Learning by Digital Games Design in Children's Teaching and Learning Process: Issues and Challenges

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Abstract
The development and rapidity on the usage of the Information and Communication Technology (ICT) in the community showed that the education system in this region is utilizing more of ICT in managing various challenges in the world's education system. Learning by design approach has the potential to be one of the most popular approaches among teachers to achieve the objective of children's learning. This article discussed three issues and challenges in implementing this approach – i) community's perception on digital games, ii) teacher's practices in implementing learning by design through digital games, and iii) children's level of creativity and skills in designing digital games for the learning process in the classroom. This article also discussed on the solutions for each issue to ensure the teaching and learning process could be stabilized to produce competitive and highly skilled digital generation.

Keywords: Children, Designing, Digital Games

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Introduction

Today's education system showed various methods and teaching techniques in achieving a more effective and meaningful teaching objectives. Some of the methods mostly used by teachers are demonstration, lectures, group discussions and tutorials. Effective learning could be achieved when teachers are intelligent and creative in planning teaching strategies that could improve students' readiness and motivation (Tomlinson, Brighton, Hertberg, Callahan, Moon, Brimijoin, Conover & Reynolds, 2003). Creative teachers are those who are able to deliver its teaching using numerous methods, techniques, teaching aids and experience in ensuring the knowledge delivered could be understood by the students effectively. Creative teachers would be able to expand intellectual power, spiritual, physical and emotions to their students optimally as aspired in the National Philosophy of Education.

Creative teachers are able to plan lessons strategically in choosing methods and teaching aids to attract students' attention. Effective teaching approaches could improve students' skills in accepting, analysing, and sythesising lessons to create new knowledge. Today's children are no longer depending on teachers. As teachers act as facilitators nowadays, teaching and learning approaches could be diversified. In their book, Roger and Freiberg (1994) also agreed with this.

> *"when teachers as facilitators of learning rather than mere givers of information, students are challenges to think for themselves. When teachers respect students as source of knowledge rather than consumers, students become engaged in the learning process."*

The above excerpt stressed on effective learning process through two-way communication between teachers and students. Teachers should give students the opportunity to self-learning with the teachers' guidance. There are multiple techniques and methods in implementing student-centred learning in the classroom such as project-based learning and problem solving.

In today's digital world, children are the generation who are exposed to the rapidity and development of the technology. They are deemed to possess natural talent in exploring technology (Maizatul, 2009). A few researchers found that one of the techniques and methods that could be practiced in the classroom is designing digital games (Baytak, Land, and Smith, 2011 – Kafai, 2006 – Prensky, 2008). Through student-centred learning, teachers act as facilitators in monitoring and evaluating the digital games that are produced. Moreover, learning by design is an approach that is used in multimedia education. This approach is believed to give students the opportunity to explore knowledge independently and enable them to share their experience with peers, teachers and parents (Maizatul, 2009).

Designing digital games is seemed as a foreign approach in the current teaching and learning environment. In this working paper, researchers will discuss three issues and challenges in implementing this approach –

i) community's perception towards digital games
ii) teacher's practices in implementing learning approach through designing digital games – and
iii) children's level of creativity and skills in designing digital games for learning in the classroom

Children as Digital Games Designer

Multimedia application in education has opened a new dimension in diversifying methods and teaching and learning aids that could be use in the classroom. Children as students have the potential to apply technology and multimedia in developing their learning products. In developing a multimedia product based on new technology, Druin (2002) has listed four children's roles which are user, experimenter, information giver and designer's partners. However, many researchers had expanded the roles by including children as the designer of digital games. Kafai (2005), who is an active researcher in research related to technology and children, highly encourage children to act as designer rather than merely as digital games players. He believed that children are highly potential to determine their learning direction according to their own needs and expectations. Therefore, in recognising children's real potential in developing multimedia products such as digital games, children's role as designer who produce their own design (without the involvement of other individuals such as professional developer, programmer and designer) has to be observed and evaluated especially in the education field (Laili & Maizatul, 2013a).

