Assessing the educational values of digital games

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Abstract

In recent years, digital games have assumed an important place in the lives of children and adolescents. Effective content design is crucial to the success of digital game-based learning. Therefore, the tool for assessing the effectiveness of game design is accordingly very important for parents and teachers, so that they may encourage or discourage students to play. The purpose of this study is to develop an assessment tool to examine the educational values of digital games. In the first phase of this research, the research team developed the indices for assessing the educational values of digital games. An expert panel consisting of game scholars and professional game designers was established to construct the indices for evaluating digital games in three focus group discussions. Seventy-four game evaluation indices were sorted into seven categories: mentality change, emotional fulfilment, knowledge enhancement, thinking skill development, interpersonal skill development, spatial ability development and bodily coordination. In the second phase of the research, the game designers were asked to assess certain games by using the 74 indices. Meanwhile, the game scholars were also asked to evaluate the same pool of games by the same indices. The assessments by both the scholars and designers were then compared and the similarities were found. This research provided a preliminary framework for future game designers, parents and teachers in assessing educational values of digital games.

Keywords

assessment of digital games, game-based learning, game educational values, online game.

Introduction

In recent years, digital games have assumed an important place in the lives of children and adolescents. Some scholars worried about the negative impacts of digital games, thinking that they might (1) turn some teenagers into violent or aggressive persons among their peers; (2) undermine their role identities; (3) stifle their thinking; (4) increase self-alienating behaviours (Cooper & Mackie 1986; Provenzo 1991, 1992); and (5) increase

mindless repetition (Coyne 2003). Will digital game involvement lead students' learning to a dead end? Bowmaw (1982) and Bracey (1992) argued that digital games provided a great incentive for teenagers to learn. Digital games of strategy, puzzle and role-playing games (RPG) could enhance the effectiveness of learning (Appleman & Goldsworthy 1999; Saltzman 1999; Salen & Zimmerman 2003; Burgos *et al*. 2007a). Furthermore, games provided competition, which could be a very effective method in motivating individuals (Deci *et al*. 1981; Malone & Lepper 1987; Yee 2006). Moreover, with game practice, students might be able to solve problems by realizing that things learned in one context could possibly be taken and used elsewhere (de Freitas

& Oliver 2006). Bork and King (1998) also indicated that video games could stimulate real-time brainstorming, thereby enhancing students' abilities to develop ideas. From the viewpoint of game theory, people practised critical thinking for decision making in game playing. So, a digital game was one kind of powerful learning environment (Robertson & Howells 2008).

Gros (2007) believed multimedia design for training and education should combine the most powerful features of interactive multimedia design and motivational content with the most effective principles of technologically mediated learning. From a more practice-oriented perspective, researchers have examined game design relevant to the way designers' values become embedded in games (Barr *et al.* 2007). Moreover, Prensky (2001) stressed that the key to learn about the effectiveness of digital games lay in their design. If game designers could incorporate educational values, learning might be enhanced for the player.

Frasca (2004) argued that the main problem was the lack of an objective, valid and reliable tool to measure educational values. Research on defining educational values for the purpose of game assessment was limited in the context of traditional games. However, the trend towards the increasing use of games in learning has indicated that digital games were becoming an important tool for the 'net generation'. Nonetheless, there have been few attempts to introduce frameworks that could help parents in evaluating educational games (de Freitas & Oliver 2006). There were several pedagogical approaches that could be used inside and/or around a game, such as learning by doing, learning from mistakes, goal-oriented learning, role playing and constructivist learning (Prensky 2001). Therefore, it is worth investigating the educational values of online games. The objective of this study was to develop an assessment tool based on educational values for rating, selecting and designing digital games.

Literature review

For decades, various researchers and scholars have studied the correlation between game behaviour and learning. Piaget (1965) argued that the process of playing games could familiarize children with the environment in which they live and create their worlds of imagination. Based on this perspective, many began to realize that human beings could actually achieve personal growth and effective learning through games (Smilansky 1968). Kafai (1996) also stated that games could help students construct their own concepts and knowledge while they accomplished the objectives of those games.

