Pertanika J. Soc. Sci. & Hum. 20 (3): 645 - 668 (2012)

PERTANIKA JOURNALS

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Computer Games Development Class with Appreciative Learning Approach: From the Perspective of Bloom's Taxonomy

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ABSTRACT

Both computer games development and appreciative learning approach are still at the infancy stage of utilization at educational setting. The purpose of this study was to explore what lower secondary students learned from the application of appreciative learning approach in computer games development class. Triangulated data comprising of interviews, logbooks, visual captures, researchers' observations, and games were produced. NVivo software was used to support data management. The compiled codes were clustered to create themes pertinent to Bloom's taxonomy. As a result, computer games development within appreciative learning approach environment was found as positively related to students' cognitive, affective, and psychomotor development. Nevertheless, caution is warranted in making inferences as different students gained different learning experiences and outcomes, analogous to different players generated different outcomes in computer games.

Keywords: Appreciative learning approach; Bloom's taxonomy; computer games development; learning outcomes

ARTICLE INFO

Article history:
Received: 25 April 2010
Accepted: 9 November 2011

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INTRODUCTION

This study was an extension of what had been previously investigated on the effects of the combination of appreciative learning approach and computer games development on students' creative perception (Eow, Wan Zah, Rosnaini, & Roselan, 2010a) and creative process (Eow, Wan Zah, Rosnaini,

ISSN: 0128-7702

& Roselan, 2010b). Although previous studies found appreciative learning approach applied in computer games development class as positively enhancing students' creative perception (Eow *et al*., 2010a) and creative process (Eow *et al*., 2010b), no extensive study has been carried out to investigate its potential beyond creativity enhancement. In order to fill in this gap, this paper was meant to investigate students' learning outcomes from the perspectives of Bloom's taxonomy.

Computer Games Development

Computer games is synonymous with the young generation's habits and interests (Eow & Roselan, 2008; Eow, Wan Zah, Rosnaini, & Roselan, 2009b; Inal & Cagiltay, 2007; Oblinger, 2006; Prensky, 2007a; Rosas *et al*., 2003; Yee, 2006). The current generation is growing up with a pastime that demands interaction and play (Becker, 2007; Henderson, 2005; Prensky, 2001). However, Caillois (2001) argues that play is an occasion of pure waste in terms of time, energy, ingenuity, skill, and money. The philosopher defines play as a free and voluntary activity that occurs in a pure space, and is isolated and protected from the rest of life. He further inserts that play is uncertain and the outcome may not be foreseen. Therefore, the question worth answering is that whether computer games development activity is just another mere play and a waste of time, energy, ingenuity, skill, and money, without contributing to any learning outcomes.

Previous research found that on average, youths spent 22 hours on computer games per week, with 70% of these youths spending at least ten continuous hours in the virtual world at one sitting (Yee, 2006). Meanwhile, a survey conducted among 236 Form One (Grade 7) students at one Malaysian secondary school revealed that 75.8% were gamers who spent an average of 8.47 hours per week playing computer games (Eow *et al*., 2009b). Therefore, it is becoming increasingly difficult to overlook the fact that computer games are the contemporary culture of today's youth.

Thus, with the current trend, what could be a better way than applying the same technology that has been the students' contemporary interest to excite and engage them? Kearney and Skelton (2003) recommended computer games development as one of the ideal ways to reach out to students who have been growing up in the playstation generation so as to inspire a sense of creativity and a desire for innovation. In addition, educational practitioners are urged to use computer games within a meaningful learning environment to promote learning and students' self-development (Egenfeldt-Nielsen, 2007). Egenfeldt-Nielsen further advised educators to move towards a new generation's usage of computer games that covers a broader scope, and not just as an information transmission tool. Besides that, Prensky (2007a) stressed that students should be allowed to go as far as they could with technologies they love using, characterize their age and at the same time be able to prepare students for the 21st

century's challenges as well. This is agreed by Shaffer (2007) who states that time has changed and education should move beyond the traditional organization of schools. This is to prepare the young generation living in the digital age with different skills and ways of thinking. With these justifications, computer games development could be a task that goes beyond information transmitter, i.e. not only it fulfils students' preferences but also contributes to their learning beyond standard curriculum. However, academic studies rarely tapped on the first persons' perspectives since education is mostly teacher-centred (Stringer, 2008). Thus, the available academic studies are mostly focusing on teachers' reflections. In fact, it could cause the formulation of theories based on false beliefs (Whitehead, 2009). For this reason, this study was projected to explore on the perceptions of the first persons, namely, the stakeholders of the learning process.

Technology has been progressing aggressively. Hence, computer games development tools have become more widely available and affordable for non-professionals. Game Maker, Torque Game Builder, Golden Game Engine, The Game Creators, Game Factory 2D and 3D Game Studio are among a few examples of the computer games development tools that are readily available for free downloading or with reasonable and affordable fees. As for this study, Game Maker was utilized because it provides a friendly and simple game developing environment that suits students at lower secondary level (Habgood & Overmars, 2006). Although computer games development courses are well established in some of the higher learning institutions (e.g. Limkokwing University of Creative Technology, 2010; University of Central Lanchashire, 2007; University of Luton, 2008; University of Worcester, 2009), it is still new to lower secondary students, especially in the Malaysian setting. This is because most Asian schools are conservatively regarded as social institutions in which knowledge is rarely dispersed beyond standardized curriculum and chalk and talk method (Tan & Law, 2004). Besides that, computer games development is traditionally known to be a difficult task which requires a big amount of expenditure (Saulter, 2007). As a result, research on computer games development often focused on higher learning level (Cagiltay, 2007; Ip, Capey, Baker, & Carroll, 2009; Killi, 2005; Ogletree & Drake, 2007; Schaefer & Warren, 2004), leaving a gap at secondary and primary school levels. Consequently, the gap created the opportunity for this study to be carried out.

