Predictors of Nutrition-Related Game Utilization among Preschools in the Philippines

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0176

The Asian Conference on Education 2013

Official Conference Proceedings 2013

Abstract

With the pending issues on malnutrition and healthy illiteracy, the focus has been turned towards the potentials share of the gaming industry in attaining the elusive health-for-all across developmental stages. Game usability testing has yielded many positive effects for both the gaming company and the gamer, but is given little attention when it comes to games for health. This paper sought to determine the system usability of a researcher-made computer game for health and test the effect of player demographics to usability and usability to the player's intention to participate in gaming. The results showed that majority of the respondents (n=30) agreed that the game handed to them was usable ($\bar{x}$=5.40; SD=0.88) and that they would play the game at the soonest time possible ($\bar{x}$=1.43; SD=0.68). Regression analysis showed that player demographics is not a determinant of the player's perception of game usability (r=0.18; p=0.82), but usability has shown to have a significant effect of the player's intention to play the game (r=0.67; p=0.00). This paper is meritorious in providing empirical evidence of the importance of usability testing before handing down games for health to the target consumers.

Keywords: Nutrition, Literacy, Preschool, Usability, Behavior Intention, Regression, Game Development

1.0 Introduction

The multitude of malnutrition among younger population has been a perennial problem in developing countries like the Philippines. Putting into simpler words the latest survey by the Food and Nutrition Research Institute of the Department of Science and Technology in 2008, in every 100 preschool children in the country, 26 were underweight and about 28 were under height. Even though numerous health initiatives serve as primal force in attaining health-for-all, the problem persists to exist. With solutions in mind, researchers turn their attention into declining health literacy. Articles suggest that ignorance plays significantly in child malnutrition (Azim, Shafi, Qureshi, Sheikh, Azim, & Hayat, 2005), and is in fact the real cause of it (Gopalan, 2000). Therefore, a dynamic attitude on innovation and re-culturing is seen as a commendable solution (Gopalan, 2000).

The increasing cases of malnutrition are somehow parallel to the innovations and advancements in the computer gaming industry. A recent report by the Entertainment Software Association (ESA, 2011) posited that 72% of American households play computer or video games, and that the real annual growth attained by the US game software industry exceeded by 10.6% from 2005 to 2009. The positive effects of playing computer games on a person's cognition and mentality impose many opportunities. The present undertaking stands that gaming can also be a potential tool to educate preschool children on the importance of proper and balanced diet, which in return will shed light in fighting malnutrition among this critical group.

If a computer game was intended to provide health information to children in order to assist for a struggle from a critical problem, then one must be tested for quality and playability. Software usability is the degree to which a product, particularly in this study a gaming software, can be operated by target users to achieve what the product intends to attain with ease and satisfaction while exhibiting effectiveness and efficiency of use (International Organization for Standardization, 1998). Placing a software under usability testing yields several benefits not only for the creator but also to the target clients. However, despite the importance of usability testing in the context of gaming, few health games have subjected to usability testing leading to erratic results in achieving its desired outcomes.

This paper, therefore intended to test a researcher-made health game for usability and test its effect on the subjects' behavior intention to participate in gaming. The game software produced is a point-and-click adventure game that provides preschool children basic nutritional food groups. The study is intended to contribute to the interesting phenomenon of health literacy, gaming, and sustainable health among preschoolers, as well as to offer good foundation for future endeavors and studies.

2.0 Background

2.1 Theoretical Framework

While this study aimed to develop a standardized game and tests its usability and effects to gaming participation among preschoolers, frameworks are essential to provide strong theoretical bases that will guide the outcome of the paper. This research was inclined to the Relevance, Embedding, Translation, Adaptation, Immersion and Naturalisation (RETAIN) Model (Gunter, Kenny & Vick, 2007) and the Experiential Learning Theory by Kolb (1984).

Gunter et al (2007) believes that gaming experience has three levels: (1) interacting, (2) engaged and (3) immersed with each level specifically determines the extent of player's satisfaction. Interaction happens when there is information flow between two entities (Salen & Zimmerman, 2004 cited in Gunter et al, 2007), the game and the player in particular. As soon as the player starts the game, interaction happens. Engagement happens when there is willingness from the player to participate or "play along" due to the feeling of realism in the experience (Laurel, 1993 cited in Gunter et al, 2007). Engagement can be: (1) emotional, where the player is willing to invest emotionally in the game; (2) intellectual, where the player is willing to exert effort to think and solve the challenges on the game; or (3) psychological, where the player is willing to extend his personality when interacting with the game (Salen & Zimmerman, 2004 cited in Gunter et al, 2007). At the grandest times where interaction and engagement interplays, immersion occurs being the highest level. At this time, there is reciprocal interaction between the player and the game and such experience later on can be transposed into learning.