According to Squire (2002), many researchers are not very interested in examining whether existing digital games offer content that may be relevant to educational value; they oppose a narrow focus on content, skills and attitudes. Instead they look to the structural characteristics in digital games that could be used for education and social processes surrounding the educational experience.

Genres and nature of games

There are a variety of genres of games but there is not one standard system of classification. Gros (2007) found that industry, developers and academics all use different taxonomies, which can be grouped into seven major genres:

1 Action games (also called platform games) – These games are reaction-based; most of the games of the first generation are action games.
2 Adventure games – The player solves a number of tests in order to progress through a virtual world.
3 Fighting games – These games involve fighting against computer-controlled characters or those controlled by other players.
4 RPG – Human players assume the characteristics of some person or creature.
5 Simulations – The player has to succeed within some simplified recreation of a place or situation to achieve a particular goal.
6 Sports games – These games are based on sports.
7 Strategy games – These games recreate a historical or fictional situation to allow a player to devise an appropriate strategy to achieve a goal.

This taxonomy is not easy to apply because some games fall into more than one category. For instance, currently most of the sports games contain information to manage the team and combine simulation with characteristics of the strategy game.

Different games had different learning effects. Hong *et al.* (2009) classified games based upon three

characteristics – domain specificity, competition and strategy – into five categories: (1) drill and practise games; (2) single combat games; (3) stable contest games; (4) evolutionary contest games; and (5) contextual games. Hong *et al*. (2009) focused their discussion on evolutionary games. An *evolutionary* game was essentially an agent-oriented game. The game design was based on dynamic game scenarios. Players had to constantly evaluate and adjust the competition/collaboration strategies, thereby engaging themselves in logical thinking. *Evolutionary contest games* also encouraged players to adapt decision making to complex information input. Several design principles were crucial to *evolutionary contest* games: (1) games were played among teams composed of several team members; (2) player interaction continued as time elapses; (3) players chose from different game modes; (4) player decisions were associated with valuable vectors; and (5) players adjusted game strategies according to game dynamics.

Coyne (2003) claimed that repetition was the driving force behind games, and variation, along with repetition, could motivate the players to search for new things, which could result in new learning. Competition was more or less needed when learners played a game so that they could develop playfulness (Lieberman 1977) or fun engagement (Natriello 1984). Additionally, the goal and strategic choices of playing were means-end (Goddard *et al*. 2001) and means-open (de Graaff *et al*. 1987). Games provide complex environments in which content, skills and attitudes play an important role during the game.

The educational values of games

Piaget (1962) stated that the process of playing games could help children master the environments that they live in and create their worlds of imagination. Playing games could also help to establish values and knowledge of the world (Coyne 2003). There was much research on games that indirectly concerned questions of value (Barr *et al*. 2007). Value had a surprisingly small overt presence, with the most specifically relevant work discussing rhetoric (Walz 2003) and ideology (Garite 2003). In the value studies, the main focus has been on whether digital games could lead to the values of aggression and violence in their players (Griffiths 1998). From a more practice-oriented perspective,

research has investigated the ways game design is relevant to ethical issues (Sicart 2005). Other approaches involved the studies of players' attitudes and cognitive development in games. In fact, there was a fairly wide consensus in the game study literature that the values of discovery and achievement were fundamental to the nature of games (Juul 2002). Games provided continuing practise through which learners could improve accuracy and better memory (Driskell *et al*. 1992). However, extended use could result in boredom and diminished improvement in memory (Peladeau *et al*. 2003). On the other hand, practice embedded in the game could help learners' academic performance (Brophy & Good 1986).