Appreciative Learning Approach

Technology alone is not sufficient to create appropriate learning outcomes (Kelly, 2005; Kiili, 2005). Thus, appreciative learning approach was employed in this study. Appreciative learning approach was based on Appreciative Inquiry (AI) Theory. Cooperrider, Whitney and Stavros (2008, p. 1) define appreciative and inquiry as:

Ap-pre'ci-ate, v., 1. to value; recognize the best in people or the world around us;

affirm past and present strengths, successes, and potentials; to perceive those things that give life (health, vitality, excellence) to living systems. 2. to increase in value. Synonyms: value, prize, esteem, and honour.

In-quire', v., 1. to explore and discover. 2. to ask questions; to be open to seeing new potentials and possibilities. Synonyms: discover, search, systematically explore, and study.

Cooperrider *et al*. (2008) further explained Appreciative Inquiry (AI) as a cooperative co-evolutionary search for the best in people, their organizations, and the world around them. Every organization or person is perceived to have something that works well, and strengths that can be a starting point for creating positive change. AI is both theory and practice (Cooperrider & Srivastva, 2001). Cooperrider and Srivastva (2001) added that a good theory is one of the most powerful resources that helps social systems evolve, adapt, and creatively alters their patterns over time. However, most traditional research focused on changing people and behaviour by using problems as a base to be fixed (Watt, 2007; Whitehead, 2009). With AI practices, instead of negation and criticism, the 4D*s* (discovery, dream, design, destiny) model helps merging the past and present capacities such as achievements, assets, unexplored potentials, strengths, elevated thoughts, opportunities, high point moments, and visions into positive changes without having the intention to solve existing problems (Cooperrider & Whitney, 2005).

Computer games are always link to controversial issues, such as fostering violence (Bartholow, Bushman, & Sestir, 2006; Carnagey, Anderson, & Bushman, 2007), low academic performance (Gentile, Lynch, Linder, & Walsh, 2004), addiction (Healthwatch, 2006), demoralisation (Anderson, 2003), and youth obesity (Bijvank, Konijn, Bushman, & Roelofsma, 2009). Despite all these concerns, computer games are undeniably the students' habits and interests due to the number of gamers recorded and also the amounts of time, money, and effort they spent for them (Eow *et al*., 2009b; Inal & Cagiltay, 2007; Oblinger, 2006; Prensky, 2007a; Yee, 2006). It is crucial to note that this study did not intend to solve any existing problems relating to computer games. Since the study was based on AI as both theory and practices, computer games development was considered as an affirming task to create positive changes in students, instead of problems to be solved. The consequences on students' learning would be referred to Bloom's Taxonomy.

Bloom's Taxonomy

Bloom's Taxonomy, Kirkpatrick's model, Maslow's hierarchy of needs, Mcgregor's XY Theory, SWOT analysis model and Berne's transactional analysis model are timeless and always relevant to the understanding and development of people (Chapman, 2006; Forehand, 2005). In this study, justifications for the use of Bloom's Taxonomy in relating the research

findings are due to the fact that Bloom's Taxonomy is a systematic classification of thinking and learning (Krathwohl, 2002), apart from being familiar to most educators (Schlemmer & Schlemmer, 2008). In addition, Bloom's Taxonomy covers complete aspects of cognitive, affective and psychomotor development (Krathwohl, Bloom, & Masia, 1964), and it has been proven to be a valuable tool for evaluation (Marzano & Kendall, 2007). Krathwohl *et al*. (1964) described cognitive as a domain that emphasizes on objectives which vary from a simple recall of material learned to a highly original and creative way of combining and synthesizing new ideas and materials. Meanwhile, affective domain relates to the feeling tone that can be expressed as interest, attitude, appreciation, value, and emotional set or biases. Krathwohl *et al*. (1964) further associated psychomotor domain with muscular or motor skill, manipulation of material and objects, or act which requires neuromuscular co-ordination. Thus, Bloom's Taxonomy is relevant not only to simple but also complex types of human learning. Bloom's Taxonomy remains a classical reference model and tool into the 21st century (Chapman, 2006). With these justifications, Bloom's Taxonomy has become the main reference pertinent to students' learning outcomes generated in this study.

As a summary, both computer games development and appreciative learning approach are still in the infancy stage of utilization at lower secondary educational settings. By tapping the contributions of computer games development and appreciative learning approach combination towards learning, educators could be assisted in making better judgment on computer games development as a technological tool and appreciative learning approach as a pedagogical strategy in actively engaging their students.

