changes in the layout and providing the appropriate style sheets based on the clients accessing the page. An extension of this principle could be applied to mobile tutoring also, whereby a tutoring system records the device last used to access the mTutor or materials suggested by the tutor, and presents it in a suitable form.

ICS supports Push to Talk (PTT) Application, which is a walkie-talkie type of single duplex communication, and the WeShare family. The Push to Talk Application enables real-time communication one-to-one and one-to-many with the press of a button. The solution is based on the Push To Talk over Cellular (PoC) standard to secure global interoperability. WeShare is a family of services enabling the sharing of pictures and video while talking. The IMS solution also includes Engine Multimedia Feature Server and Presence Server to provide IP Centrex applications for enterprise customers as well as multimedia offerings to residential broadband customers. Also included in the Ericsson IMS is the Service Development Studio which is a development tool with on open source integrated development environment for new applications that can run on the Ericsson IMS platform. It is possible for developers to develop content that use the services offered by the Ericsson IMS eg. Presence, group lists and so on.

2.3 Presence Service

The Presence service is a component of the IMS platform that may be used by other applications e.g WeShare. It enables a user to subscribe to another users presence. This

means that user1 will send a message to user2 requesting the ability to see their presence and any changes that may occur to it. User2 will see a pop-up message with this request and can either allow it or not. If they allow it, User1 will be able to see when they log on. All users will have the ability to change their availability, much in the way that MSN Messager does i.e. busy, out of office. Even moods will be possible to indicate. So User1 will see any of these changes when user2 changes them. So for example,in WeShare, when a list of buddies is called up on the mobile handset, it will be possible to see who is logged on or not. A tutor would be able to initiate a WeShare session with a student or vice versa.

2.4 Group List Management

Group List Management is the IMS platform whereby a list of buddies (addresses) may be stored in a shared server, or on application specific servers. This is a component that is available to other applications, eg. Push To Talk. If a user wished to contact one of their stored PTT buddies, it is simple to lookup the buddy address and send a voice message. Similarly, if a tutor wished to notify a group of students as to an up and coming deadline, for example, he can simply select this groupname and send a message.

2.5 Service Development Studio

It is possible to develop IMS applications by using the Service Development Studio and thereafter launch them on the Ericsson's SIP Application server or the Ericsson Application Server. This could allow the developer to develop specific learning applications, that could facilitate the tasks that a tutor should perform as part of their role.

2.6 Push to Talk

The PoC service, as defined by the Open Mobile Alliance (OMA), provides the possibility for two or more users to communicate in a walkie-talkie type of fashion using mobile telephones. It requires the person speaking to press a button while talking and then release it when they are done. The listener then presses their button to respond. The call setup is quick, involving only the press of a button, allowing instantaneous communication.

PTT is implemented over standard GSM/GPRS/EDGE and CDMA200 networks. The solution can be implemented on the same device that is used as a traditional mobile phone. This feature makes it particularly suitable for mlearning for students who cannot afford PDAs or smartphones that to date have proved more effective for mobile learning. Ericsson IMS PTT is based on IETF and 3GPP/3GPP2 standards and uses the Session Initiation Protocol (SIP) for control signaling. This adherence to standards guarantees interoperability and therefore more widespread availability and use and also provides 'future-proofness'.

Features of PTT

- One person can talk to everyone in the group at one time, just by pressing the PTT key.

- User Contact List – Users can view the availability of contacts (or buddies) in their contact lists. They may be listed as individuals or as group members in the group contact list. Based on who is available, the user can select one or many buddies from the contact list and send them a PTT invitation.

- Instant Personal Talk - This service includes 1-to-1 communication as well as 1-to-many communication.

- Instant Group Talk – PTT enables the set up of group calls, where one user sets up the group session either by selecting a pre-defined group or by creating a temporary group on-the-fly.

- Invite or Reject – A recipient has the option or manually accept or reject joining a PTT session.

- Presence Indicators – This provides a user with an indication of the presence of another user on the network, in other words, indicating that a user is registered.

- Do-Not-Disturb (DND) – If a user is engaged in another call the presence will be set to a do-not-disturb mode. All PTT invitations will automatically be rejected in this mode. A user can also choose to activate and deactivate the DND function while not engaged in a call.

- Contact and Group Management – The user is able to manage their buddy list and create groups from the mobile device, or from a Web interface. Users can add, edit and remove contacts on their lists.