John Dewey (1938) and David Kolb (1984) agreed that experiential learning results from the reflection of a person's experience, and the quality of the experience and reflection is significant to over-all learning. Kolb's Experiential Learning Theory in 1984 asserts that learning is a product of "prehension" or the grasping of experience followed by "transformation". Transformation is initiated by "reflective observation" wherein the person organizes the experience to make sense out of it, followed by "active experimentation" where the reflection is modified towards the person's own accord.

Provided with such knowledge, it is understood that in order to ensure the quality of learning of an individual, one must be involved at the level of immersion. The quality of reflection would also depend on the tool to aid the person's reflection and the person's behavior (Fowler, 2008) – which is the computer game.

2.2 The Developmental Stage of Preschool

Preschool stages carries out many developments in a child's physical, social, emotional and cognitive functions. At this stage, children starts to express themselves through language (Videbeck, 2008) and asserts their power and control through directing play and social interactions (Cherry, 2012). But one predominant developments among preschool children is their graphical observation. At this stage, children begin understand meaning within symbolic gestures and starts to classify objects (Videbeck, 2008) and use them in systematized and logical fashion (Boyd, 2008). Symbols not only comprises of gestures but also words and even mental images.

Such changes can open a lot of room for innovation and terms of learning methods and gaming. This must also be a beneficial time to present children with computer games that can also educate them about health. Children at this age can get simple directions (Videbeck, 2008) so simple gameplays can be learned easily. Children also learn through symbolic play (Boyd, 2008). They also tend to learn to manage conflicts and anxiety (Videbeck, 2008). Simple games often offer challenges and conflicts of many sort and children can use it to their advantage. Winning a computer game is also

beneficial to their development because they feel capable and able to lead other (Cherry, 2012).

2.3 State of Nutrition and Malnutrition among Preschoolers in the Philippines

Nutrition as always been a matter of concern among all countries, particularly the developing ones. By definition, nutrition is the overall process of taking in and assimilating substances that drive cellular growth and repair in order to sustain life (Brookover, 2012). But according to the United Nations International Children Emergency Fund (UNICEF, 2003), it is basically a human right, vital in sustaining humanity. It is very important mainly to the growth and development of children (DevPulse, 2008). However, the term nutrition has been always accompanied by its negative equivalent – malnutrition.

Malnutrition is defined by the World Health Organization (WHO) (2011) as the absence of the necessary nutrients that a normal, healthy body possesses. At the back of the simplicity of its definition lies an enormous problem that enforces to the world especially to the third world countries such as the Philippines. The magnitude of this problem has led UNICEF (2012) to coin malnutrition as an "invisible emergency". And up to this point, this emergency has not been eradicated.

A number of local and international groups support the severity of the situation through their presented data. According to Social Weather Station (2008 cited in DevPulse, 2008) roughly 2.9 million families have personally expressed unintentional hunger, while about 760,000 families expressed severe hunger. Other surveys reported that as of the year 2008, 26.2% of children 0-5 years of age were underweight (FNRI-DOST, 2008) and as of 2009, 20.7% of the children were underweight (WHO, 2011). Also according to the 7th National Nutrition Survey (2008), 6.1% and 27.9% of children 0-5 years old were known to be wasted and stunted respectively. Objective data were gathered through measurement of anthropometry, or body sizes such as weight and height and observation of clinical signs such as visible bipedal pitting edema (Walton & Allen, 2011). This does not end to such data, unfortunately, because malnutrition unseals a lot more subsequent complications to children.

Many impediments were surprisingly associated to malnutrition. In fact, childhood underweight is the leading reason as to why the world experiences most disease imaginable (Caulfield, de Ontis, Blossner & Black, 2004). Vitamin A deficiency, which is one depiction of malnutrition (DOH, 2012), generates about 350,000 additional occurrence of blindness and partial blindness to children every year, while iodine deficiency, another manifestation of malnutrition, still persists to cause preventive mental retardation worldwide (Jukes, 2007). Child mortality as result of many diseases has been also associated with malnutrition. Specifically, 60.7%, 52.3%, 44.8% and 57.3% of deaths due to diarrhea, pneumonia, measles and malaria respectively were linked to malnutrition (Caulfield et al, 2004). Lastly, though surely not the least, is the fact that children experiencing malnutrition have higher chances of being deprived from schooling. Studies have shown that undernourished children were more likely to be absent from school or worse, not to enroll at all. Specifically, stunted children have been found to enroll at school at a later time than other children (Jukes, 2007) leading to more complicated problems such as deprivation of information not only on academics but also on health and nutrition.

2.4 Health Literacy among Preschoolers

A bit of literature link the lack of access to health information to malnutrition, but this deficiency might be the primal origin of the problem and why is cannot cease to occur. According to Gopalan (2000), although poverty is known to be the principal cause of malnutrition, the lack of adequate nutrition must instead be pointed towards ignorance. Moreover, ignorance must be addressed the way poverty is addressed to achieve optimal results since poverty alone does not cause the problem (Azim, Shafi, Qureshi, Sheikh, Azim & Hayat, 2005).

