BRINGING MOBILE PEDAGOGICAL AGENT TO SUPPORT VIRTUAL COOPERATIVE LEARNING

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Bringing Mobile Pedagogical Agent to Support Virtual Cooperative Learning

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ABSTRACT
The purpose of this study is to introduce MPA (Mobile Pedagogical Agent) into virtual cooperative learning that can support student-centred group learning for a practical course like 3D Animation. The study involved 30 students from Cosmopoint, Melaka. They were divided into two groups; one group with MPA and the other group without MPA. To enhance the learning process among the students, this project is built with cooperative learning framework. The students used the MPA during cooperative work and report their experiences through survey at the end of the study. Results of this study provide a useful knowledge in cooperative learning using MPA. It also contributes a new framework for implementing virtual cooperative learning.

KEYWORDS: Computer-supported collaborative learning, e-learning, collaborative learning, knowledge construction, mobile learning, virtual collaborative learning

1. INTRODUCTION
Mobile learning or called m-learning, is the ability to learn anywhere anytime, facilitated by a range of mobile devices. People use to stay in contact via SMS, mobile phones, chat rooms, and email [1][2][3]. Today’s learners’ key traits are being digitally literate, ‘always on’, mobile, experimental, and community oriented [2]. Therefore, applying mobile learning method among the learners are very useful since it has a series of characteristic such as ubiquitous which means that the content can be accessed anywhere, regardless of location providing the coverage by the mobile providers has increased [4].

More than one-third of world’s adult population especially those living in the developing countries has no access to printed knowledge, new skills and also technologies that could improve the quality of their lives [5]. Hence, it becomes a major barrier in the developing countries in term of cost-effective delivery and quality education [6]. Therefore applying a knowledge-based system into the mobile learning would be really helpful and beneficial for the learners. ICTs especially mobile devices can empower teachers and learners by facilitating communication and interaction, offering new modes of delivery and also transforming teaching and learning processes [6].

2. BACKGROUND
Collaboration in a simple word means working with others. Collaboration is more than either communication or coordination. Communication can help people do their jobs better by providing more complete information, but it does not require any joint activity. Coordination involves joint activity, but allows individuals to maintain their own sets of goals, expectations, and responsibilities [7]. Hence, applying collaborative work will increase the quality of end product which may not be gained by working alone.

The emergence of Computer Supported Collaborative Learning (CSCL) and Mobile Computer Supported Collaborative Learning (MCSCl) makes the collaborative learning environment improve tremendously. More flexible approaches to learning and greater use of online tools provide new opportunities for student collaboration and gives new challenges for teachers in supporting group work [8].

In order to improve education through technology, the availability of the knowledge and tutors or instructors to assist students should not be neglected. There are systems that provide both the knowledge acquisition and tutor together such as in Intelligent Tutoring Systems. These systems can provide knowledge acquisition and assist students concurrently 24/7. Bringing it the same way as a human tutor, the Intelligent Tutoring Systems in this study provide natural language negotiation for its users. Normally, knowledge based systems always deal with incomplete knowledge database, therefore additional knowledge should be entered by users and fit into the existing one. In this study, the knowledge will be 3D Animation subject for higher learning students from Cosmopoint International College of Technology, Melaka.

3. KNOWLEDGE-BASED SYSTEM AND ARTIFICIAL INTELLIGENCE
Knowledge-Based Systems (KBS) are productive tools of Artificial Intelligence (AI) that work to impart quality, effectiveness, and knowledge-oriented approach in decision making process [9]. In Business area, basically knowledge-based software is used because it can answer the questions of the customers even if the support officers are not there to answer. A professionally administered knowledge-based can cater the needs of the customer on 24/7 basis [10]. Hence, the main feature of knowledge-based system is to answer queries and be able to retrieve information from the database. Besides, there are studies that apply knowledge-based system into education field such as Digital Aristotle [11] for science learning, COG-K-DIT [12] for mathematics learning and collective knowledge bases system such as Open Mind [13] gather training sets for learning algorithms (e.g., for handwriting and speech recognition) which add contribution from publics.