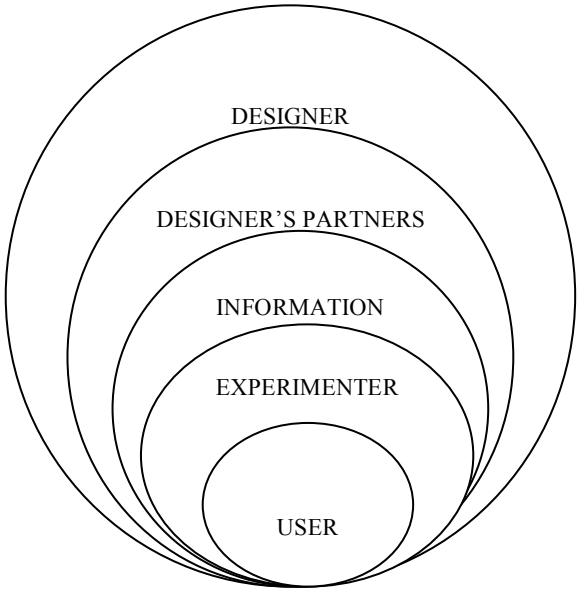

Chart 1 – Adaptation of children's roles in designing new technology (Druin, 2002).

In this working paper, researchers stressed more on children's role as a designer of educational digital games. Children's involvement as digital games designer give many benefits mainly for learning purposes such as below –

i) Deep understanding towards learning that could be mastered through the games (Gershenfeld, 2011).
ii) Increase in students' preparation and understanding to learn (Baytak, Land & Smith, 2011).
iii) Twenty-first century skills that could be enhanced along with developing deeper knowledge (Kamisah&Nurul, 2013).
iv) Students are free to explore self-learning or collaborative process (Robertson & Howells, 2008).
v) Give students the opportunity to apply different learning styles (Lim, 2008).

Children are categorized as novice users without technical and programming knowledge in developing and designing digital games. Writing tools such as *Gamefroot, Scratch, Gamestar Mechanic and Scratch* are suitable to be used by children as they contain high usability and are interactive (Laili & Maizatul, 2013). These writing tools are easy to use and could be downloaded for free. Apart from accentuating creativity, children's skills could be trained to fulfill the needs of the 21st century.

Learning Approach through Digital Games Design

Approaches, methods, techniques and teaching aids for today's digital children generation must be different than the older generations. According to Prensky (2008), the way today's generation process information and thinking are far more advanced. Hence, the conventional approaches are not suitable to be practiced as learning content and technology develop rapidly. Learning by design is one of the student-centred methods that could give positive impacts in teacher's teaching pedagogy (Kalantzis & Cope, 2010).

The definition of learning by design from education multimedia perspective is based on constructivism theory that stresses on learning values through creation, programming or other activities that involve the process of digital design which could lead to meaningful learning (Han & Bhattacharya, 2001). In the context of this working paper, teachers could use learning by design approach by delivering the lessons and students could learn from the digital games that have been designed. Froebel agreed that learning process occur effectively in a fun situation where children could build, design and invent through play (Resnick, 2007). In addition, intrinsic motivation and deep learning strategies could be increased through this approach.

In the learning pyramid by the National Training Laboratories, it will be easier for 75% of the students to accept and remember the lessons through self-learning process (Alexandria, Virginia. Oblinger, 2004). This approach is also supported by constructivism learning theory pioneered by Papert (1991) in which learning become more meaningful when students actively build their own artifacts and share them with others. Moreover, Piaget in Baytak, Land & Smith (2011) also stated that students could build their knowledge independently during the designing process. In

the Digital Taxonomy Bloom adapted by Churches (2008), designing activity in invention category is the students' highest order thinking skill.