The continuous existence of the younger population has always been the goal of the local and international governments (Jukes, 2007). Thus, various initiatives were done to address the problem on malnutrition, such as the Food Fortification Program (DevPulse, 2008) and the Operation Timbang of the World Health Organization, in association with the Department of Health of the Philippines. But after such effort, malnutrition still exists.

Few researches explain about health literacy among children, especially the importance of improving their knowledge and self-efficacy to their overall health status. What is known is that early exposure to health development programs significantly increases literacy among children, especially wherein educational graphics are found first mostly at school (Puchner, 1993). Therefore, in line with technological advancements in education, it might be possible to use computer games in order to educate these population about health.

2.5 Gaming Definition and Demographics

Technological innovation in education has started to get to the senses of the people as new methods of learning emerges. But among these advancements, computer games are central in educating children and teenagers alike (Kostkova, Farell, de Quincey, Weinburg, Lecky & McNulty, 2010). Game, as defined by Schell (2008), is a "problem-solving activity approach with a playful attitude." Such entertainment draws people into playing these games. In fact, there has been an immense community of players existing. In the US alone, 72 out of 100 American household play computer games, and 18% of these gamers are below 18 years (Entertainment Software Association, 2011). Using computer games, however, as a method of educating has been given little attention (Kostkova et al, 2010).

2.6 Usability of the Computer System Software

Usability had a lot of definitions, and does not have a standard meaning to it. But one, being the more well-known (Juristo, Moreno & Sanchez-Segura, 2007), pertains to the components defined by Jakob Nielsen (1993). According to Nielsen (1993), usability composes learnability, efficiency and memorability of software, as well as number of errors and subjective satisfaction of the target users. Another definition was given by International Organization for Standardization (ISO) 9241-11 (1998). According to this organization and very similar to Nielsen's characteristics, usability is "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."

Learnability is the simplicity or straightforwardness of learning the software and it answers the question "How easy is it to learn the system?" (Glinert, 2012) Efficiency and effectiveness are related to the accuracy and completeness of the goal and the amount of physical effort and time for the user to use achieve the goals (ISO 9241-11, 1998). Memorability is the simplicity and the ease of remembering the controls and interface of the system (Nielsen, 1993). Lastly, satisfaction measures the extent to which users are free from discomfort, and their attitudes towards the use of the product (ISO 9241-11, 1998).

Getting into specifics, games also have sets of user requirements to render them usable. Gunter, Kenny & Vick (2007) developed Relevance, Embedding, Transfer, Adaptation, Immersion and Naturalisation (RETAIN) design and evaluation model to help designers create serious games. The model evaluates "how well academic content is endogenously immersed and embedded within the game's fantasy and story context [and] promotes transfer of knowledge".

According to Gunter et al. (2007): (1) Relevance is the applicability of the game, together with the learning styles incorporated, to the user; (2) Embedding is how closely the academic content merges with the story or fun content; (3) Transfer is how players would use the knowledge attained in other areas; (4) Adaptation is the change of player's behavior as a result of playing the game; (5) Immersion is being with the gaming environment without distracting the learning process; finally, (6) Naturalisation is the spontaneous usage of knowledge outside the gaming environment.

Placing a software or system under usability testing may yield many benefits for both the creator of the software and its target users. Usability testing "improves productivity and raises team morale, reduces training and documentation costs, improve user productivity, [and] increases e-commerce potential." (Trenner, 1998; Battey, 1999; Donahue, 2001; Griffith, 2002; & Black, 2002 cited in Juristo et al) Similarly, the Usability Professionals Association (UPA) (2012) cited the benefits of undergoing usability testing. According to Launder (1995) (as cited from UPA, 2012), the cost of productivity loss due to flawed designs can be up to 720%; but can rise from 4% to 9% annually if usability testing is applied, making usability testing

beneficial to increase of productivity. According to Diagnostic Research (1990, cited in UPA, 2012) a study found out that training time for new computer users can decrease up to 11 hours when using a more usable computer against 21 hours when using a standard computer. UPA (2012) also indicated that usability yields increases sales and revenues. Magaziner (1998, cited in UPA, 2012) indicated by statistics that IT contributes to one-third of United States' real growth. Bosert (1991, cited in UPA, 2012) also stated that the development cycle of a product, or the time spent to start and finish creating a product, can decrease by 33%-50% when usability engineering techniques were implemented. The benefits might seem overwhelming, but undergoing usability is not enough to create desired product. According to Juristo et al. (2007), "Special attention also has to be paid to other usability features with impact on both UI (user interface) and the development process." However, that portion of matter, as the researcher implies, is still open for researches.