2.7 WeShare

WeShare is a family of services combining the circuit swiched voice with packet switched data, like pictures, video and games. These services have a very obvious potential to be tools for tutoring any type of mLearning course. It is flexible allowing media to be sent at anytime during the call.

The advantage of WeShare for tutoring is that it is built on existing behavior. During voice conversations, (face to face) people share things. So they will probably want to do this when having a voice conversation that is not face to face. (This is why it is called weShare.)

Features of WeShare

- The user can combine any voice call with different media types: weShare includes Video, Picture, Stored File as current share-able options with, Games, Music and Web.

- Whiteboard application allows two users to see the same diagram and add text or graphic to it. So if user1 adds an arrow, user2 will see this arrow on the shared whiteboard. Voice will simultaneously be heard with this.

- It is easy to understand. It is almost totally intuitive. Nothing difficult about using it at all.

- Minimises user input, just a few key strokes are required, therefore suitable for a mobile learning environment

- Users can introduce service & educate each other during the call

- A user can see immediately (via the CSI icon) whether or not the other party has weShare.

- Can spontaneously add something to help convey the message

- Material can be stored or created during the conversation

3. Applications enabling tutoring of mlearning students

Telephones are still used an enormous amount by both students and their tutors but have only recently become again the subject of critical analysis and research, mainly in the context of mobile phones and 'mLearning' (Keegan 2002). In a paper presented to the Third EDEN Research Workshop, Oldenburg in 2004 by Gaskell and Mills, it was found that proactive and responsive contact from the tutors in the Open University UK as well as over-the-phone tutorials were favourably received by the students, improving student performance on the course assignments as well as increasing student retention. Their paper did not examine the functionality of the mobile phone beyond voice and SMS messaging. The technologies discussed in section 3 have the potential for the tutor in a mobile learning environment. However, the task of designing mLearning applications and appropriate learner support is complex and challenging. The impact of new mobile technologies need to be appraised and evaluated. What the following section covers is the suggested applications of 3G mobile technologies for the purposes of mTutoring.

In section 2 the role of the tutor was discussed, and more specifically, what a tutor should actually do was analysed. Table 2 in section 2 listed some of these tasks. Section 3 examined the available tools to do this. In order to give some structure to applying the functions offered by the tools in section 3, we revist table 2, this time applying the possible use of the tools which we have since learned about. Table 3, below, introduces a third column, which lists the technology that could be used to achieve the task identified by Silander and Rytkönen's research. Some other technologies are suggested here in combination with IMS applications. MultiMedia Messaging Service (MMS) or picture messaging enables graphic and text to be sent to/from student and tutor. This could be a map, diagram etc. Short Message Service (SMS) is a circuit switched technology for

transmitting small amounts of text. Global Positioning System (GPS) is present in 3G networks and can approximate the position of a mobile terminal. Wireless Access Protocol provides mobile access to the Internet. (iMode also performs this function.

Role	Task	Technology
1. Tutoring and guidance of the learning process:	Tutoring by SMSs Blog Student's enquiries Receiving and answering student's acute questions in problem situations Reaching students rapidly Tutoring by video phone calls Providing help by SMSs if needed Maintaining tutoring dialogue Getting students answers to learning tasks / assignments Getting material like pictures and text gather by a student in an mobile environment Easy access to students Learning diaries / learning log books	SMS Web based system Email,SMS,PTT,Voice call with WeShare add-in Voice call or Video call (WeShare) PTT WeShare SMS Voice,WeShare WAP access for students to get to pre-assigned tasks. Students submit video,voice, picture messages to tutor. These could be stored on database as part of mLMS Presence service with PTT or WeShare PTT, SMS, Email
2. Receiving students products:	Easy access to students observation logs and reports Chat One-to-many communication	Web access to stored student logs and reports PTT, SMS, Email PTT, conference call
3. Communication:	Real-time Interaction Student's portfolio Gathering continuous evaluation information on students' learning	WeShare, Voice Call mLMS support mLMS support
4. Evaluation / assessment:	Gathering evaluation	mLMS support

	information from mobile learning situations	
6. Positioning of students (GPS)		Global Positioning System
7. Simulations		WAP access to simulator. WeShare stored maps, games, demos, video walkthrough of an equipment upgrade procedure, for example.