In integrating digital games in the classroom, Mclester (2005) stressed that the designing activity is the best method. This is supported by Rieber (2005) in his research that claimed most of the learning occurred during the designing process as compared to merely playing digital games. Teachers could use this access as teaching aids that link teaching content with games (Ash, 2011). Teachers also play important role in conducting this activity to ensure learning objectives could be delivered effectively. They have to ensure that the content, pedagogy, knowledge and technology used are well-balanced. Kamisah & Nurul (2013) listed three teacher's roles in using this approach successfully which are:

i) Teacher as facilitator in exchanging knowledge in the learning process
ii) Teacher as facilitator in learning across curriculum and transfer of skills and knowledge
iii) Teacher as evaluator in the learning outcomes (Roberston & Howells, 2008).

Research conducted by Maizatul & Masuch (2007) showed children's abilities in expressing creativity, implementing original ideas as well as learn to think logically and structurally based on their environment by designing digital games. Lim (2008) and Prensky (2008) found that this approach could increase the socio-cultural aspect in the classroom. Furthermore, research showed that children have more opportunity to be creative and could feel the excitement in learning through exploration and new invention (Kamisah & Nurul, 2013; Laili & Maizatul, 2013a). Active learning environment and experience could encourage students to be interested and ready to learn. Through this approach, teacher should guide students in understanding concept from various perspectives to ensure their thinking expand dynamically. This could assist children in preparing for future challenges that are more challenging.

Issues and Challenges in Implementing Learning Approach through Designing Digital Games

Learning by design in the classroom requires special attention from teachers. Teachers have to plan suitable strategy that will be implemented and the technology that will be used to achieve the teaching objectives. There are a few issues and challenges that teachers have to face in implementing this approach.

Community's perception towards digital games

When talking about digital games, many of us would imagine shooting, racing, or odyssey games that portray violent and rough characters. This is not something new as the community is exposed to the negative implications of digital games. Negative perceptions among teachers and parents towards the use of digital games as one of the learning aids becomes one the reasons it is rarely used in the classroom (Rice, 2007). Moreover, there are some schools that are not able to accept the integration of digital games in the learning curriculum and proscribe its usage as teaching aids. This is due to the fact that the content of most digital games in the market is not

appropriate for teaching (Ertzberger, 2008). Digital games developers only focus on the commercial value rather than the content and pedagogy that are fundamental in educational products. In addition, there are less cognitive elements in the games that only emphasise on play (Hogle, 1996) and excessive entertainment (Okan, 2003) which cause students to not pay attention when studying. This factor will disturb the teaching and learning process.

In an effort to increase the effectiveness of digital games in the teaching and learning process, a few agencies such as Osaka University and UK Department of Trade and Industry Technology had conducted research on this matter. Even though the game-based learning approach had been introduced to the education system in developed countries such as America and Europe, it is deemed as inappropriate to be used in Asean countries because of cultural issues (Lim, 2008). The content of video games that are too open did not adhere to the norm and courtesy manners of the East community. Furthermore, the social and cultural structures that are practised by the education system are conventional which make it difficult for teachers to accept new approach and method in their teaching. Several developers have taken the initiative to introduce educational games. However, it did not receive great responses as they were uninteresting and players did not feel the same zest as when they were playing the common digital games. In his research, Ito (2008) depicted that most of the educational games are digitalized based on drilling that adhere to the conventional curriculum. Students may be interested in the games for the first time but they would not be able to focus on it for a long time and return to playing games. These types of constraints act as challenges in the implementation of learning by digital games design approach.

Teacher's practices in implementing learning by digital games design approach

Teachers' negative perceptions toward the use of digital games in the teaching and learning process also influence their practices in implementing learning by digital games design approach. They feel the activity of designing digital games is hard to conduct. This is because the teachers did not have adequate knowledge in digital games, the platform and softwares to design games (William, 2009). They thought that they need high computer literacy knowledge and skills to implement this approach. Although there are various writing tools that could assist novice users and children to design digital games, teachers gave excuses of not having the time to explore and learn it independently before they could guide their students.

