

Learning Application with the Multi-Touch Interactive Technology-A Study of Jigsaw Game

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Abstract: Multi-touch technology has become increasingly popular interactive technology of teaching content. The displays with multi-touch are responsive enough to support a wide variety of applications. In this study, we attempt to apply three different technologies of C#, Microsoft Surface and Windows Presentation Foundation developing an interactive jigsaw game. This game would design with the multi-touch interactive technology and adapt the scaffolding theory to construct three scaffolding levels based on the operated features of multi-touch interactive technology. The three levels are the progressive learning by the easy to the difficult. In addition, this study also proposed collaborative and competitive learning scenarios for the multi-touch jigsaw interactive game. The collaborative learning scenario allows two learners to help each other and to perform a jigsaw game at the time appointed. The competition learning scenario allows two learners to perform their own jigsaw game by themselves, enable learners to more easily and quickly learn and to get the knowledge in a jigsaw game.

Keywords: *Multi-touch technology, scaffolding theory, jigsaw game, interactive surfaces*

1. Introduction

In recent years, classroom learning has changed from the multimedia presentation of teaching content into the presentation with interactive technology. However, multi-touch technology has become increasingly popular interactive technology of teaching content. The displays with multi-touch are responsive enough to support a wide variety of applications. In [3, 4, 6, 8] studies, they have explored the multi-touch application in education. Multi-touch interactive technology could support children to guide collaborative design task [3, 4, 8], collaborative Web search [6], and learning with a mind mapping application [2]. Some studies also indicated that multi-touch interactive technologies are very enjoyable and engaging [2, 8] for learners, not always to produce learning gains [2, 4]. However, the combination of the multi-touch interactive technology and jigsaw game does not that discuss in previous studies. In addition, this study will adapt scaffolding theory in jigsaw game, to enable learners to more easily and quickly learn and to get the knowledge in a jigsaw game. In light of these concerns, the purpose of this study attempts to design a multi-touch jigsaw game with three scaffolding levels for learners. Such study is still in its infancy, but it may have a contribution to the learning application with multi-touch interactive technology in education.

2. Literature review

In this section, we will explore the scaffolding theory, the development of multi-touch interactive technology and its application in education.

2.1 Scaffolding Theory

The scaffolding theory is based on the social development theory of learning by Russian psychologist Lev Vygotsky. Wood, Bruner, and Ross' (1976) idea of scaffolding also parallels Vygotsky's work [9, 10, 11]. The term of "scaffolding" meant to represent the support and assistance offered by a teacher or peer to support learning. "Scaffolding" is a metaphor that describes the way a teacher provides assistance to the learner during the learning process. In such way, the construction of scaffolding provides the learners a temporary support to build their own knowledge. When the learners take responsibility for or masters their learning task, the teacher would begin to fade or to remove the scaffolding, which allows learner to work independently. Scaffolding theory proposes that teachers will act as assisting roles in the learning process to provide a temporary support (scaffold) in order to assist learners to construct self-learning. Scaffolding Theory includes two main procedures, which are to setup the scaffold and phased removal of scaffold. The scaffold can be a teaching strategy or a teaching tool; it can be provision of clues, a reminder, and encouragement, solution, providing an example or assistance through information technology. Meanwhile the learning responsibility is gradually shifted from teachers to learners and eventually learners can lead their learning [9, 10, 11]. According to their findings, there are two levels of scaffolding: soft and hard. An example of soft scaffolding in the classroom would be when a teacher circulates the room and converses with his or her students [9, 10, 11]. The teacher may question their approach to a difficult problem and provide constructive feedback. In this study, we attempt to provide the learners three scaffolding levels from easy to difficult to perform their jigsaw games. These levels would base on the operated features of multi-touch interactive technology.

2.2 Development of multi-touch interactive technology

An interactive technology, multi-touch technology, would replace the use of keyboards (button) and a mouse used in the recent. The system design of multi-touch technology in the past can only mostly sensor to one touched finger. It would restrict to apply the interactions with multiple users. So far, the present touch technology was improved which sensor a lot of and keep in touch at one time, the range of application of multi-touch technology more overall [5]. Multi-touch interactive technology allows user to interact the presented information through several touched fingers. To use the multi-touch technology, the device must be equipped with touch screen or touchpad, at the same time be a little more than loading the same time recognizable touch software. In contrast, the biggest difference between its standard touch technology that can identify single touch.

Recently, there have been some studies have applied multi-touch interactive technology in education and can more easily promote collaborative learning. In [12] combine the system of the smart board and video conference. Other related studies have also investigated the use of multi-touch interactive technology to support children guide collaborative design task [3, 4, 8], collaborative Web search [6] and learning with a mind mapping application [2]. These studies indicated that multi-touch interactive technologies are very enjoyable and engaging [2, 8] for learners, not always to produce learning gains [2, 4]. The previous study in [7] found that the multi-touch interaction can support a very fair participation in learning situations. As discussions of the pervious studies, it could be

concluded that the multi-touch interactive technologies would be a very popular and effective application in education. However, the combination of the multi-touch technology and a jigsaw game into application of collaborative and competitive learning does not that discuss in previous studies. Therefore, this study will design a multi-touch Jigsaw game and explore application in education, such as in geographic instruction. The system design of the multi-touch jigsaw game is shown in section 3. The collaborative and competitive learning are designed in section 4.