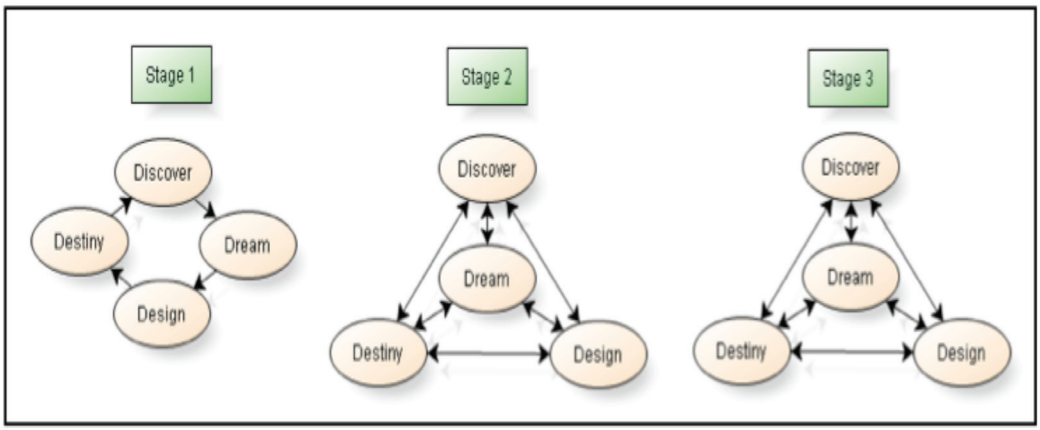

Fig. 1: Appreciative learning approach model applied in the action research study (adapted from Cooperrider *et al*., 2008)

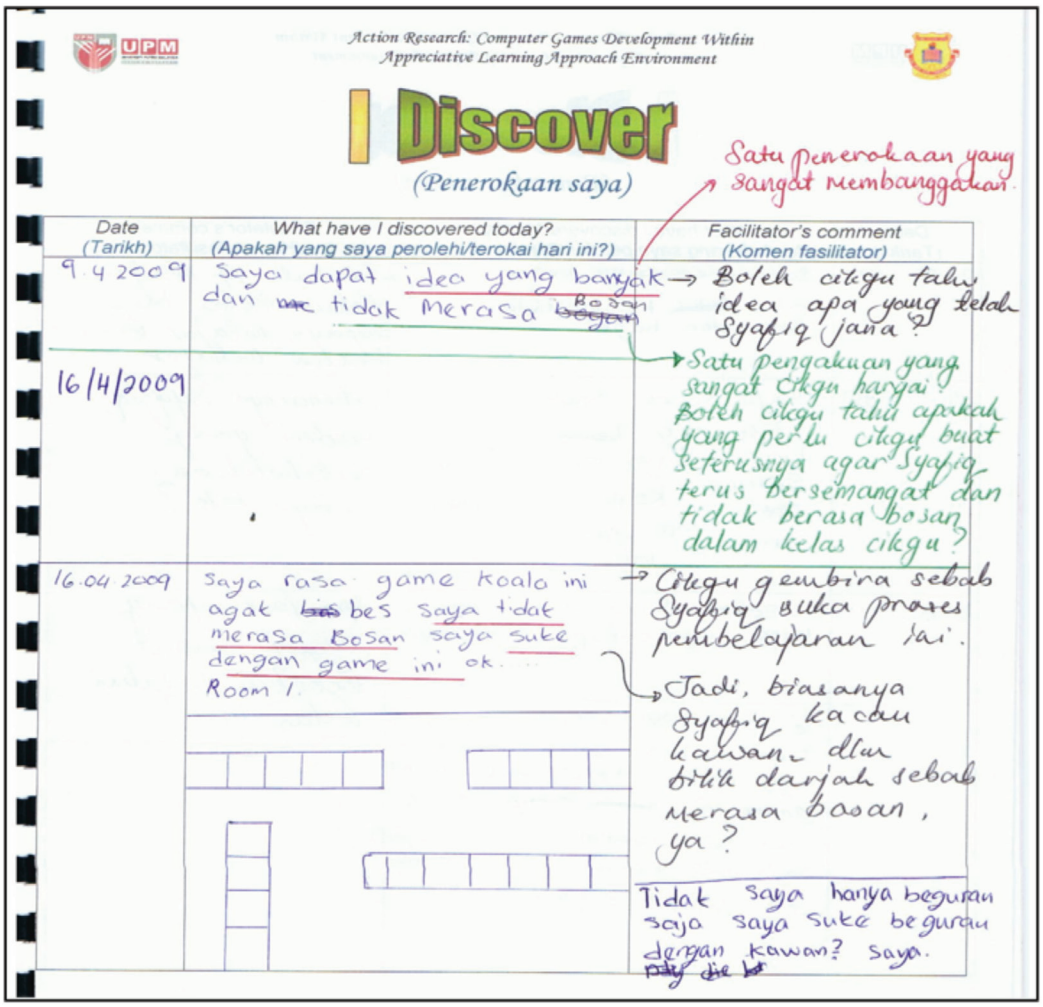

Fig. 2: Discover section of the logbook

MATERIALS AND METHODS

Research Procedure

The findings on the learning outcomes were generated through interviews at three different phases of action research methodology. The first phase of the action research study applied the 4D*s* model suggested by Cooperrider *et al*. (2008) which consisted of discovery, dream, design, and destiny stages revolving in the respective sequence (Fig. 1). However, as the study progressed, students' opinions were taken into consideration (Eow, Wan Zah, Rosnaini, & Roselan, 2009a) and subsequently the model was altered to create more flexibility to suit students' needs and appeals in the second and third phases of action research (Fig. 1). The 4D*s* stages were carried out simultaneously fulfil students' different preferences. Students wanted more control on their actions instead of following the

sequence of the initial model (Eow *et al*., 2009a). Nevertheless, the initial objectives for each phase remained the same. The discovery stage was carried out with the intentions to get the gamer students see new potentials and possibilities in computer games. Group conversations were carried out for students to share their views and experiences. However, at the second and third phases of the action research, group conversation was toned down as some students regarded it as a threat to their privacy (Eow *et al*., 2009a). In order to accommodate students' intrapersonal trait, researchers introduced "My 4D*s* Project" with a specific designed logbook (Fig. 2) as the main mode of communication between facilitator and students. Since it was positively accepted by the students, the practice was continued during the third phase of action research. The obvious differences between the second phase and the third phase of the study were the grouping of the students and the games designed. The students worked individually in the first and second phases and in a group of two in the third phase. The games produced at the third phase were with educational features, while no educational elements were embedded in the games that were produced during the first and second phases of the study.