There were teachers who wanted to apply the activity of designing easy digital games in their lessons. However, constraints in terms of limited infrastructure facilities such as computer labs, computers and software MEMBANTUTKAN their wish (Ertzberger, 2008). In Malaysia, this approach is difficult to be implemented due to lack of relevant subjects in the national education curriculum (Kamisah & Nurul, 2013). Most of the learning topics rarely focus on inventions such as the invention topic in the subject of Life Skills. Moreover, the inflexibility of time for the teaching and learning process limit the implementation of this approach (Ertzberger, 2008; William, 2009). Thirty minutes lesson for each subject is inadequate for teachers to finish the syllabus if they apply this approach. Hence, teachers are more comfortable to stick to the usual approaches and methods as long as the objectives of the lessons are achieved and the syllabus could be completed.

Children's level of creativity and skills in designing digital games

The approach that teachers use in the teaching process could influence students' learning styles. Creative and skillful teachers could create greater generation in terms of intellectual, emotional, physical and spiritual aspects. Communities often perceive and evaluate children's creativity and skills through art-related activities such as drawing and singing. In today's digital and globalised era, learning approaches that could generate creativity and improve students' skills could be widen to various techniques and indicators in line with the aspirations of national education. Playing digital games has been a norm for children yet designing digital games is something fresh for them. Most of them did not have the opportunity to design their own digital games because they were not given the chance to exhibit their creative and skills through this approach (Laili & Maizatul, 2013b). It is rare to see digital games that use children as its main source of idea in the designing process. Most researchers merely place children as players. If the children were given the opportunity to design, it is believed that they could show their capability in designing digital games according to their own idea and bring it to a more meaningful learning and transferable skills.

There are several indicators that are used to measure the creativity levels and skills in art and sport activities. However, the standard indicator to measure the creativity levels and skills in the use of technology in learning has not been identified (Joint Research Centre – European Commission, 2010). Even though many researchers use benchmark and rubric in evaluating their research, the measurement is not holistic and only focuses on the products and certain users. This made it difficult for teachers to evaluate the approaches that they use to achieve the teaching objectives and in guiding students to think creatively and become skillful.

Teachers should know their students' level of creativity and skills in the process of designing digital games to ensure the lessons could be maximized without any interruption related to technical or students' basic knowledge in designing digital games. In addition, this could prevent imbalance lessons between the bright and the weak. If teachers were not able to identify their students' potentials, the weak students will be left behind when the brighter students dominate the activity. Consequently, the teaching objectives would not be fully and effectively achieved.

Proposals in Implementing Learning by Designing Digital Games Approach

Researchers have proposed three alternatives that could assist in overcoming the issues and challenges in the learning by designing digital games approach.

Control the content of digital games for educational purposes

Digital games that are available in the market are different than the educational digital games use for learning in relation to content and pedagogy. The Ministry of Education (MoE) under the responsibility of Education Technology Department has to monitor more closely the content of digital games that are appropriate to be used in the classroom. Ibrahim and Jaafar (2009) stated that the two components that should be in educational digital games are educational component (learning theory,

learning styles and pedagogical aspects) and games aspect (challenges, rewards, objectives, spatial and mechanical aspects). Additionally, in his research, Prensky (2001) proposed that the content and games context should be separated in learning to ensure children feel that the educational video games are similar to other digital games. Although these two components are separated, they should be balanced to ensure the teaching and learning process could be done in harmony without any negative influence on the students.

Negative perceptions toward digital games need to be shifted through control and guide in evaluating the content of digital games for educational purposes. It is believed that the combination of expertise from teachers, researchers, and the industry practitioners of digital instructional and games design could produce educational games that are suitable to be used in the teaching and learning process. Apart from the suitability of the content of the syllabus, it should also be culturally appropriate. Characters and the environment could be design based on the local characteristics that are more decent and familiar to the students. This factor could increase the trust from the community especially from parents in applying the use of digital games inside and outside of the classroom. When the community perceives digital games as a positive medium, teachers could expand playful activity to designing digital games.