Squire (2002) pointed out that games had educational potential from both cognitive and social perspectives. Games could support, reinforce and accelerate the learning process, and support higher-order cognitive development (Green & Bavelier 2003; Klabbers 2003; de Freitas 2005; de Freitas & Oliver 2006). As a type of process-based learning, the educational meaning of contextual games was to train students to deal with the process of confronting a question, making a hypothesis and then proving that hypothesis (Coyne 2003). Students collected the information they needed, applied it and engaged in learning. Walliser (1998) believed that game-based learning stimulated critical thinking, information gathering and sharing and collective problem solving. Mutual trust and communication skills had effects on the interactions (Stanulis & Russell 2000). In short, games could introduce new knowledge, fix previous acquired knowledge, train skills, share experiences, discover new concepts and develop outcomes (Burgos *et al*. 2007b).

In addition, de Freitas and Oliver (2006) proposed a four-dimension framework for parents and teachers to select games: (1) learner specification: learner profile, background and/or group profile, etc.; (2) context: informal or formal curriculum; (3) mode of representation: level of fidelity, interactivity, immersion, etc.; and (4) pedagogical considerations: learning models used and approaches taken. Moreover, Prensky (2001) argued that students' parallel processing ability, graphic ability, level of awareness and random-access ability could be elevated by playing digital games.

When a child (or an adult for that matter) plays a game, she/he exercises her/his mind by putting herself/himself into a simulation of real-life situations. When a

game is played, real-life-like decisions are made, solutions analysed and problems solved (Denis & Jouvelot 2005). Based on the examination of learning domains, in this study the researchers developed indices of educational values for digital games.

Motivation and game-based learning

Motivation theories basically propose that individuals are motivated to the extent that their behaviour is expected to lead to desired outcomes (Robbins 2005). Motivation is a result of an interaction between a situation and an individual. Motivation is a desire for change that an individual has and is driven by situations. Motivation to learn can be extrinsic motivation or intrinsic motivation. Extrinsic motivation is an involvement as a means to an end. Intrinsic motivation is an involvement for its own sake (Eggan & Kauchak 2004). Researchers have determined that learners are intrinsically motivated by activities or experiences that present a challenge, give the learner control or evoke curiosity (Lepper & Hodell 1989).

One of the most widely mentioned theories of motivation is the hierarchy of needs theory put forth by psychologist Abraham Maslow (see Fig 1). Maslow (1943) saw human needs in the form of a hierarchy, ascending from the lowest to the highest, and he concluded that when one set of needs is satisfied, this kind of need ceases to be a motivator. Maslow and Lowery (1998) mentioned that as each of the five needs are substantially satisfied, the next need becomes dominant. From the standpoint of motivation, the theory would say that although no need is ever fully gratified, a substantially satisfied need no longer motivates. So if you want to motivate someone, you need to understand what level of

the hierarchy that person is on and focus on satisfying those needs or needs above that level.

Digital games are more and more considered through their educative potential since they gather and employ promising features: interactivity, user-centred design and state-of-the-art computer technologies. They lead to high-quality multi-sensory rendering environments in which students can experience learning by doing. But the main reasons for this increasing interest are the medium's success, the motivation of players and their deep engagement while playing (Hlodan 2008).

Instinctively, motivation seems to be a key asset to get children actively involved in the learning process: a motivated learner cannot be stopped (Prensky 2003). Why is motivation so effective with respect to digital gaming? Learners tend to think of such activities as being fun, a potent source of intrinsic motivation. Digital games are examples of user-centred designs that motivate through learning, arousing players' interest and giving them the power of ample expression (Frenouillet, 2003). Developing an assessment tool to examine the educational value of a game needs to concern the level interest of a student, since it is an important motivator.

