Collaborative Educational Game for
Thai Primary School Students

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Abstract—English language, Mathematics and Science
for life are mandatory subjects for Thai students to finish their
primary school studies. Regarding the unsatisfactory result of the
annual assessment, there are many students fail those subjects
every year. This paper thus proposes the educational computer
game to enhance learning of English language, Mathematics
and Sciences subjects. The proposed game employs the concept
of collaborative learning integrated into the game to promote the
better understanding of contents and the familiarization of team
work experience, while the players are still filled with the joy
and the challenge. The proposed game is designed as a multi-players
online game. All players compete among each other to be a leader
and conduct the game along with help from team members to
achieve the goal. The developed game is evaluated with 2 aspects
including the learning efficiency and the satisfaction of students.
The empirical study is conducted with 100 students from 3
different primary schools in Chiang Rai, Thailand. These students
are divided into 2 groups including the group playing game
individually and collaboratively respectively. The first group has
25 students while the second group has 15 groups with 5 students
per each. The results reveal that, the students playing game
collaboratively can achieve higher learning efficiency than the
students playing game individually. Moreover, the collaborative
game obtains Good satisfaction level by the students.

Keywords—Educational Games, Edutainment,
Collaborative Learning, Collaborative Games

1. INTRODUCTION

At present, the teachers are not only responsible for
transferring knowledge to their students in the classrooms but
also creating learning media to motivate and encourage the
learners to learn by themselves. Because the learners want
to learn under the atmosphere of fun and joyfulness to gain
knowledge for solving problems, the term “Edutainment”
[1,2] thus has been widely introduced recently. Edutainment
integrates the concept of education and entertainment
together with the advanced Information Communication
Technology (ICT) and multimedia technology. The educators
nowadays see benefits of Edutainment as the supplement
to promote more effective learning [1,3]. Edutainment
is derived from two reasons. Firstly, people usually have
problems in learning difficult things, so it is necessary to add
something that stimulates motivation and interest of learning
and understanding [1]. Finally, due to the perspectives of
the society that the social entertainments, such as cartoons,
games and movies are joyful to people, so it is necessary to
increase more knowledge in those social entertainments [2,4].
Therefore, the entertainment producers have intention for the
learner to have more than just entertainment [3,5] but also
knowledge. Those reasons cause 2 types of edutainment. The
first type requires learners to participate in the activities such
as responding to or interacting with the media as the games.
The second type does not require learners to participate, but
only listening to or watching, for example, watching movies,
visiting museums or zoo, etc. Generally edutainment is widely
found in different forms of medias, such as computer games,
Internet / website, digital television [6,7], etc. Because these
activities are fun and they can create motivation in learning
more than the traditional approach [1,6,8], most elementary
schools around the world offer the curriculums that is divided
into subject matters which must be appropriate for student’s
level into different kinds of learning activities and medias.
From the observation in the classroom, it has found that content
in some lessons are difficult to explain to students. Especially
the subjects that develop thinking skill are usually boring for
students [1]. Therefore the edutainment is now expected
to take the main role for motivating the students to learn more
effectively under the fun and joyfulness atmosphere.

Regarding a result from the assessment of standard
quality in 2008 by the Bureau of Education Testing, Office
of the Basic Education Commission, Ministry of Education,
it is shown that the number of Thai primary school students
having the age between 11-12 years old, who pass the good
level (3.44 %) are much less than the students who pass the
required improvement level (33.62 %) and the fair level
(62.94 %). These results are from the total numbers of 197,910
grade six students testing English language, Mathematics
and Science for Life [9]. This evidence implies that most of
grade six Thai students now require the need to improve their
learning efficiencies in those three subjects. For this reason,
this paper proposes a concept of Edutainment to develop the
game for grade six students to promote learning efficiency
for those three subjects at the same time. The statistics from
the National Statistical Office in 2002 indicated that three
million Thai teenagers having the age between 11 -14 years
old use computers for playing games as the most reason [10].
In addition, the research [11] has indicated that the number
of game players increase more every year [12]. Because
students love to play computer games and they are willing
to spend more time with computer games, so implementing
computer games as tools to develop students’ learning is more
appropriate strategy for this paper.
Besides developing the game to convey the knowledge to the learners under the joyful atmosphere as the concept of Edutainment, this paper also implements the concept of collaborative learning into the developed computer game. Collaborative learning has been successfully introduced as the learning strategy to promote the better understanding of content to the learners through team work experience. The principle of collaborative learning is that all team members build the consensus by interacting among each others. Moreover, the students help among each other to achieve the common goal together. Because the traditional game is more competition, this paper thus presents the collaborative game to promote not only the joyful atmosphere but also the collaborative atmosphere where the learners can perceive the positive attitude of working in team.

This paper is organized as following. Section 2 shows the literature reviews of computer games and collaborative learning. Section 3 describes the proposed work. Section 4 shows the research methodology. Section 5 shows the empirical study and results. Section 6 is the conclusion of this paper.

