Design an Augmented Reality Teaching System with Concept Mapping Technique

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Abstract: With growing of technologies, multimedia as an important role of teaching material while transmitting knowledge to students. It provides potential benefits of incorporating dynamic multimedia in knowledge maps when they are to be used for learning. However, the traditional media, the static images or animations, is not enough anymore in the interaction between user and learning content. Therefore, many researchers point out the AR offers unique educational benefits such as a seamless interaction between virtual and real communicative environments. Besides, the seamlessness between physical and virtual objects in AR environments presents new teaching/learning strategies even for children with limited computer experience. But, these AR educational systems don’t explain designing procedure of these teaching systems. In the other words, the designing procedure of these teaching systems is called a kind of “black-box” way. Therefore, in this study, we proposed to use concept mapping as a tool for designing interactive teaching system with AR technology.

Key Word: Augmented Reality, Concept Map, Tangible Interaction

1. Introduction

In order to increase the degree of student understanding, the teacher will usually complement it with the textbook or the utensils of the teaching material while transmitting knowledge to students. It provides potential benefits of incorporating dynamic multimedia in knowledge maps when they are to be used for learning. However, the traditional media, the static images or animations, is not enough anymore in the interaction between user and learning content. Therefore, many researchers point out the AR offers unique educational benefits such as a seamless interaction between virtual and real communicative environments. Besides, the seamlessness between physical and virtual objects in AR environments presents new teaching/learning strategies even for children with limited computer experience. But, these AR educational systems don’t explain designing procedure of these teaching systems. In the other words, the designing procedure of these teaching systems is called a kind of “black-box” way. Therefore, in this study, we proposed to use concept mapping as a tool for designing interactive teaching system with AR technology.

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2. Implementation

The topic we choose is ingesting relationship between various kinds of biological in the small stream and valley as our interactive concept map system contents. The design process includes two parts: construct a concept map of learning topic and incorporate AR technology to build the interactive concept map system. The concept map will integrate teacher and students’ opinions for this learning subject and the result will be the blueprint to develop our AR teaching system.

Before constructing a concept map process, we arrange a practice...
for students knowing what concept map is and how to construct it. We use “circulation of oxygen” as the practice subject. Teacher carries on the class with software “powerpoint” (be able to show the images and illustrations) to introduce a concept of the practice subject and he will also write this concept on the blackboard. After teacher finish the lesson, he write all concepts among the practice subject on the blackboard. By referring to the textbook, asking teacher finish the lesson, he write all concepts among the practice subject on the blackboard. By referring to the textbook, asking students to organize these concepts on the blackboard and do concept mapping (to link any two related concepts and identify the term to explain the link). And we encourage students to do his possible to suggest the related concepts among daily life and integrate them into the concept map. Through this process, student will get experience about doing concept mapping.

Hence, we begin to construct the concept map we needed. First, teacher shows the title of the teaching content (ingesting relationship between various kinds of biological in the small stream and valley). With the associated thinking method, we ask students to suggest any related knowledge about this subject and do his possible to express the knowledge in a concept map way (to link one related concept to another and identify the term to explain this link) and write them on the paper. However, if a suggested concept without any linking to another is doesn’t matter. After that, just like practice section illustrated above, teacher begins to teach the lesson and write all concepts on the blackboard to ask students doing concept mapping. After doing concept mapping, we ask students to integrate the map he just has done with the concepts done before lessons. Finally, we collect these concept maps (Figure 1) to be the blueprint to develop our AR teaching system.

![Figure 1. Concept map for AR teaching system.](image)

Based on the concept map we have done above, we construct our AR teaching system with five components: concepts, linkages, relating terms, and animations. First, based on collected pictures of concepts, we set the looks of concepts by sketch and build 3D models to show the concepts with AR technology. Each concept is relating terms, and animations. First, based on collected pictures of concepts, we set the looks of concepts by sketch and build 3D models to show the concepts with AR technology. Each concept is represented on the square cards (Figure 2), drawn different patterns to identify 3D virtual objects, to represent tracking markers. Usually, we use the pencil to draw a related line as relationship while doing concept mapping. In our AR teaching systems, we use the strings as related linkages. The 3M stickers are used to write down the related terms and fix on the strings to illustrating the relationships between concepts. Finally, we make the 3D animations to illustrate the relationships between related concepts and importing them into AR teaching system for students’ doing interaction.

While students manipulate AR teaching systems, they take two different markers together to see whether the relating animation take place or not. If the relating animation doesn’t happen, search for another concept (marker) again. Once the relating animation does happen, we use the strings to link these two relating concepts together and write down the relationship on the 3M sticker and paste on the string. Students continue to link any two related concepts and identify the term to explain the link again.

![Figure 2. Different marker to represent different Concept.](image)

3. Results and Conclusion

Based on combining the concept mapping and AR technology, our system is constructed. Hence, with the AR technology, the teaching content is presented more completely and with the concept mapping way to do interaction (focus on integrating the knowledge and relationships between concepts behind in a subject). There have been a lot of papers to indicate that concept map do have effects to improve students’ learning achievements. But can concept map help students attain to higher learning achievement as we integrated it with AR technology? Therefore, more usability evaluation issues need to be conducted to investigate how AR teaching system would affect the student learning after applying the concept map during the design process. However, our preliminary user feedback indicates that our AR teaching system with concept map technique can provide completely knowledge space for learning.

Reference