The discovery stage was meant for the students to self-discover Game Maker knowledge and skills with the guide of game modules adapted from Habgood and Overmars (2006). During the first phase of action research, the students were introduced to a more general type of leisure game, followed by a puzzle game in the second phase, and a platform game in the third phase. The modules were designed with an increasing difficulty at each phase, as more complex events and actions were introduced, while less instruction on the steps to be undertaken was given when students proceeded to the next level. This was because the students were expected to engage more in thinking rather than mere imitation.

Next, in the dream stage, the students were asked to dream on how they wanted their own games to be. For this, the students were asked to sketch or to note down their dreams or ideas on the logbook provided. In the design stage, the students started to develop computer games based on the dreams and ideas generated. Lastly but not least, was the destiny stage where the students envisioned how they were going to empower their newly found knowledge and skills in Game Maker. As a result, appreciative learning approach provides opportunities for students to be heard, to explore and dream, to take actions, as well as share their products and envision their future.

Subjects

During the first phase, 34 Form One (grade 7) students aged between 13 to 14 year-old, who were interested in learning computer games development, had been playing computer games for at least two years, and are still actively playing, were randomly selected from the interested population generated from a school located

in Kuala Lumpur, Malaysia. As the research progressed to the second and third phases, the number of students who had fully attended the activity conducted and managed to produce computer games of their own was reduced to 30.

Data Collection

Qualitative research methodology was employed in this study as the primary concern was on the description and interpretation of what was happening in a specific setting (Lacey & Luff, 2007). The main data were collected through interviews to explore students' learning outcomes from the students' own perspectives. Twenty-one students were interviewed throughout the study (with eight during phase one, six in phase two, and seven in phase three). All the interviews were audio-taped as it was assumed to be less distracting (Ary, Jacobs, Razavieh, & Sorensen, 2006). The interview questions were constructed with the concept of learning in mind. Nevertheless, the interviews were carried out according to the students' own themes and ideas as they emerged during the interviews.

Analysis of Data

The audio-taped interviews were transcribed and analysed through the process of coding. The compiled codes were clustered to create categories according to Bloom's Taxonomy. NVivo software package was used to manage the data. Finally, the information was concluded and reported. Although the transcribed interviews were the main data, visual captures, students' logbooks, and computer games produced were also used to triangulate the data collected in order to establish a more rigorous study in terms of reliability and validity. It is important to note that data triangulation can also be conducted through contrasting data gathered at different times and settings (Turner & Turner, 2009). As for this study, data pertinent to the learning outcomes experienced by students were collected at all the three phases of action research so as to reveal the typical and recurrent patterns that could improve the confidence of the findings. Meanwhile, credibility of the data (Lincoln & Guba, 1985) in this study was established through the proof reading process by the students interviewed. It served to confirm and revise the data transcribed. Besides checking for accuracy, it was also used as a way to get students' consent for the use of data in the research report. Many reviewers considered respondents' validation in qualitative research to be a mark of quality and a way of demonstrating rigorousness (Lacey & Luff, 2007). Meanwhile, constructivist theorists believe students are the creations of their own learning (Schunk, 2004). Simpson (2002) agreed to the notion that all knowledge is subjective and personal. Hence, a person's learning constructions are true to that particular person and not necessarily to anyone else. Therefore, researchers would not judge the students' learning outcomes as authentic or contradictory.

RESULTS AND DISCUSSION

In this study, the students were interviewed at different phases of action research. Through the help of NVivo, however, data management was able to trace the similarity of the 16 identified themes pertinent to Bloom's taxonomy at each phase of action research (Fig. 3). It is crucial to highlight the fact that different students might have different perceptions of what they have learned. The following findings and discussions were the accumulations of the students' perceptions generated throughout this study.

Cognitive Domain

Knowledge (Level 1)

During the interviews, students indicated that they gained knowledge and skills that they had never learned before. By the end of the first phase of the action research, most of the students were already aware that they could load sprite, object, background, sound, and music into their games without referring to the game modules. Besides that, the students were able to list some of the English vocabulary learned throughout the learning process. As they proceeded to the subsequent level of action research, the number of English vocabulary listed further increased and varied. However, students also claimed that there were a lot more knowledge and skills in Game Maker that they have yet to master, as they also realized they could not design games with more sophisticated features. AI theory assumes every living system as having many untapped, rich and positive inspirations (Cooperrider & Whitney, 2005). Thus, the learning environment of the appreciative learning approach applied in the study focused on friendly, supportive and unthreatening guided autonomy atmosphere that enables the students to progress with more self-