Data that may appear relevant and easily understandable in one retrieval context may be completely unintelligible in another, even to the same audience. There are various factors that affect the Knowledge Discovery in Databases (KDD) and Information Retrieval (IR) processes in knowledge based system [14]. These factors include information seeking characteristics, tools and methods used to search and retrieve the structure and size of the data set or database, and the data itself. Therefore, an intelligent system should be integrated into the knowledge based system to improve the system.
4. KNOWLEDGE-BASED SYSTEM AND ARTIFICIAL INTELLIGENCE

Intelligent Tutoring Systems (ITSs) are systems that can provide personalized instruction to students or in other word can also be referred as one-on-one tutoring [10]. Furthermore, one-on-one tutoring has been proven to be a very effective form of instruction [10]. Many experiments done by the researchers, ITSs induced learning scores higher than those in classroom environment, but lower than those measured in one-on-one interactions with human tutors [17]. Therefore, knowing more about human tutoring would help improve the design of ITSs. An effective use of natural language might be a key element since most of the studies claimed that systems with more sophisticated language interfaces performed better than other experimental conditions [17].

5. INTELLIGENT TUTORING SYSTEMS THAT USE NATURAL LANGUAGE

Tutors, pedagogical agents or avatars are also considered as ITSs that use natural language [18]. Pedagogical agents are autonomous agents that inherit computer learning environments and facilitate learning by interacting with students or other agents [19]. The effective pedagogy agents act as peers, co-learners, competitors, helpers or instructors by asking and giving respond to questions, giving hints and explanation, monitoring students and providing feedback [20]. While avatar is an engaging, personalized and simple interface that can be a substitute for a human teacher [21]. Thus, 'tutoring may be provided by pedagogical agents, avatars or other simpler mechanisms (e.g. staged textual hints) and is tailored to the individual learner to help them progress through the immediate task’ [18].

The ITSs require knowledge like problem statements, principles, commonsense knowledge and etc from its authors [22]. There are several studies that use natural language for presenting knowledge in ITSs:

1) ISSAC [23] solves physics problems stated in English. It is a tutoring system that receives a problem statement written in natural language text and solves the given problem by transforming it into semantic frames.
2) MECHO [24] solves a wide range of mechanics problems from statements in both predicate calculus and English. It uses the technique of meta-level inference to control search in natural language understanding, common sense inference, model formation and algebraic manipulation.
3) PAT [25] is an intelligent tutoring system developed to help teach introductory algebra. The system identifies mathematical modeling of problem situations which are described by linear equations. It adopts the idea to fix parsing errors using intermediate representation.

6. THE STUDY OF UKAS

UKAS is a system that consist Mobile Pedagogy Agent (MPA). The usage of MPA is to test the hypotheses to see whether it can influence students in collaborative learning or not. Apart from that, it is also an identification of the usefulness of mobile technologies in collaborative learning. This action is taken to explain the variance in the dependent variable or to predict the outcomes.

The learning content for this study is derived by using MPA that will answer all the questions that the students ask. This will provide the students with appropriate and refined answers so that the students can access the content faster. On the other hand, this agent will help students improve conversation skills among students.

To encourage the students to access the content, they will need to participate in collaborative work. The instructors will pose a question to students and each students will have their own personal time to use MPA as a support to get idea or knowledge before share them in class with their peers or group members.

7. ARCHITECTURE OF UKAS

UKAS – Ubiquitous Knowledge Acquisition System is a system that provides open source knowledge. The main idea of the system/prototype is it can always be updated with new idea or knowledge by the students.