2. LITERATURE REVIEW

2.1 Computer Games

Computer game normally is an implementation of lessons from subject matters with the graphic computer games. It can also be a simulation of a specific situation [13,14]. Currently traditional computer games for education can be played alone offline to promote the individual learning [15,16]. Once the computer games are developed as multi-player games, there is the need of the internet connection called online game [12]. Currently, online games are widely used for the primary school students for their self studies within or outside the classroom for solving the problems given by the teachers [12,13]. However, the multi-player online games are not widely used in education area. The general multi-players online games are used for the purpose of entertainment only. The games are generally designed for the players to compete among each other to be a winner. This evidence may affect the negative behavior of the learners that they aim to overcome more than to help among each other. This paper thus would like to propose the online multi-player games for education game which is to promote the collaborative atmosphere instead of competitive atmosphere as mentioned before.

2.2 Collaborative Learning

Collaborative learning can reduce the risk of negative behaviors and help students to learn effectively [17]. At the same time, collaborative learning can also promote the learning environment where there is the share of knowledge and the acceptance of each others’ options among students. The basic elements of collaborative learning are positive interdependences among students, primitive interactions of team members, personal responsibility, small group skills and group processing [18,19]. At present, the implementation of collaborative learning can be seen as 2 types. The first type is happened in the classroom where the teacher builds the learning activities for students to work together as a group [18,20]. The second type is happened through the network, where the students work with other members via the Internet such as e-learning, conference calls, video conferencing or web conference [17,21,22]. From these evidences, it has shown that collaborative learning has been announced as the successful learning pedagogy. This paper thus implements the concept of collaborative learning into the developed games to promote the better understanding to the content and team work experience to students.

3. PROPOSED WORK

This paper proposes the multi-player online game for education to promote the higher learning efficiencies of Thai primary school students having the age between 11-12 years old for three subjects including English language, Mathematics and Science for Life as its structure is shown in Figure 1.

The online game is proposed for the convenience access of students anywhere. As mentioned before, the proposed game also implements the concept of collaborative learning to promote the collaborative atmosphere through team work skills to the students. The students can also learn social skill better through this game because they don’t know each other before but they have to work together. The developed game is designed to have the following components.

3.1 Goal: Students are fun, challenged, and excited and at the same time they can learn three subjects simultaneously while playing the game. The English language emphasizes only in the vocabulary. The mathematics aims to practice fast calculation. Finally, the Science for Life aims to explain the scientific phenomenon in daily life.
3.2 Game Features:

3.2.1 Collaborative Learning Module: The chat room is a communication channel for sharing knowledge together and promoting the collaboration atmosphere in the game.

3.2.2 Self Learning Module: The repositories of contents for all three subjects are also provided for students for their individual learning.

3.2.3 Rules: All members of the team have the right to play sequentially in each round by walking through the given pavement as shown in Figure 2. Along the walk, the different questions will be given to the students for collecting the rewards to help them getting the goal. The different types of questions are shown Figure 3.

3.2.4 Challenges: The game is also designed to challenge the students by having the competition module. The team members will have to compete among each other to gain the maximum power so that he/she could gain more power for helping team members to achieve the goal.

3.2.5 Appearance: The game is designed to have a colorful cartoon graphics, animation, and music as shown in Figure 2.

3.2.6 Management Group: There is the management module for the teachers to manage the group members.

Fig. 2. Game appearance snapshot.

Fig. 3. Questions appearance snapshot.
4. RESEARCH METHODOLOGY

There are 5 steps for the methodology of this paper as shown in Figure 4.

4.1 Studying and Analyzing Basic Information: This process emphasizes the preparation of basic information for developing the online game such as the infrastructure and the implementation requirements. The content of each subject is also prepared in this step.

4.2 Designing Game: This step is about designing all components required for the proposed game as mentioned before in section 3. The game story is about kidnapping everybody in school and the hostages are kept into the different locations for testing new chemicals on human, but five students are safe. Group members must collaborate among each other to find the places and find the key to turn the door to help hostage within the limited time limit, or until they can destroy the chemical laboratory successfully.

4.3 Developing Game: This is the step of implementing the designed game. Macromedia Flash program for creating characters and inserting coast scripts, Adobe Swish Max program is used for creating each scene, Photoshop CS program is used for creating object, and Adobe Audition 1.5 program is used for entering and adjusting music and sound.

4.4 Testing and evaluating: This process is to test the developed game with the target students. The target students are 100 grade six Thai students in Chiang Rai province, Thailand. The students have the same age which is between 11-12 years old. The evaluation is conducted in order to investigate 2 main aspects including to which extent the students satisfy this game and to which extent the students satisfy this game and to which extent the students satisfy this game and to which extent the students satisfy this game and to which extent the students satisfy this game.