3 System Design

In this paper, the technologies of C # and Microsoft Surface 2.0 were used to develop a multi-touch interactive jigsaw game. Learning with jigsaw game brings people together to connect, learn and decide with a 360-degree interface that supports touch and real-world objects.

3.1 Presentation

We apply three different technology of C# 、Microsoft Surface and Windows Presentation Foundation to develop a jigsaw game. The presentation of this system is shown in Fig.1. In Fig. 1, there are three functionalities in this system, the first functionality is to change the two different learning scenarios, collaboration learning scenario and competition learning scenario of two programs. The second functionality is the Scaffolding Levels which is divided into three scaffolding levels by different difficulty from easy to difficult. In Fig. 1, the third functionality is to select the desired image would be automatically separated into nine puzzle pieces. In Fig. 1, two buttons are designed to control the current jigsaw game, the first button is to restart the current jigsaw game by removing, the pieces of jigsaw and to open a new jigsaw game. The second button is to stop the timer of the current jigsaw game. This timer is designed to measure the playing time of playing a jigsaw game.



Fig.1. The presentation of the multi-touch interactive jigsaw game

3.2 Scaffolding Levels

Scaffolding theory can be provided in learning support [9, 10, 11] provides assistance to the students during the learning process in much the same way that construction scaffolding serves as a temporary support until the building can stand on its own. So, this studies according scaffolding theory to construct three-levels scaffolding of jigsaw game according to the operated features of multi-touch interactive technology. These operated features consist of moving, rotating, and resizing. The three-levels are the progressive learning by the east to the difficult. The three levels are described as follows: (1) Level one: It allows the learner to move the piece to touch the desired region and then this piece will be attracted into the correct space. (2) Level two: It allows the learner to move the piece to touch and rotate the shape of desired region, and then this piece will be attracted into the correct space.

(3)Level three: It allows the learner to move the piece to touch and rotate the shape of desired region. Also, the learner needs to scale the size of the move piece having the same size of the desired region. Finally, this piece will be attracted into the correct space.

4 Learning Scenario

This study designed collaborative and competitive learning scenarios for the multi-touch jigsaw game. The collaborative learning scenario allows two learners to help each other and to perform a jigsaw game at the time appointed. The competition learning scenario allows two learners to perform their own jigsaw game by themselves. The outcome of completion depends on who could finish the game first. It through such learning programs for learners in learning when to play jigsaw game can be effectively improved.

4.1 Collaborative learning scenario

Collaborative learning scenario enables two learners to perform one jigsaw game together. Both of these two learners can learn how to complete the jigsaw game in the complement and collaborative way. However, each learner could have different cognition on a picture. In this scenario, the present of timer would urge both of learners to learn actively. Fig.2 shows the system design of collaboration learning scenario. The support of multi-touch interactive technology allows four touched fingers to operate on the screen simultaneously. Therefore, each user can use two touched fingers to complete the jigsaw by using this kind of technology.



Fig.2. System Interface of the Collaboration learning scenario

4.2 Competitive learning scenario

In this study, the multi-touch jigsaw game in competitive learning scenario enables learners to complete two separated jigsaw games as shown in Fig.3. As mentioned above, the four touched fingers would be assigned two fingers to each of learners. According to the example in the figure, the cognitions of these two learners on the map of a country have different degrees of familiarity. Therefore, learners may finish their jigsaw at different time. In this way, the system in this study would measure the playing time of each learner. The completion in this scenario would actuate learner's potential capacity.



Fig.3. System Interface of the Competition learning scenario

5 Conclusion and future work

In this study, we have explored the scaffolding theory [9, 10, 11] and, development of multi-touch interactive technology and in education application [1]. The purpose of this study is to develop a multi-touch interactive jigsaw game with three scaffolding levels. So that, this study apply three different technology of C# 、Microsoft Surface and Windows Presentation Foundation to design the this system. We believe that three different scaffolding levels could provide the learners a good learning assistance to learn in geography. These three levels would be a temporary scaffolding support for learners to learn the knowledge of presented image and to construct the cognition of spatial information.

Although the design of scaffolding level has purposed in our system, we will keep adjusting the scaffold of learning jigsaw game in the future research. The scaffolding support of learner will decrease during the learning process. The other limitation of current work is rooted in the luck of empirical study of using the multi-touch interactive jigsaw game. We are hopeful that future research will provide more detailed results which may understand the effects of learning application in multi-touch technology and playing with jigsaw game. Therefore, a next step of our study should be considered is why certain strategies are used to develop jigsaw game increasing the learning effectiveness.

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