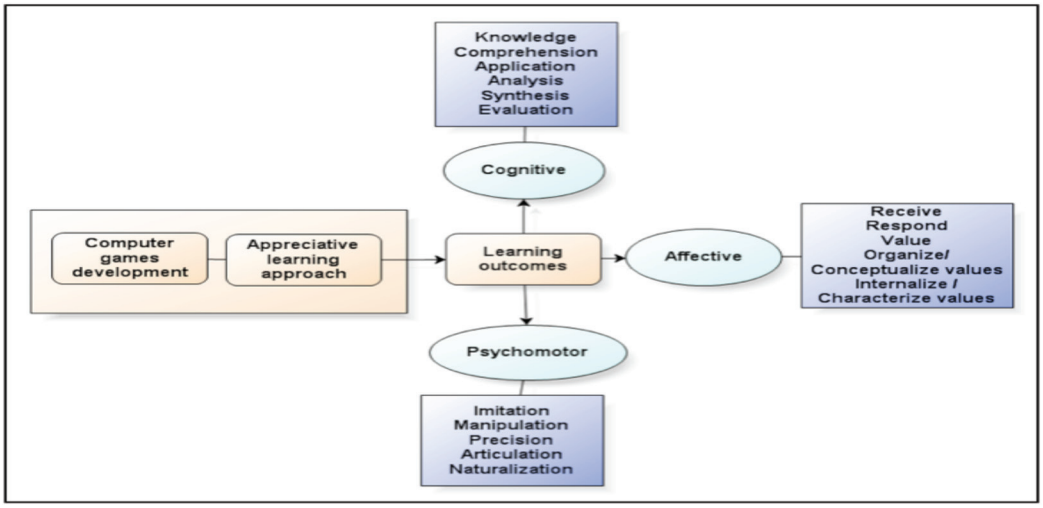

Fig. 3: Learning outcomes generated from the application of appreciative learning approach in the computer games development class as perceived by the students

fulfilling. However, knowledge constructed by human is tentative and incomplete as it will keep shifting and expanding (Juniu, 2006). Accordingly, students displayed their interest and inquisitiveness in acquiring more skills and knowledge in Game Maker at every phase of the action research.

Comprehension (Level 2)

Students stated that computer games development helped them to understand how typical computer games were developed. During the interviews, several students were able to relate some of the tasks they did during the class to the readily available games online. Bencze (2007) believe that students could not change their ways of thinking or perception if they were lacking in their understanding of knowledge, skills, and resources availability. Hence, computer games development and appreciative learning approach combination have helped students to see things in bigger perspectives by enlightening them on the alternatives through discovery, dream, design, and destiny stages. Thus, students would not end up just being mere gamers without understanding the environment they were engaging in and the alternatives availability pertinent to computer games.

Application (Level 3)

By understanding how computer games were developed, students demonstrated their capabilities in applying the knowledge into their own products, which in this case were the computer games produced. Some students thought previous experiences in playing computer games had helped them in discovering new events and actions to be developed. These students further added that their products resembled some of their favourite online games. Several students claimed that they even downloaded their favourite music and characters in order to construct their own computer games. In addition, the students stated that they had also modified the games suggested by the game modules. Thus, learning outcomes reflecting the application level were further supported by students' designs, which portrayed the subjects' learning materials such as mathematics, science, languages, and geography. Therefore, the design stage of appreciative learning approach offered students the opportunities to apply various knowledge and skills that could be learned within and beyond traditional classroom curriculum.

Analysis (Level 4)

Students learned analysis skill during computer games development class. They did troubleshooting and analysing mistakes done in the previous level. However, most students alleged of being weighted down when their games could not run as desired. Researchers would like to emphasize that appreciative learning approach applied in the study was grounded on the belief of connection between positive image and positive action (Yballe & O'Connor, 2000). Yballe and O'Connor (2000) described mistakes or problems as possible sources of frustration, pain, or loss. Thus,

it is undeniable that the analysis domain experienced by students could have caused frustration and loss in students. As the facilitator in the study was grounded with the practice of appreciative learning approach, facilitator stayed within the boundary by positively encouraging students throughout the process. In more specific, facilitator continually praised the students for their volunteered actions taken and the outcomes generated in order for students to feel appreciated. Even a small task done was a big achievement from the facilitator's perspective. As a result, half of the interviewed students described their achievements in developing own computer games prevailed over the frustrations faced earlier. In fact, students were very proud of their ability in overcoming the frustration they had faced earlier on and deemed it as meaningful.

Synthesis (Level 5)

During the interviews, almost all the students expressed their excitement, amazement, pleasure, or self-satisfaction when they managed to design computer games, which are not only playable but presentable as well. According to Fitzgerald, Murrell and Miller (2003), the creation and sustaining momentum for change require large amounts of positive affect and social bonding such as hope, excitement, caring, *esprit de corps,* sense of urgent purpose, and sheer joy in creating something meaningful together. All these were made possible by the application of appreciative learning approach in computer games development class. AI theory allows one to see the world in a way which has probably never been imagined before (Cooperrider & Srivastva, 2001). In addition, it merges students' past and present capacities such as achievements, strengths, high point moments, and visions into positive changes without negation and criticism of students' work (Cooperrider & Whitney, 2005). Consequently, it gives way to imagination and innovation. Accordingly, it provides students with the opportunities to create and to feel appreciated without feeling weighted down by their feeling of incompetence. Meanwhile, the positive images of oneself and the world around them are expected to inspire the students for more volunteered actions and innovations (Cooperrider & Whitney, 2005; Lebrun, 2007). Therefore, appreciative learning approach facilitated students in enhancing synthesis skill and countered initial negative images, beliefs, and expectations pertinent to computer games. By acknowledging the habits of playing computer games as the students' strength, students are made to believe in their ability as being more than just players. In this study, students were lead to be game designers. There were also vast opportunities for students to practice their synthesis skill. Students' products, which consisted of computer games produced and logbooks, were the best evidences of the synthesis skill that they had applied (Fig. 4).