Research design

The measurement of educational values was a great concern for those interested in game practice. The problems associated with measurement primarily related to the difficulty in conceptualizing the constructs to be measured, selecting a measurement paradigm, selecting a measuring instrument and interpreting the data (Waltz & Strickland 1990). Pask (1976) indicated that holistic and sequential styles of cognition would affect how well learners studied. If the strict understanding condition is relaxed, as it is in class tuition or self-study, some students are disposed to act like holists (comprehension learners) and others like serialists (operation learners). Students who are able to act either way, depending upon the subject matter, and if they excel in both pursuits, are deemed versatile. The design of digital game-based learning should include an examination of individual differences. Therefore the objective of this study was to explore the educational value of selected digital games in order to propose a fact-based framework by which game designers and users could evaluate and select digital games.

Fig 1 Abraham Maslow's Five Needs Hierarchy Theory.

For this study, the research team developed game assessment indices to examine the educational value of different types of digital games. The research team's long-term goal was to carry out a large-scale evaluation of the commercially available games in Taiwan after the research tool was further optimized. The research was divided into two phases:

Phase I: developing a game evaluation index

Prensky (2001) identified six key structural elements of games. All games contained: (1) rules; (2) goals and objectives; (3) outcomes and feedback; (4) conflict, competition, challenge and opposition; (5) interaction; and (6) representation. With those elements, games had the power of engaging people in fun ways, providing interaction, opportunities for problem solving, enticing storylines and other elements that gave the users structure and motivation while promoting involvement and creativity, among other benefits (Prensky 2001). This study adapted the focus group discussion method in order to develop and identify the indices of educational values in digital games. The focus group method has been recognized as an advantageous research tool in soliciting information through interactive discussions among group members under time constraints.

Focus group methodologists generally advocated seeking homogeneity in group composition (i.e. segmentation) and recruiting participants that shared similar characteristics to add fluidity and depth to discussions (Lehex *et al.* 2006). Thus, the experts who participated in the focus groups of this study included both educational psychology scholars and game designers, who had at least 10 years of experience in games used in educational contexts or design. The focus group members shared common expertise in games, while holding their distinct perspectives of academic and practical aspects. In total, three focus groups were held and each discussion lasted about 1.5 h.

Item generation of the educational value index
The focus group experts (five game scholars and five game designers) joined the first session to generate the attributes for assessing digital games based on the KJ method.[1] The KJ method was used to analyse the

[1] The KJ method was invented and developed by Dr. Jiro Kawakita, a Japanese anthropologist (Raymond 1997). It is a technique developed for problem solving in a group exercise.

interview data into themes (Sheppard 2002). The procedures of the KJ method are: (1) card making, where all relevant facts and information are written on individual cards and collated (Post-its would do); (2) grouping and naming, where the cards are shuffled, spread out and read carefully; (3) the process of redistribution, whereby the cards are collected and reallocated so that no one is given their own cards; (4) chart making, which involved arranging the groups carefully on a large sheet of paper in a spatial pattern that makes it easy to appreciate the overall picture; and (5) the explanation stage, where the participants and facilitator try to express what the chart means and records their observations.

A total of 125 educational values were proposed by the focus group members to start this process. Each item was listed on a 3×5 card and provided for screening and grouping by the KJ method. Through focus group member discussions, common agreements were reached and used to assign the items into seven categories: mentality change, emotional fulfilment, knowledge enhancement, mind shifting, interpersonal skill development, spatial ability development and bodily coordination. A criterion of agreement rate of 80% was used for item selection. Thus, after the screening procedure, a total of 74 items was generated as the preliminary version of the indices for the following stage involving validity construction.

Credibility construction of the educational value index
The last two focus groups were organized to explore and reconfirm the educational value implied in each index. The following procedure was conducted for this purpose. Initially, five professional game designers (Cho-Pu Lin, Hsin-Hu Fu, Tso-Yun Lin, Gu-Yu Lee & Kevin Lee) and five educational psychology scholars (Jen-In Chen, Yun-Qun Lin, Jen-Dau Wu, Yam-Haur Huang & Michelle Wu) from Taipei City in Taiwan were invited to play with the game *Destiny of an Emperor III* (Capcom Co., Ltd., Osaka, Japan), and used the preliminary version to assign the educational values of this game. Secondly, these experts examined the consistency and exclusivity of the index items after the application. Next, the second focus group discussion was held to revise the preliminary version. Fourthly, these experts tested the revised version with the *Destiny of an Emperor III*. Lastly, the third focus group discussion was held to further revise the second version of the index. Finally, a total of 74 items from seven

categories was identified as the game evaluation indices (Appendix A).