Table 3 Educational practices and technology used

4. Moop Project

Having examined the roles of the tutor and then listed the newer ICS technologies in sections 1 and 2, we then looked at some suggested uses of these tools for mobile tutoring that could be developed, based on the pedagogical models discussed in section 2. But are there any current applications of these technologies for the purposes of mobile tutoring? Some projects that use a small number of theses applications have been mentioned in this chapter already, but a very good example of a system that uses nearly all of them is a system called Moop. The pedagogic and technical know-how of Moop is developed in collaboration of the public and private sector. The Moop application is developed by the software house Incode Oy from the city of Oulu in Finland. The project is supported by Nokia, Elisa and Viestimaa companies. The pedagogical planning and development work of Moop environment has been done by the schools of Korvensuora, Oulunlahti and Patamäki in Finland. The project has received funding from Oulu's development project for network services and from the Smart Oulu project. To conclude this chapter we will examine how Moop is used and how, going forward, a similar system could rework this model for the purposes of mobile tutoring.

Moop is an existing mLearning system that utilises many of the above mobile services. It is included here because it is very close to demonstrating how most of the above technologies could be used by an mTutor. It is based on a sound, learner-centered pedagogy. The teacher in the Moop system fulfils some of the roles of the mTutor discussed in section 2, but it could very easily extended to provide a full system for mobile tutoring.

Moop is learning platform for situations where a pupil first makes observations, then saves and manages them on a mobile and web-based platform. It promotes interaction among students and teachers. The learning environment is closed and safe for pupils to use, requiring users to log in before allowing access. The system enables learning through observations – taking photos, recording sounds and interviews or filming short

video clips in the nearby surroundings of the school. A camera phone is used as a tool that supports elementary school learning. The basic functions of a mobile phone are normally usable. The real-time learning situation is coordinated by the teacher and enables interaction between pupils using Push To Talk. Maps and GPS are used for safety. The environment offers tools that support communication between pupils, pupil groups and teacher.

The work is divided up into 4 steps:

1. Teacher or Pupils Prepare the Task Courses on the Computer – The teacher logs into the system and assigns tasks to the student. These may be location dependent.

2. Execute – The student logs into the system and sees the list of assigned tasks. The student performs the task by writing an answer, sending a picture, recording a sound or for example by filming a short clip according to the task. The observation is then sent to a database with a push of a key.

3. Real time interaction – The teacher can see the location of every pupil or group from the map view of MOOP teacher's web application. Also the map view of MOOP teacher's mobile phone application can be used. The tasks executed and pupils' observations are delivered in real time to the teacher's and pupils' MOOP web applications. The teacher and pupils can communicate through the mobile phone's PoC connection while outdoors.

4. Finish the task –The pupil logs on the MOOP pupil's web application. All the tasks and observations have been saved and can be seen in the pupil's MOOP application. Attached to every observation, there is a small map showing the location where it was delivered from. The pupil can revise the observations by for example adding clarifying notes to the pictures.

This system of mobile learning is learner centred and motivates a pupil to drive his own learning path. A similar system could incorporate the role of an mTutor into this learning path. The activities of the Moop teacher are very similar to those of a mTutor (discussed in section 2). An mTutor would take a step back in the execution step, but would be available for queries. The mTutor should not provide any direct solutions, just providing the student with support at this stage. Step 3 could be an opportunity for Peer-to-Peer tutoring. While in the authentic environment tutoring from a peer that is present or in a remote location would benefit the tutor and tutee. Step 4 of the Moop course could be extended much more for the purposes of the mTutor. The mTutor can look at all students submitted observations and notes and mark them accordingly. The mTutor could facilitate a group discussion to review the tasks with input from all students. The mTutor could suggest a student re-take the task if a student went about the it the wrong way, or send further material to give the student better understanding of the topic.

5. Summary

To conclude, it is clear that mobile technology and applications can have various pedagogical roles in tutoring students in a mobile learning environment. The design and implementation of a mobile tutoring system using mobile technology must be with reference to a soundly researched pedagogical model. It is possible that mTutoring may be semi-automatic, and it is likely that it would be part of an existing mLMS with a database tracking the students' progress, storing grades and completed assignments. Mobile learning is fast developing in its scope and effectiveness, moving from short-term small-scale pilot projects into mainstream education and training as part of a blended learning environment. The research and development of mTutoring systems will develop with it. While it is a small field at the moment, the area of tutoring mobile learning is one that is likely to grow.

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