Fig. 4: Computer games produced and students' logbooks were the best evidences of the synthesis skill applied by students

Evaluation (Level 6)

The analysed interviews revealed that all the 21 students evaluated their own computer games by running them throughout the design stage. Some even went a step further by asking their friends to evaluate their computer games. Students thought that by doing evaluation frequently, they would be able to trace inappropriate events and actions developed in their computer games. Besides that, the students also stated that the evaluations done were meant for polishing games in order to look more presentable and interesting. Visual captures confirmed these statements as students were seen playing games developed, as well as discussing and giving suggestions to friends (Fig. 5). During the interviews, several students justified the use of computers beyond chatting, playing games, typing, and surfing internet. These students were able to recognize computer as a tool for innovation. Meanwhile, one student seemed to be learning evaluation skill at a more complex level by criticizing and making judgment on the teachers in general. He was quoted as saying, "Now I realized teachers are not smart in everything. They do not even know how to develop computer games." However, this comment should not be looked from the negative perspective as Prensky (2007b) observed that students tend to view their teachers being lack of fluency with modern tools and illiterate in the very domain which students regard as their future technology. Thus, the smartest teacher is the one who will collaborate with their students, whom most of the time are eager to teach their teachers (Prensky, 2007b). In fact, Prensky (2007b) highlighted on the needs for teachers of the current generation to realize that the acquisition of knowledge

Fig. 5: A student was trying out his game while friends looking on and giving suggestions for more improvement

and skills is a shared responsibility for both students and teachers. It no longer rests on teachers' shoulders as students are the ones who should take the biggest responsibility. Therefore, the whole learning process helps students to evaluate not only about themselves but also about the world around them.

Affective Domain

Receive and Respond (Levels 1 and 2)

Computer games development and appreciative learning approach combination facilitated students in learning to receive and to respond to phenomena. During the study, the students went through computer games development activity for four hours every session without complaining of tiredness. In fact, most students asked for more time allocation during the interviews. Computer games are undeniably the students' interests as they responded positively through their attendance to each session. Students claimed that they were fully engaged with the activity and eager to know the outcomes of every action taken. In addition, the students demonstrated the skills of receiving and responding to the new learning experiences positively when they expressed their willingness to participate in future study. Students perceived it as their lifetime opportunity. At the end of the third phase of the action research, the students asked for more of such activity to be conducted in the near future. Besides that, most students responded positively during group conversation by sharing their experiences related to computer games. The process of listening and sharing stories among the students during discovery and destiny stages reflected the poetic principle of AI theory (Doveston & Keenaghan, 2006). Group conversation was carried

out with the intention for students to feel belonging to a community with shared experiences, values, and aspirations. This connection development will help create a deeper understanding of one another (Egan & Lancaster, 2005). Thus, computer games development and appreciative learning approach combination provide students the opportunities in learning to receive and respond to new friends and learning experiences as well.

Value (Level 3)

On some superficial level, students play computer games because they enjoy the overall experience (Shaffer, 2007). As for computer games development with appreciative learning approach, several students commented that it was more enjoyable and exciting than playing the available computer games. When students revealed how much they had enjoyed themselves and the excitement they experienced during computer games development process, it reflected their commitment and value towards the tasks given within the learning environment provided. Meanwhile, three students narrated how the facilitator had detected their smoking habits through the strong smell of cigarettes on their bodies. However, the facilitator did not reprimand them. On the other hand, the facilitator started with friendly conversation with these students by asking them why, when and how they had started smoking and their feelings being smokers. The students also revealed that the facilitator expressed her wish to see them smoking less. Smoking less was the destiny expressed by the facilitator for the students to take action. In fact, the facilitator did not criticize students on their smoking habits. Gradually, these students reacted with their overt behaviour when they came to class with as less as possible of the cigarettes smell thereafter. This illustrates how appreciative learning approach assists in transforming by focusing on what is right and not the existing problems (Fitzgerald *et al*., 2003). In this case, smoking was not a problem but smoking less and getting rid of it became the focus. Although the issue of smoking was not within the focus of this study, the practices of appreciative learning approach allowed it to be apprehended as education is not restricted to skills and knowledge acquisition. Accordingly, appreciative learning approach guides students in developing value skill of what is preferable in their social system.

Organize or Conceptualise Values (Level 4)

Students were also believed to have reconciled internal conflict when they claimed that the combination of computer games development and appreciative learning approach had helped them to accomplish their previously unachievable dream in developing own computer games. According to Darby (2008), the normal games loving persons do not fit into the professional category that uses programming languages. On the other hand, most games loving persons would normally love to fulfil their dream of developing a game of

their own. In fact, many people have the aspirations in developing own computer games, but just do not know if it is possible to do so or where to start (Darby, 2008). Aside from that, students seemed to have organized or conceptualised values when they had altered their initial perceptions towards school. After going through computer games development class, most students began to perceive their school as an exciting place and has something different from other schools. They wished the activity to be carried out for years to come as students believed that there are more to be learned in Game Maker. In fact, some students quantified these personal views with the reason that the more they know about Game Maker, the more they feel insufficient.