Despite the importance of usability in the context of gaming, few researches have studies the concept with preschools and their corpus of data. Likewise, a little number of health games have undergone usability testing. Thus, this study advanced the following inquiries:

Research Question 1: *What is the system usability of the researcher-developed health game as perceived by the preschool respondents?*

Research Question 2: *Is there a significant difference in the usability of the research-developed health game when grouped according the respondents' profile?*

Accordingly, the research postulated that:

H_1(+): *Developmental stage has a significant effect on the perceived polarity of usability of the researcher-made computer game.*

2.7 Behavior Intention for Gaming Participation

Playing computer games is both discipline and process. Understanding human participation in gaming and the underlying rationale for such is essential.

Entertainment Software association (2011) enumerate several reasons why children participate in gaming such as (1) entertainment, (2) level progression, and (3) goal attainment. Parents believed that computer games have positive effects on their children such as mental stimulation and learning, and enhance relationships with family and friends.

Some other factors are consequent to behavior intention, or the player's reason for participation to play a computer game, which is both technical and psychological in nature. One major factor is the software's ease of system (Baker-Eveleth & Stone, 2008), a heap component of usability. The easiness of a system is of great significance as to encouraging players to use the software and also influences self-efficacy and positive attitude towards the system (Baker-Eveleth & Stone, 2008).

Playing computer games also entails a variety of psychological effects on the brain that are necessary to ponder on before one can be able to relate it to education or to health care. These psychological effects are also the main essence of the game's entertainment value and replayability. Based on Schell's (2008) definition of a game, games – in order to succeed in them – require the player to think. Computer games produce positive effects on the body when a person in having "hard fun", wherein during this time, the player experiences "eustress" (McGonigal, 2011). The player becomes engaged and the attention is all on the game and the player creates good decisions for the game (MobiHealth News Research, 2011). The optimism generated during eustress is mood-boosting, especially when one meets the challenge and feels interested and motivated (McGonigal, 2011). Now the player is immersed and deeply involved in the game. Over-all, the reward circuit of the player is activated (McGonigal, 2011). The results can be remarkably helpful to the player, as during the time the brain is stimulated, the player is encouraged to think creatively and adaptively, and this can be applied in real life, after playing the game (McGonigal, 2011 cited in Entertainment Software Association, 2011). The stressful situation is generated on purpose by the game developers to draw the involvement of the player.

The usability of software gives the impression that it is very significant in determining the expected outcome. However, little is known on the effects of usability on the

behavioral intention of preschoolers for gaming participation. Hence, the following question was raised:

Research Question 3: *What is the effect of usability to the behavior intention among preschoolers to participate in gaming?*

In relation to the previous, the following hypothesis is postulated:

H_2(+): *The system usability of the computer game has a significant effect on the polarization of behavior intention to participate in gaming among preschoolers.*

Considering the relationship involved on the usability and the game, the following research simulacrum was developed:

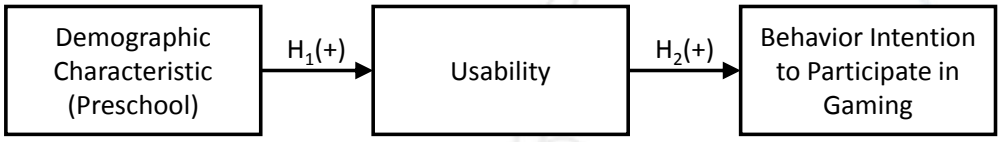

Figure 1: Hypothesized relationship between demographics and perceived usability and behavior intention to play the game

3.0 Methods

3.1 Game Development

The development of videogames has progressed creating a humongous entertainment industry; therefore, creating a game program requires substantial knowledge about computer programming (Moreno-Ger, Sierra, Martinez-Ortiz & Fernandez-Manjon, 2007). Fortunately for individuals with average computer literacy, there are typologies of software requiring no expert experience. In the study, the researcher developed a computer game using Game Maker 8.1.

A game developer shall be cognizant of the attributes in the game development process. Games are fundamentally composed of the (1) artistic elements (Moreno-Ger et al, 2007) that include graphics and sounds, (Walfisz, Zackariasson & Wilson, 2006;

Ampatzoglou & Chatzigeorgiou, 2006), (2) character programming and (3) plot (Walfisz, Zackariasson & Wilson, 2006; Ampatzoglou & Chatzigeorgiou, 2006; Moreno-Ger et al, 2007) and it is essential to integrate these components to create one (Walfisz, Zackariasson & Wilson, 2006). Game Maker software is one of the well-known initiatives that allow interested individuals or group of people to create videogames without or with little computer programming (Moreno-Ger et al, 2007).

The researcher utilized the game development process as presented by Moreno-Ger et al (2007) consisting of the following phases:

1. Production of the storyboard

This details everything that players should expect to see, including design, the interface of the game, (Walfisz et al, 2006) as well as the game logic which contains the game's story and flow (Ampatzoglou & Chatzigeorgiou, 2006). For this study, the researcher also included the setting plan for the game, which includes the genre and plot. In this process, the researchers put up their efforts and ideas to come up with a game for health education.