Phase II: Assessing educational value: A case study of an online word searching contest

The aim of this phase was to test the usability of the game educational value indices. Therefore, in this phase of the research, an interpretive approach in the form of a case study was used to examine a digital game that lets educational values emerge from game playing. The test included several steps, as follows:

1 Representatives from academia (educational psychology scholars) first selected an evolutionary game to be assessed. The scholars evaluated and analysed the educational value of the selected game using an interpretive approach and with the indices developed in Phase I.
2 From a more practice-oriented perspective, research has shifted to examine the ways that game designers' values became embedded in games (Flanagan *et al*. 2005). Therefore, the five game designers were involved in explaining the educational values that they believed were incorporated in the game. The scholars then reviewed the game designers' explanations of the educational value of the game.
3 The results of the scholars' review were presented to the designers, who provided feedback on how the educational meanings were incorporated.
4 Finally, the scholars and researchers completed the assessment of the digital game, based on suggestions from both the scholars and designers.

The word searching game
The research team aimed to explore how the final set of values could be applied to examine the educational value of the commercially available digital games in Taiwan. The research team thus used the final educational value indices to examine the educational implications of an online word searching game developed by Ling-Wen Chang in Taipei, Taiwan: *Super Word Searching Contest*, an online game-based vocabulary contest for young English a Second Language (ESL) learners in Taiwan. The game is described below.

Game profiles
Here, the game condition is changed for each player each time he or she plays, which corresponds to the key

principles of an evolutionary game. The other features of this game include:

1 Team competition. *Super Word Search* allows team competition. It is a highly dynamic and interactive game played among school classes instead of between individuals. Teams from around Taiwan compete to be the regional champion of north, central, south and east Taiwan. Then the four winning teams enter the finals for the national championship title.
2 Frequent player interaction. *Super Word Search* encourages the players on the same team to exchange ideas and offer suggestions for the best game performance under the time constraints.
3 Differential scoring for different game strategies. The players get extra points for spelling longer English words as compared to shorter ones. This encourages the players to make up more words in the English language in order to obtain higher scores.
4 Dynamic gaming process. The game design of *Super Word Search* encourages the players to constantly adjust game strategies and develop different tactics. According to the rules of the vocabulary contest, the participating teams should take turns spelling one English word at a time; the first team spelling enough English words to cover a row wins. The players therefore have to constantly re-evaluate game conditions and select strategies in responding to the opponent teams.

Research findings

After the panel review session, the main educational values of the *Super Word Search* were identified as follows (See Fig 2):

Mentality change

The following attitude changes were found in the players who participated in the contest to test the evaluation indices.