Internalise or Characterise Values (Level 5)

Computer games development and appreciative learning approach combination were presumed to have provided students with the opportunities to adopt their own belief system. For example, when the students believe themselves as being more computer competence, they display it through their actions in helping out friends solving problems (Fig. 6). The students also demonstrated their ability to cooperate in the group activity, as well as working independently. In fact, the facilitator did not play a significant role in controlling the students' behaviour as they were expected to have their own value system while working within the appreciative learning approach environment. Therefore, the appreciative learning environment has offered students

Fig. 6: Helping a friend to solve problems

the opportunity to behave consistently to their personal values. At the same time, the students also commented that computer games development was not as hard as what they had thought before. Some students even claimed of experiencing great self-satisfaction and being proud of themselves when they were able to solve problems during the learning process. According to Henry (2005), appreciative learning approach has the ability in breaking through to new level of consciousness. When the facilitator recognized and amplified the students' successes and strengths, it created a new image of the future that would be compelling in resulting students consciously and unconsciously moving towards the images without much confrontation. Subsequently, the students' own value system controlled their persistency in developing computer games.

Psychomotor Domain

Imitation and Manipulation (Level 1 and 2)

A few students preferred copying and reproducing the actions of other students or game modules without much modification. Although imitation and manipulation are a part of the psychomotor skills, these skills were not encouraged as they inhibited students' potential to be creative and innovative (Fig. 7). On the contrary, the students should present what they know rather than memorizing what the teachers or textbooks tell them (Jonassen, Howland, Moore, & Marra, 2003). Jonassen *et al*. (2003) further added that computer technology is a tool which students should learn with and not from, as students do not learn from technology, but they learn from thinking. The students who

Fig. 7: Imitation and manipulation skills were parts of the skills learnt during the discovery stage but not encouraged during the designing stage

preferred imitation and manipulation skills to articulation skill admitted that they were actually lazy in thinking beyond the materials provided. They perceived thinking as a tiring task, which would consume enormous energy and time. Thus, the researchers attempted to minimise the setback by encouraging the students to dream more and sketch or note down their dreams and ideas into the logbooks provided (Fig. 8).

Precision (Level 3)

Most students perceived themselves as self-dependence since they managed to perform the tasks given to the level of self-acceptable quality without much assistance or help from neither facilitator nor friends. This could due to the fact that Game Maker is a friendly software (Habgood & Overmars, 2006). In addition, computer games are students' habits and interests (Eow & Roselan, 2008; Eow *et al*., 2009b; Inal & Cagiltay, 2007; Oblinger, 2006; Yee, 2006).

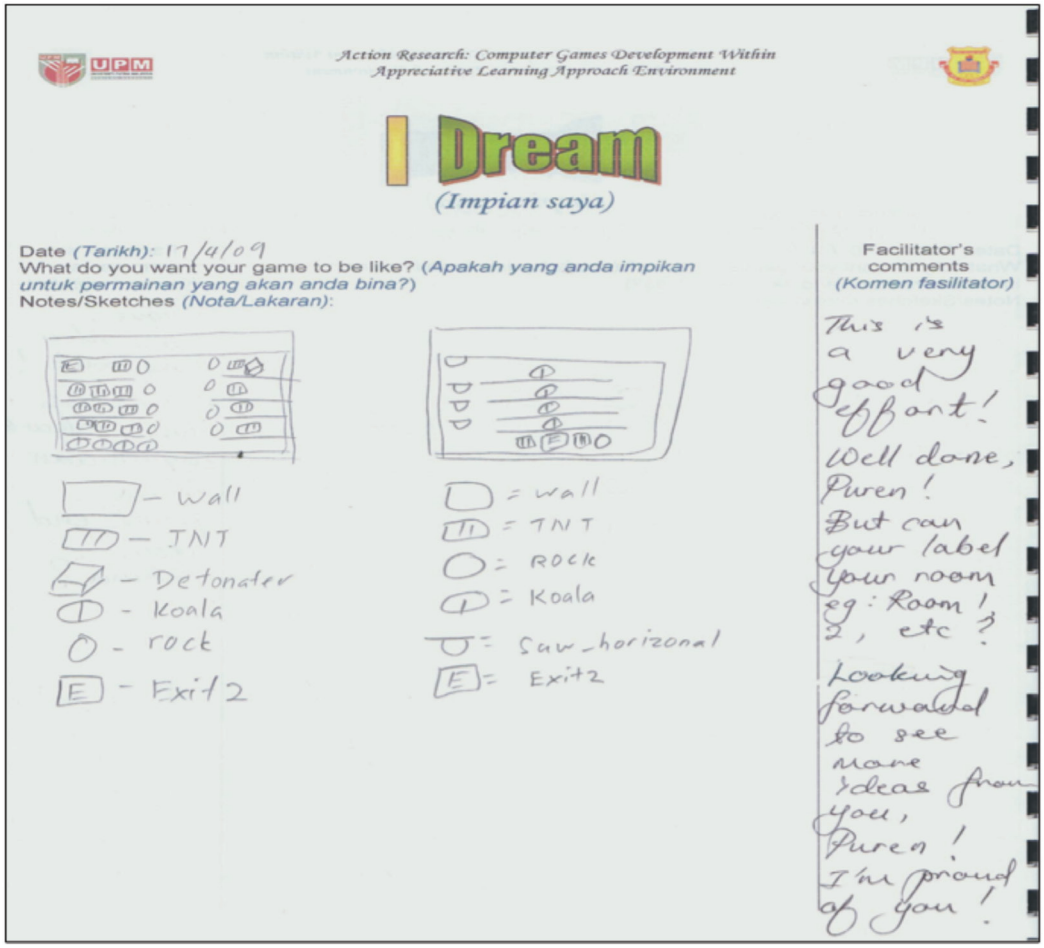

Fig. 8: Dream section of the logbook

Therefore, they could easily enhance their precision skill especially during discovery and design stages of appreciative learning approach.