The game is point-and-click type of the adventure genre intended to teach preschool age children the difference between energy-giving, body-building and body-regulating groups of food, and the foods that belong to each group. For each stage, the player will be given a list of a certain food group. Different foods will fall down the screen and the player must click on the foods that are listed. Clicking foods from a different group will cause the timer to go down further. Also, the characters' expressions changes depending on the standing of the player. The player is given generous time limit to finish the stage but clicking on a wrong food will cause the timer to fall down.

2. Mark-up of the storyboard

The aim of this process is to translate the storyboard into a programming language or a "mark-up language" (Moreno-Ger et al, 2007). The researcher used Game Maker 8.1 Lite software to create the programming. This process was started halfway during

the storyboard production. At this point, no graphics or sounds were employed to the program. Instead, the researcher used dummy "sprites" such as boxes to represent the objects in the game. The researcher pronounced the product of this stage as pre-alpha version. The pre-alpha version cannot be played completely as the player will encounter several errors while playing. After series of debugging the game, the game was marked as alpha version. The alpha version contains minor bugs but the player can be able to finish a stage. The game needs polishing of object behaviors but in general, the game is already playable.

3. Production of art assets

Graphics and audio are elements that assist the player to understand any progress in the game especially the story (Ampatzoglou & Chatzigeorgiou, 2006). After a playable alpha version of computer game has been created, the researcher started to created suitable graphics and sounds and fitted into the dummy sprites. The graphics included the different food icons the player will encounter, the buttons, the graphic interface, and the characters that will appear on the game. The sound included every sound effect audible during the game. After replacing the dummy sprites with the suitable graphics, the researcher pronounced the game at beta version.

4. Production of the videogame

After the language has been created, it should undergo through an engine so that the program will take place (Moreno-Ger et al, 2007). Game Maker also has its own game engine where the researcher only needs to click on the play button to see the outcome of the language. Since the engine is incorporated with the software, this stage was done simultaneously with every stage in the game development process, practically to check whether the program created works or not.

After the beta version, the game has undergone series of improvement such as tailoring graphics and polishing object behaviors until a release version is created.

3.2 Research Design

The extensive rudiments of entertainment utilization to health education has led the researcher to a positivist approach in this study. Specifically, descriptive design was utilized to determine the usability of a researcher-made computer health game. Descriptive designs aim to discuss a variable or phenomena without engaging into its relationship or causation with outside variables (Grimes & Schulz, 2002; Polit & Beck, 2003). It limits itself to descriptions, observations and documentations of said phenomenon (Polit & Beck, 2003). It answers the basic W-questions, acts as preliminary approach to new events (Grimes & Schulz, 2002) suitable for future theory creation and development (Polit & Beck, 2003).

Causal research design was also utilized to determine the effect of demographics to usability score and usability to behavior intention of the preschool respondents to participate in gaming. Causal researches focuses on the effect of one variable to another, commonly to predict hypothetical scenarios (DJS Research Ltd, 2013). Specifically, the study used the one-shot case study, which is a type of single-group or pre-experimentation design. One-shot case studies are used when there is a single group exposed to a treatment, then given a single measurement to determine the result of the exposure (Mertens, 2009).

3.3 Study Subjects and Locale

There are few reports that extrapolate usability testing among children; however, involving children in testing the usability of a product intended for children would be more beneficial (Markopoulos & Becker, 2003). In this study, the researcher intended to test the usability of the computer game with selected participants. Spool & Schroeder (2001, cited in Bastien, 2010) have reported in their article that more than 5 users, preferably 15 are required to test the usability of a system. In this study, the researcher employed 30 preschoolers from a selected preschool facility in Valenzuela City to play the computer game and answer the questionnaire.

In order to gather the respondents, purposive sampling was utilized following this set of criteria: (1) must be a preschool student of the selected facility regardless of age,

(2) has a computer at home which can play the researcher-created game with minimum requirements or higher, (3) must be willing to participate in the study, and (4) has consent of a parent or a guardian to participate in the study. Likewise, the researcher was guided by the following criteria for the selection of preschool facility: (1) must be conducting normal preschool education in case the facility is also providing special education, and (2) must have given the researcher permission to conduct the study in its premise.

3.4 Study Tools

3.4.1 Basic Information Sheet

A basic information sheet was prepared to obtain the basic demographic profile of the respondents. It contains the basic information about the respondent, such as its name, address, age and gender. It also contains the name of the school, and guardian's name. More importantly, it asks about the ownership of computers at home.