Promotion of adventure
The level of adventure increased as the game involved multiple players. The players took more risks when seeking to obtain higher scores in the face of keen competition.
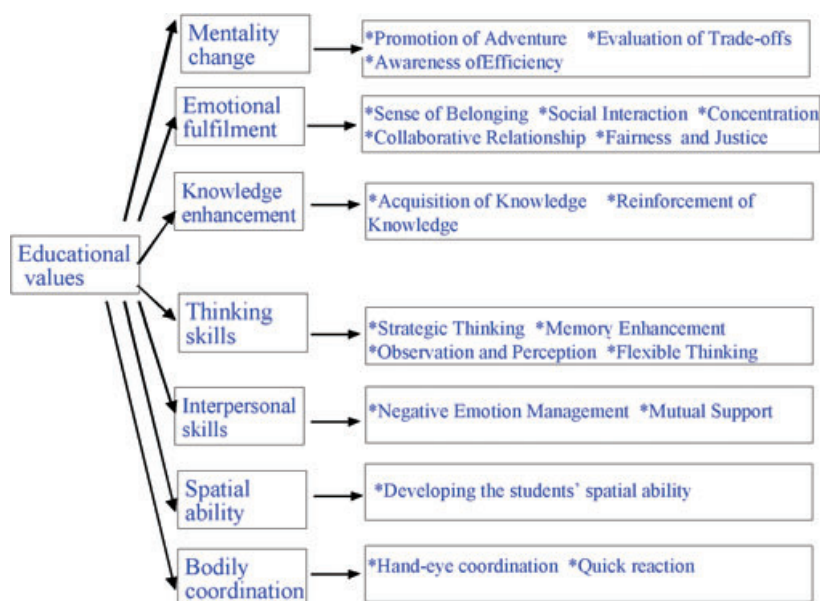
Fig 2 Main educational values of the *Super Word Search*.

Evaluation of trade-offs

The players received more points but lost more time when attempting to spell a longer word. As a result, the players realized that they had to evaluate the trade-offs of each decision given in the time limit.

Awareness of efficiency

The players learned the importance of developing efficient game strategies, such as effective scoring techniques or teamwork methods, for winning. For example, the players had to decide whether they should attempt longer words, which would yield more points, or follow the word sequence provided by the system.

Emotional fulfilment

Several of the players' emotional needs were satisfied as they experienced the dynamic and interactive gaming process.

Sense of belonging

The competition counted each class's final score in this way: the total scores obtained by the students in a class divided by the total number of times those students played the game. This promoted interaction and collaboration among the students and increased the sense of belonging among the class members.

Social interaction

The fact that a team's final score was dependent upon each student's performance encouraged the participation of the uninterested students. It also helped the students to improve their social skills as well as promote teamwork among them.

Collaboration relationship

The scoring of the game created a collaboration mechanism that permeated the entire class. Separate social circles within the class began to interact and collaborate as the better-performing students took the initiative to help the slower learners.

Concentration

The game's time-sensitive nature required each student's full attention as she/he attempted different word-forming possibilities in rows, columns and diagonals.

Fairness and justice

The students realized that all players and classes should follow the same rules without partiality.

Knowledge enhancement

Acquisition of knowledge
The game provided strong incentives for the students to learn the *1000 Key English Words* recommended by the Taiwan Ministry of Education.

Reinforcement of knowledge
To create a learning-for-playing environment, the teachers encouraged the students to memorize the 1000 words, so the students could best enjoy the gaming experience by quickly and correctly answering the questions.

Thinking skill development

Strategic thinking
After several attempts, students learned that spelling longer words would most likely result in higher scores despite the increased amount of time that was needed. In the second phase of the contest, the students quickly learned the power of elimination by first matching the words they knew as shown below. In addition, both individual and team strategies played crucial roles in winning the game. For example, the students had to decide between spelling longer words for more points or following the word sequence as it appeared on screen.

Memory enhancement
The game assisted in the enhancement of students' short- and long-term memories. The students' short-term memory was put to the test when solving the crossword puzzle in the game; meanwhile, each student's long-term memory was significantly enhanced as she/he practised and memorized the English words for the contest under the teacher's guidance.

Observation and perception
The second phase of the game, *Mix and Match Challenge*, contained a wide range of sensory stimuli such as pictures, sounds and words. It encouraged students to apply their observation and perception skills as shown below.

Flexible thinking
When searching for the English words in the crossword puzzle, the students often found themselves targeting the same letters as their opponents. As the letters they needed were often taken up by their opponents, the students quickly learned to be resourceful and flexible when developing the game strategies.