The content of the Knowledge Archive in UKAS system is designed as follows:

i) Goal based [26]
   The instructions provide both computer operations and the context by providing production samples. From these samples, the learners can get the basic idea to develop other production.

ii) Small Steps [27]
   The contents are divided into small steps and indexed. The materials are structured visibly as the learners can study easily. If the learners are beginners, it is necessary for them to study step-by-step to enable them follow the instructions easily. If they are in more advanced, they can select the contents to study.

The main or initial stage of UKAS will only have introductory Knowledge about 3D Animation. At this stage, the students will have the opportunity to study individually the basic part of knowledge. Then, for the Advanced Knowledge, the students are given a small task or challenge so that they can use the skills in Introductory Knowledge while working on Advanced Knowledge. This can be done through collaborative work among the students to construct new ideas. Furthermore, learners with scripts argued better and acquired more knowledge on argumentation than learners without script [28]. At the final stage, the best ideas from the students are selected and added into Advanced Knowledge domain. Refer Figure 1, which illustrate the architecture of UKAS system and Table 1 that summarize the functions of each component in UKAS system. Figure 2 shows the main interface to UKAS.

![Figure 1: Architecture of UKAS system](image-url)
Table 1: Components in UKAS and its function

<table>
<thead>
<tr>
<th>Component</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Management</td>
<td>- Records the users' information</td>
</tr>
<tr>
<td></td>
<td>- Enable users to create new account in order to access the system</td>
</tr>
<tr>
<td>Knowledge Archive (Content</td>
<td>- To manage and insert the Introductory Knowledge content into database</td>
</tr>
<tr>
<td>Management)</td>
<td>by Admin</td>
</tr>
<tr>
<td></td>
<td>- To update the knowledge content with Advanced Knowledge which is</td>
</tr>
<tr>
<td></td>
<td>provided by students.</td>
</tr>
<tr>
<td>Knowledge Archive (Knowledge</td>
<td>- To provide requested knowledge for users'</td>
</tr>
<tr>
<td>Acquisition)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: UKAS Main Interface

7.1 Content Management Component

The content management component is where the content of the 3D subjects are inserted. Only admin or instructors are able to view, edit, delete or add the contents. There are six fields that the users can fill. The title column, subtitle column, content column, recently asked questions column, tag keyword column and firstly is the file upload column. The content column is provided with editor to make ease for the user to manage the proportion of the text or graphic accordingly. The most important part for the UKAS system is the tag keyword column because this is where the search queries of the MPA are taken into consideration. The file upload column is where the user can upload notes, tutorials or sample maya files for the students learning purposes. Figure 4 shows the interface for inserting new content to UKAS.

7.2 Knowledge Acquisition Component

The knowledge acquisition component is the output design of UKAS. It is where the students can view the content, for example 3D subject, in both from their laptop or even on mobile phones. This component is mainly built as a search engine that can provide answers based from the students question. There is also text indexing option available to refine the user's search. The text indexing option is captured from the 'file' of the content. Figure 5 shows the interface design for the Knowledge Acquisition page showing automatic text indexing to assist users in refining their searches. Figure 6 shows the interface design for Knowledge Acquisition page showing a list of search results.

Figure 5: Knowledge Acquisition interface design with automatic text indexing.
8. User Study

The study involved 30 students from Cosmopoint, Malaka. They were divided into two groups; one group with MPA and the other group without MPA. To enhance the learning process among the students, this project is built with cooperative learning framework using Jigsaw method. The students used the MPA during cooperative work and report their experiences through survey at the end of the study. Detail results will be presented in another paper.

9. CONCLUSION

We have presented a summary of our design work describing our vision of applying a Mobile Pedagogical Agent (MPA) in virtual collaborative learning environment, and an architecture for integrating the use of mobile technologies into an existing collaborative environment. The students perform a collaborative work during completing a 3D project that were given at the beginning stage, and at the same time use MPA as a resource to support them while doing collaborative work. Hence, this study contributes a new framework for implementing virtual collaborative learning.

REFERENCES