3.4.1 Post Study System Usability Questionnaire (PSSUQ) (Lewis, 1992)

The process of usability testing can range from complex, especially when done simultaneously with the creation of the system (Gonazales, Lores & Granollers, 2008), to a more modest method, like when utilizing the Post Study System Usability Questionnaire (PSSUQ) (Lewis, 1992). The original usability questionnaire was adapted by Diño (2012) and was tailored for usage of research respondents. The questionnaire was content validated by the author and yielded a very commendable Cronbach's Alpha score of 0.99 hence making the tool much reliable for usability testing. To enhance the suitability of the questionnaire to researcher's needs, the rating scale adapted from Diño (2012) was transformed into visual type (Hannah et al, 1997 cited in Markopoulos & Becker, 2003), which is most appropriate for children.

3.4.2 Behavior Participation Questionnaire (BPQ)

Attached to the PSSUQ is a short questionnaire that asks about the intention of the respondents to play the game if given another chance. Choices include playing the game immediately, at a later time, or never again.

3.5 Data Collection and Analysis

After filling up the basic information sheet and the consent forms, 30 preschool children were allowed to play the researcher-made computer game for at least 20 minutes per day for a total of 3 days, or for a total of 1 hour. After which, the same respondents were given the PSSUQ and BPQ to answer. Data were encoded using a spreadsheet software. Usability results together with the demographic profile were presented in percentage and statistical mean. Effects of demographics to perceived usability and usability to behavior intention were calculated regression analysis. Regression is used to determine the relationship between independent and dependent variable (D'Urso & Santoro, 2006), particularly to predict the effect of the independent to the dependent. SPSS v21 was utilized to automatically compute for the statistics.

SPSS or Statistical Package for Social Sciences is a Microsoft Windows package program (Arbuckle, 2006 cited in Schreiber, 2008) that calculates quantitative data for a many multivariate statistical methods (IBM, 2012). Specifically it can process and present a researcher's proposed model in more understandable interface to determine the relationship among variables (Hsu et al, 2011; IBM, 2012), may it be causal strength or direction, or direct or indirect relationships (Hsu et al, 2011).

4.0 Results

Table 1 explicates the demographic profile of the respondents as to their gender and age. As shown on the table, 60% of the respondents gathered are male and 40% are female. As to their age, 43% are 6 years old, 40%, 10% and 7% are 5, 4 and 7 years old, respectively. The table also lists the respondents' answers to the Behavior Participation Questionnaire (BPQ). According to the data, 67% of the respondents

answered “play immediately”, while 23% answered “play later” and 10% answered “no play”.

Table 1

Demographic Data of the Respondents and Behavior Intention Scores

	f	%
Gender		
Male	18	60
Female	12	40
Age		
4	3	10
5	12	40
6	13	43
7	2	7
Behavioral Intention		
Play Immediately	20	67
Play Later	7	23
No Play	3	10

Table 2

Usability and Behavior Intention Mean Scores of the Respondents

	X	SD	I
Usability	5.40	0.88	“Agree”
Behavioral Intention	1.43	0.68	“Play Immediately”

Table 3

Regression Analysis on Demographics, Usability and Behavior Intention

Regression	R	P-value	
Demographic ↓ Usability	0.18	0.82	Not significant
Usability ↓ Behavioral Intention	0.67*	0.00	Significant

**Significant at 0.05*

Table 2 presents mean scores of the respondents on usability and behavior intention. Usability representing "agree" has a mean score of 5.40 with a standard deviation of 0.88. Behavior intention representing "play immediately" has a mean score of 1.43 with a standard deviation of 0.68

Table 3 shows the regression values obtained for demographics, usability and behavior intention. On one hand, testing the effects of demographic characteristics of the respondents to their perceived usability yielded a regression value of 0.18 with a p-value of 0.82. On the other hand, testing the effects of game usability to the respondents' intention to play the game returned a regression score of 0.67 with a p-value of 0.00.

By comparison of the research data against the researcher hypotheses, the following figure emerges:

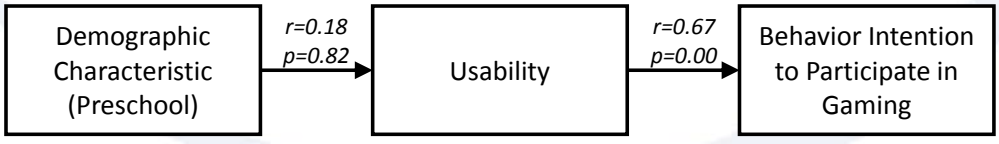

Figure 2: Resulted relationship between demographics and perceived usability and behavior intention to play the game

5.0 Discussion

Upon consideration of the data gathered and presented, several discussion have come up from this research. The research data suggest that majority of the respondents happened to be males who belong to age 6. This might be in relation to the higher number of male players than female players (ESA, 2011). This could be significant especially when speaking about the homogeneity of result. However, after testing its effects to the usability perception, it appears that demographic data has no significant effect on the usability of the game. It gives the implication that the usability of the game does not rely on what gender the players are or how young the players are, given they are currently at preschool stage. This is important when constructing or designing games suitable for health teaching. It would be more efficient to produce games that target a more general spectrum of players.