Supports from educators in implementing learning by digital games design approach in the teaching and learning process

21st century teachers are teachers who are equipped with informational knowledge such as science and technology, able to think creatively and innovatively as well as could inculcate values in students through their lessons. As a responsible individual in implementing the learning by digital games design approach, teachers should be fully exposed to basic knowledge related to digital games, technical and teaching guides. MoE and educators should consider this approach holistically as an effective learning approach in integrating Information and Communication Technology in education (Kamisah & Nurul, 2013). Training of Trainer that is held by school in collaboration with industry practitioners in designing digital games could give a more accurate exposure in implementing this approach.

Support from school in providing infrastructural facilities to teachers is crucial in implementing this approach. Facilities related to tools, places, and softwares could be discussed among teachers with the school administrators to get the allocation needed. It should not be a huge problem as this approach is not only appropriate to be used in the subject of Information and Communication Technology. Creative teachers could implement this approach in other subjects such as Mathematics, Science, and Languages as long as the pedagogical aspect and learning objectives in designing digital games fulfill the needs of the curriculum (Prensky, 2008). The reconstruction of the syllabus and teaching time have to be revised to ensure it is suitable for the 21st century education which include self-learning aspects and constructivism where teachers act as facilitators. Exposure through formal courses, mass communication, and electronic media could gain teachers' attention in using this approach to diversity techniques and teaching aids.

Children's creativity evaluation and skills in designing digital games

Teachers have to identify the strengths and weaknesses of each student to ease them in planning effective teaching strategy. They should not proceed in using the guides in implementing an approach without knowing the students' competence level. Before teachers implement the activity of designing digital games in their lessons, it is suggested that teachers see their students' potential in creativity aspect and designing process skills. They could use a range of appropriate instructional models such as ADDIE and ASSURE which are commonly used in integrating technology in education (Jamalludin & Zaidatun, 2000) as a guide in conducting this activity. In those models, teachers need to set the standards in evaluating students' level of creativity and skills in designing digital games that could meet the learning needs.

The creativity of the children in designing and producing digital games for learning could be research empirically to examine its suitablity and effectiveness. Teachers need to refer to the indicators that are used by famous figures and experts in creativity. For example, Paul Terrance, who is known as the father of creativity, has produced four indicators which are originality, smoothness, flexibility and clarity in his research set known as *Torrance Creative Thinking Test* (1987). The Ministry of Education has also outlined three main cores in 21st century skills which are i) learning and innovation skills, ii) informational, media and technology skills; and iii) life and career skills. Teachers could also refer to set or measurement checklist in rubric and scales related to digital games design. The measurement could be obtained from Internet and should be adapted according to the teachers' activity plan to ensure the teaching objectives could be achieved effectively through this approach.

Conclusion

Meaningful learning is influenced by conducive environment and effective teaching. Teachers play a vital role in the teaching and learning process in the classroom to ensure the teaching objectives could be achieved and improve students' achievement. Even though student-centred learning place teachers as facilitators, teachers need to be wise in planning activities that are systematic in a fun learning environment. One of the potential approaches in training students to self and independent learning is learning by design. The use of digital games in the teaching and learning process does not eliminate teachers' duties. In fact, teacher's role as a facilitator could strengthen this new approach in our education system.

Challenges and issues that hinder the implementation of this approach could be solved through supports from various parties especially the Ministry of Education, school administrators, teachers, parents, and communities. Collaboration between teachers, researchers and industry practitioners could produce a guide related to procedures in implementing this approach for it to be used in our national education curriculum. The researchers believed that the learning by designing digital games approach could strengthen the education system in line with the technology development and advancement of the 21st century education.

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