Interpersonal skills

Negative emotion management
When several students (maximum of four) competed in the crossword game, it was common for them to experience stress or anger when the game did not turn out as they planned. This prompted the students to develop coping strategies for negative emotions in order to calm down and seek alternative solutions.

Mutual support
A team's final score was dependent upon the performance of each student in the class. As a result, better performing students often took the initiative to help under-performing ones. This, in turn, promoted mutually beneficial collaboration among all class members.

Spatial ability

The word search game in the contest was created according to universal crossword design principles: the English words in the puzzle may go from left to right, right to left, lower left to upper right, top to bottom, bottom to top, upper right to lower left and lower right to upper left. This special design helped students to develop spatial ability as they searched for letters in rows, columns and diagonals.

Bodily coordination

Hand-eye coordination
When playing the *Mix and Match* game, the students had to use a mouse to link answers on the right with questions on the left as quickly as possible. This helped the students become more dexterous by developing their hand-eye coordination skills.

Quick reaction
The crossword game required the students to locate and mark the English words in the puzzle faster than their opponents. Success in the game lay in both the quick reaction times of a student's vocabulary knowledge and hand-eye coordination.

Conclusion

Recently, digital games have played an increasingly crucial role in developing intelligence in young learners. Some games have little educational value not because they are *games*, but because they lack pedagogical design and game-based learning principles (Prensky 2001). The researchers believe, despite being described as *sugar coating* by some educators, that game-based learning can be a very efficient tool if it is designed to reflect pedagogical and learning needs in a real educational setting.

To examine the educational value of digital games in Taiwan, the research team divided different types of games into five categories. In the first phase of the research, an expert panel (consisting of five game scholars and five professional game designers) was established to discuss the index for evaluating digital games. The panel identified 74 items in seven categories as the game evaluation indices. In the second phase of the case study, the designers and scholars were asked to assess an online vocabulary game, *Super Word Searching Contest,* by the interpretive approach and with the indices developed in the first phase. The assessments by both scholars and designers were compared, and the results showed that the vocabulary game helped the players develop flexible thinking skills, improve inter-personal skills and broaden vocabulary, among other skills. This research accomplished the development of an educational value index for digital games. Furthermore, it provided a preliminary framework for future game designers and for educational psychologists in assessing the educational value of digital games. The researchers suggested that educators, researchers and developers need to collaborate at all levels of the education system to ensure games are an effective learning tool. Games must have clear rules and goals, most important of all, they must be fun to play and gain values. However, due to the limitations of this study, more research would be needed in order to determine the extent to which different learning units might generate different responses. For example, further study could be conducted by having the respondents rate items by giving stars (*) for more valuable items. In this way, parents or teachers could more easily select games for educational use, and game designers could more easily develop an awareness of how to incorporate educational values in digital games.

Acknowledgement

Appendix A

Evaluation Indices for Assessing Educational Digital Games

※Name of Game:_____ Platform:_____
※Target age:_____
※Domain of Knowledge of the game (you may check more than one):
□Math □English □Chinese □PE □Art □Natural Science □Social Science □Music □General
※Game Mode:
□Drill & Practice □Single Combat □ Stable Contest □ Evolutionary contest □Scenario
If the game involves more than one mode, please indicate the percentage (%) of each mode.
1._____% 2. _____% 3. _____%

Please indicate whether and how the following statements describe the educational value of the game.

Mentality change
The game will be able to . . .
□1) cultivate lawfulness and good ethics. Why?
_____
□2) cultivate adventure. Why? _____

☐3) cultivate tolerance. Why? _____

☐4) cultivate perseverance and encourage players to always make things better. Why?

_____

☐5) cultivate sense of responsibility. Why? _____

☐6) cultivate planning ability. Why? _____

☐7) cultivate long-term planning. Why? _____

☐8) anchoring the sense of *trade-off*. Why?

_____

☐9) be aware the importance of efficiency. Why?

_____

Others:_____Why?_____

Emotional fulfillment

The game will be able to . . .