When it comes to the usability of the researcher-created computer game, majority of the respondents agreed that the game is usable. This means that the game created by the researcher is generally playable. Specifically, it means that the game was easy and enjoyable to play, and the information that the player needs can be easily acquired and understood in the game. It also means that the general respondents agreed that the interface is clear and that they are contented with the experience. More relevantly, this might mean that it is expected that the game would achieve what it intended to attain, though this was not measured in the PSSUQ and in this study.

The general agreement from the study participants may be the result of the thorough compliance to the step-by-step process of game development presented by Moreno-Ger et al (2007). The author – game creator – has made certain that the game elements such as the graphics and sound (Walfisz et al, 2006), the character development and story plot (Walfisz et al, 2006; Ampatzoglou & Chatzigeorgiou, 2006; Moreno-Ger et al, 2007) were carefully planned and integrated to perform smoothly before reaching the release version of the game.

Another important finding in this study is the behavior intention scores of the respondents after the game exposure. Majority of the respondents reported that after exposure to the researcher-created game, they would play the game as soon as possible. This indicates a high replay value of the game. Replay value is very

important especially on a game that intends to instill an information to the player. However, Very few have dealt with researches regarding the importance of the game's replay value.

Lastly, the data suggest that the usability of the computer game show a significant effect on the polarization of behavior intention to participate in gaming among preschoolers. This is very congruent with the report of Baker-Eveleth & Stone (2008) that the ease of system is very significant to encourage players to use the game and promotes positive attitude towards the system. This implies that the usability of computer games is a determinant for participation of the players to the game. This is vital because this provides empirical basis on the importance of testing a computer game's usability before handing it to the target consumers.

Conclusion

The findings that the study presented are very appropriate for game producers as well as the healthcare team and the educators. This paper was able to generate evidence of what determines participation of players to play computer games. This information can be utilized in creating games which also focus on health teaching.

Still, there are limitations that this paper needs to address the future researchers. Future researchers can recreate this type of research to a more enclosed environment – a computer laboratory for an instance – in order to provide more reliable data. It is also recommended that future studies would extend their usability testing to measure if the game has commendable effects to health literacy among the target group, though the researcher has already conducted a separate follow-up study. Similar studies are beneficial to provide stronger evidence of these data. But regardless of limitations, this paper is exceptional in providing new understandings in order to pursue the ultimate goal of providing health-for-all.

References

Ampatzoglou, A., & Chatzigeorgiou, A. (2007). Evaluation of object-oriented design patterns in game development. *Information and Software Technology*, *49*(5), 445–454. doi:10.1016/j.infsof.2006.07.003

Azim, W., Shafi, H., Qureshi, S., Sheikh, T., Azim, S., & Hayat, F. (2005). Perceptions and Practices of Mothers Regarding Child Feeding. *Biomedica*, *21*.

Baker-Eveleth, L., & Stone, R. (2008). Expectancy Theory and Behavioral Intentions to Use Computer Applications. *Interdisciplinary Journal of Information, Knowledge, and Management*, *3*.

Bastien, J. M. C. (2010). Usability testing: a review of some methodological and technical aspects of the method. *International Journal of Medical Informatics*, *79*(4), e18–e23. doi:10.1016/j.ijmedinf.2008.12.004

Brookover, A. (2013). What Is the Definition of Nutrition? Retrieved May 21, 2013, from http://www.healthguidance.org/entry/9975/1/What-Is-the-Definition-of-Nutrition.html

Caulfield, L., de Ontis, M., Blossner, M., & Black, R. (2004). Undernutrition as an Underlying Cause of Child Deaths Associated with Diarrhea, Pneumonia, Malaria and Measles. *The American Journal of Clinical Nutrition*, *80*(193), 8.

Cherry, K. (2013). Erikson's Psychosocial Stages - Preschool, Middle Childhood, and Adolescence. *About.com*. Retrieved May 21, 2013, from http://psychology.about.com/od/psychosocialtheories/a/psychosocial_2.htm

D'Urso, P., & Santoro, A. (2006). Fuzzy clusterwise linear regression analysis with symmetrical fuzzy output variable. *Computational Statistics & Data Analysis*, *51*(1), 287–313. doi:10.1016/j.csda.2006.06.001

Department of Health (DOH). (n.d.). *What types of malnutrition occur in the Philippines?* Retrieved March 20, 2012, from Department of Health: http://doh-gov.indanet.com/content/what-types-malnutrition-occur-philippines

Department of Science and Technology. (2008). *7th National Nutrition Survey* (p. 11). Food and Nutrition Research Institute - Department of Science and Technology.

DevPulse. (2008). Nutrition in The Philippines: A Continuing Challenge, *12*(16), 2.

Dewey, J. (1997). *Experience and education*. New York: Simon & Schuster.