Articulation (Level 4)

More than half of the students interviewed wanted the computer games produced to be different from others. As a result, they invested extra efforts by adapting and integrating other skills such as searching for graphics and sounds to be constructed into the computer games, and using trial and error process in creating new events and actions. The students even claimed that all these were volunteered actions. According to Kelly (2005), learning system should adapt to the differences of students' interests, backgrounds, learning styles, and aptitudes. Jonassen *et al*. (2003) stressed that students do not learn from teachers or technologies. On the other hand, students learn from thinking, and that thinking mediates learning and learning results from thinking. Appreciative learning approach has the potential in providing students the opportunities to think about what they have done, are doing and going to do next in its' 4D*s* stages while computer games are the students' habits and interests. Therefore, by creating an appealing environment through appreciative learning approach and computer games development combination, it would help to engage them in thinking, and subsequently, generate the learning of articulation skill.

Naturalization (Level 5)

Generally, learning outcomes at naturalization level were initiated when the students were seen executing their own strategies in achieving their dreams and claiming ownership of the computer games produced. Students claimed ownership through the name stated as the designer of the computer games produced. They expressed of being proud when proclaiming the products in front of their friends and siblings. Fitzgerald *et al*. (2003) stated what we perceived and experienced would create our realities through shared symbolic and mental processes. In this study, appreciative learning approach seemed to have provided the students with vast opportunities for them to discover their many unexplored potentials related with computer games through the 4D*s* stages of discovery, dream, design, and destiny. It worked on the assumption that every student has the potential for self-development. This study has guided students in exploring their potential rather than focusing on problems and difficulties faced during the learning process. Meanwhile, affirmative statements and questions were posed during the learning process through face-to-face conversation, as well as on students' logbooks. This was to help the students in reflecting on what they had done, were doing, and going to do next. These positive and affirmative statements on the students' actions and decisions were the appreciative elements created by the facilitator. The facilitator who was bounded with AI practices would then shift the focus

on failures towards possible achievements that could be attained by the students. When students perceived themselves positively, it would help them create their own reality naturally. Therefore, the naturalization skill learned by students is strongly supported by certain evidence such as students' inventions (computer games) and their ability in managing a project given (computer games embedded with learning materials, Fig. 9) during the third phase of the action research.

As a summary, this study has shown that computer games development and appreciative learning approach have complemented each other in contributing to holistic positive learning outcomes. Jonassen *et al*. (2003) classified technology as more than hardware, which consists of designs, environments, techniques, and methods in engaging learners. Thus, computer games development and appreciative learning approach are both technology for encouraging students in learning new skills and knowledge.

CONCLUSION

One of the most powerful and ancient learning strategies is through struggling in accomplishing a difficult but highly motivating task that requires new knowledge, carefully scanning a complex and changing environment, and seeking individualized help from experts or friends (Kelly, 2005). Computer games development and appreciative learning approach is a perfect pair of learning strategy that not only provides a highly motivating task but also a platform for students to learn the holistic skills of cognitive, affective, and psychomotor domains. Appreciative learning approach creates a lot of opportunities for students to engage in thinking, making decision, and taking ownership of the products. Meanwhile,

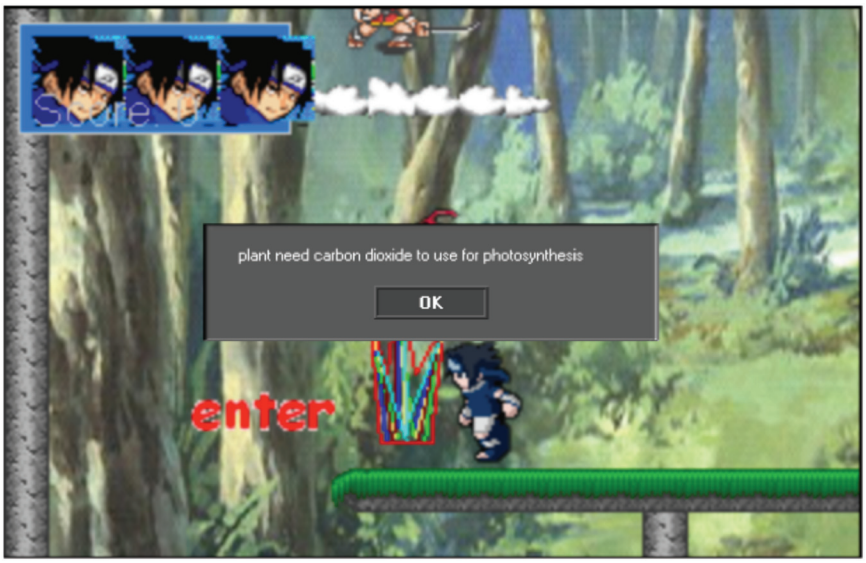

Fig. 9: One of the computer games embedded with learning materials

computer games are the students' habits and interests. Although the combination of computer games development and appreciative learning approach was found to have the positive impact on cognitive, affective, and psychomotor domains, caution is warranted in making inferences. This is because different students gained different learning experiences and outcomes, akin to different players having different endings in games. In addition, it is noted that there is no best teaching method or technology that could accommodate all domains, age groups, and cultures (Shelton & Wiley, 2007). Therefore, the question remains as to what degree of differences it would have on the students' learning outcomes. This further creates a gap for future research.

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