☐1) satisfy the need for belonging. Why?

_____

☐2) foster social identity. Why?

_____

☐3) encourage cooperation. Why?

_____

☐4) cultivate kindness and faithfulness. Why?

_____

☐5) enhance concentration and staying power. Why?

_____

☐6) cultivate fairness and sense of justice. Why?

_____

☐7) cultivate frugality. Why? _____

☐8) cultivate tidiness. Why? _____

☐9) reduce worry for short-term gains and losses. Why?

_____

☐10) decrease irritability. Why?

_____

☐11) makes players more oblivious to the passing of time. Why?

_____

☐12) increase aggressive behavior. Why?

_____

☐13) make players more prone to long-term value. Why?

_____

Others:_____Why?_____

Knowledge enhancement

The game will be able to . . .

☐1) construct concepts so players learn to migrate. Why?

_____

☐2) familiarize players with certain skills. Why?

_____

☐3) develop players' vocabularies. Why?
_____

☐4) develop players' depth and width of verbal expression. Why?
_____

☐5) increase maturity of language usage. Why?
_____

☐6) cultivate musical abilities, such as rhythm, tones and the ability to compose. Why?
_____

☐7) cultivate the ability to solve mathematical questions. Why?
_____

☐8) develop mathematical concepts. Why?
_____

☐9) develop the ability to construct and apply natural science concepts. Why?
_____

☐10) develop literature reading and expression. Why?
_____

☐11) develop the ability to construct and apply technology in life.
Why:_____

☐12) develop the ability to construct and apply knowledge in history and geography. Why?
_____

☐13) develop the ability to appreciate and express art. Why?
_____

☐14) develop the ability to understand and apply the concept of supply and demand in economics.
Why? _____
Others:_____Why?_____

Thinking skill development
The game will be able to . . .
☐1) cultivate strategic thinking. Why?
_____

☐2) cultivate proactive thinking. Why?
_____

☐3) inspire imagination. Why?
_____

☐4) cultivate logical thinking. Why?
_____

☐5) cultivate critical thinking. Why?
_____

☐6) cultivate the ability to prove hypothesis. Why?
_____

☐7) cultivate sharp inductive thinking. Why?
_____

☐8) cultivate deductive thinking. Why?
_____

☐9) develop memories capacity. Why?
_____

☐10) cultivate the ability to analyze and solve questions. Why?
_____

☐11) improve application of the knowledge one has learned. Why?
_____

☐12) cultivate decision-making ability in face of a dilemma. Why?
_____

Others:_____Why?_____

Interpersonal skills
The game will be able to . . .
☐1) help to develop players' EQ. Why?
_____

☐2) cultivate the ability to handle the timing for communication. Why?
_____

☐3) develop communicative expression ability. Why?
_____

☐4) encourage one's care for others and the society. Why?
_____

☐5) inspire one's respect for others and the society. Why?
_____

☐6) emphasize the importance of helping others. Why?
_____

☐7) emphasize the importance of trusting others. Why?
_____

Others:_____Why?_____

Spatial ability development
The game will be able to . . .
☐1) develop players' spatial navigation skills. Why?
_____

☐2) develop players' ability to perceive an object from multiple angles. Why?
_____

☐3) develop the ability to identify the original shape of an item that has been turned into different shapes. Why?
_____

Others:_____Why?_____

Bodily coordination
The game will be able to . . .
☐1) increase the level of handiness/dexterity in players. Why?
_____

☐2) develop physical coordination of the limbs. Why?
_____

☐3) put all spirit and body together. Why?
_____

☐4) develop coordination in the periphery of extremities. Why?
_____

☐5) increase proneness to fatigue in muscles and limbs'. Why?
_____

□6) increase the vulnerability of hand and arm tendons. Why?

_____

□7) improve reflex. Why? _____

□8) cause numbness of limbs. Why?

_____

□9) damages eyesight. Why?

_____

Others:_____Why?_____

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