5. EMPIRICAL STUDY & RESULTS

As mentioned before, the game is online game, the target students are selected mostly from the schools having good quality of internet connection. The numbers of 100 grade six Thai students, from 3 primary schools in Chiang Rai, Thailand are divided into 2 groups. The first group consists of 25 students. This group plays the developed game individually. The second group consists of 15 groups of students and 5 persons per each. This group plays the developed game collaboratively. The students do not know each other before. Before and after playing the game, all students are asked to have the pre-test and post-test respectively. The scores of the second group are randomly chosen only 25 students from 75 students to compare with the students from the first group. Both tests are multiple choices with 4 alternatives for each subject. The different scores of pre-test and post-test of both groups reveal how collaborative learning can help the students to enhance their learning efficiencies in those 3 subjects. Table 1 shows the comparison of pre-test and post-test scores for both groups of students. The results from Table 1 show that the students from the first group have enhanced their scores with Mean = 7.58 or 25.27%, while the students in the second group have enhanced their scores with Mean = 10.02 or 33.40%. Therefore, it can be concluded that the students playing the game collaboratively have higher learning efficiencies than the students playing the game individually.

Table 1. Comparative pre-test and post-test scores of students playing educational game individually and collaboratively

<table>
<thead>
<tr>
<th>Educational Game Type</th>
<th>N</th>
<th>Mean</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Game</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Test</td>
<td>25</td>
<td>15.18</td>
<td>50.60</td>
</tr>
<tr>
<td>Prost-Test</td>
<td>25</td>
<td>22.76</td>
<td>75.87</td>
</tr>
<tr>
<td>Advancement</td>
<td>+7.58</td>
<td>25.27</td>
<td></td>
</tr>
<tr>
<td>Collaborative Game</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Test</td>
<td>25</td>
<td>15.18</td>
<td>50.60</td>
</tr>
<tr>
<td>Prost-Test</td>
<td>25</td>
<td>25.20</td>
<td>84.00</td>
</tr>
<tr>
<td>Advancement</td>
<td>+10.02</td>
<td>33.40</td>
<td></td>
</tr>
</tbody>
</table>
Moreover, the students playing the game collaboratively are also asked about their satisfactions to the game. The questionnaires with 3 different rating scales are used in this process to study how collaborative game satisfies the students. In this paper, the poor level, the fair level and the good level are the scores between 1.00-1.50, 1.51-2.50 and 2.51-3.00 respectively. Table 2 shows how the students playing the game collaboratively satisfy the developed game for different criterion.

<table>
<thead>
<tr>
<th>Satisfaction Criterion</th>
<th>Mean</th>
<th>Std dev.</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Illustration in a colorful game</td>
<td>2.87</td>
<td>0.35</td>
<td>Good</td>
</tr>
<tr>
<td>2. Readable characters</td>
<td>2.93</td>
<td>0.25</td>
<td>Good</td>
</tr>
<tr>
<td>3. Language easy to understand</td>
<td>2.87</td>
<td>0.35</td>
<td>Good</td>
</tr>
<tr>
<td>4. Qualities of sound and music</td>
<td>2.47</td>
<td>0.63</td>
<td>Fair</td>
</tr>
<tr>
<td>5. Interesting and observable story</td>
<td>2.53</td>
<td>0.51</td>
<td>Good</td>
</tr>
<tr>
<td>6. How to play straight forward</td>
<td>2.97</td>
<td>0.81</td>
<td>Good</td>
</tr>
<tr>
<td>7. Suitable play time</td>
<td>2.57</td>
<td>0.63</td>
<td>Good</td>
</tr>
<tr>
<td>8. Fun and challenge</td>
<td>2.60</td>
<td>0.56</td>
<td>Good</td>
</tr>
<tr>
<td>9. Content Learning</td>
<td>2.87</td>
<td>0.35</td>
<td>Good</td>
</tr>
<tr>
<td>10. Satisfaction of each subject</td>
<td>2.87</td>
<td>0.35</td>
<td>Good</td>
</tr>
<tr>
<td>11. Team Collaboration</td>
<td>2.53</td>
<td>0.51</td>
<td>Good</td>
</tr>
<tr>
<td>12. Willing to play again</td>
<td>2.57</td>
<td>0.63</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td>2.72</td>
<td>0.22</td>
<td>Good</td>
</tr>
</tbody>
</table>

From Table 2, it can be concluded that the satisfaction of students to the developed collaborative game are averagely in the Good level. Only the Qualities of sound and music is in the Fair level.

6. CONCLUSION

This paper proposes the collaborative education game for Thai high school students to promote the higher learning efficiencies of English language, Mathematics and Science for life. Besides providing the collaborative atmosphere, the proposed game also provides the satisfaction in different criterion to the students. The empirical study is conducted with 100 students from 3 different primary schools in Chiang Rai, Thailand. These students are grouped into 2 groups for playing the game individually and collaboratively. The first group consists of 25 students and the second group consists of 15 groups of students which has 5 members per group. The results show that the students playing the game collaboratively have higher learning efficiencies for those three subjects than the students playing individually. Moreover, the proposed game can satisfy those students averagely in the Good level.

**REFERENCES**

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