DJS Research Ltd. (2013). What is Causal Research? *Market Research World*. Retrieved May 21, 2013, from http://www.marketresearchworld.net/index.php?option=com_content&task=view&id=799&Itemid=64

Entertainment Software Association. (2011). *Essential Facts About the Computer and Video Game Industry* (p. 16). United States.

Glinert, E. (2012). Gamasutra - Features - Upping Your Game's Usability. *Gamasutra*. Retrieved May 21, 2013, from http://www.gamasutra.com/view/feature/132499/upping_your_games_usability.php?print=1

González, M. P., Lorés, J., & Granollers, A. (2008). Enhancing usability testing through datamining techniques: A novel approach to detecting usability problem patterns for a context of use. *Information and Software Technology*, *50*(6), 547–568. doi:10.1016/j.infsof.2007.06.001

Gopalan, S. (2000). Malnutrition: Causes, Consequences, and Solutions. *Nutrition*, *16*(7/8), 556–558.

Grimes, D. A., & Schulz, K. F. (2002). Descriptive studies: what they can and cannot do. *The Lancet*, *359*(9301), 145–149. doi:10.1016/S0140-6736(02)07373-7

Gunter, G. A., Kenny, R. F., & Vick, E. H. (2007). Taking educational games seriously: using the RETAIN model to design endogenous fantasy into standalone educational games. *Educational Technology Research and Development*, *56*(5-6), 511–537. doi:10.1007/s11423-007-9073-2

Hsu, I.-Y., Su, T.-S., Kao, C.-S., Shu, Y.-L., Lin, P.-R., & Tseng, J.-M. (2012). Analysis of business safety performance by structural equation models. *Safety Science*, *50*(1), 1–11. doi:10.1016/j.ssci.2011.04.012

IBM. (n.d.). *IBM - SPSS Amos - United States*. Retrieved May 21, 2013, from http://www-03.ibm.com/software/products/us/en/spss-amos?S_CMP=rnav

International Organization for Standardization. (1998). *Ergonomic requirements for office work with visual display terminals (VDTs)*.

Jukes, M. (2007). Impact of early childhood health and nutrition on access to education in developing countries. *Paediatrics and Child Health*, *17*(12), 485–491. doi:10.1016/j.paed.2007.09.006

Juristo, N., Moreno, A. M., & Sanchez-Segura, M.-I. (2007). Analysing the impact of usability on software design. *Journal of Systems and Software*, *80*(9), 1506–1516. doi:10.1016/j.jss.2007.01.006

Kolb, D. A. (1984). *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, N.J: Prentice-Hall.

Kostkova, P., Farrell, D., de Quincey, E., Weinberg, J., Lecky, D., & McNulty, C. (2010). eBug--teaching children hygiene principles using educational games. *Studies in health technology and informatics*, *160*(Pt 1), 600–604. doi:10.3233/978-1-60750-588-4-600

Lewis, J. (1992). Psychometric evaluation of the Post-Study System Usablity Questionnaire: the PSSUQ. *PROCEEDINGS of the HUMAN FACTORS SOCIETY 36th ANNUAL MEETING*, 1992.

Markopoulos, P., & Bekker, M. (2003). On the assessment of usability testing methods for children. *Interacting with Computers*, *15*(2), 227–243. doi:10.1016/S0953-5438(03)00009-2

McGonigal, J. (2011). *Reality is broken why games make us better and how they can change the world*. New York: Penguin Press. Retrieved from http://www.contentreserve.com/TitleInfo.asp?ID={44205F90-D66A-4B2B-8483-8A0CDB6A8822}&Format=410

Mertens, D. M. (2010). *Research and evaluation in education and psychology: integrating diversity with quantitative, qualitative, and mixed methods* (3rd ed.). Los Angeles: Sage.

MobiHealth News Research. (2011). *Mobile Social and Fun Games for Health*. Chester Street Publishing, Inc.

Moreno-Ger, P., Sierra, J. L., Martínez-Ortiz, I., & Fernández-Manjón, B. (2007). A documental approach to adventure game development. *Science of Computer Programming*, *67*(1), 3–31. doi:10.1016/j.scico.2006.07.003

Nielsen, J. (1993). *Usability engineering [...] [...]*. Boston [u.a.: Acad. Press.

Polit, D. F. (2004). *Nursing research: principles and methods* (7th ed.). Philadelphia: Lippincott Williams & Wilkins.

Psychiatric nursing: contemporary practice. (2008) (4th ed.). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Puchner, L. (1993). *Early Childhood, Family, and Health Issues in Literacy: International Perspectives*. National Center on Adult Literacy.

Schell, J. (2008). *The art of game design: a book of lenses*. Amsterdam ; Boston: Elsevier/Morgan Kaufmann.

Schreiber, J. B. (2008). Core reporting practices in structural equation modeling. *Research in Social and Administrative Pharmacy*, *4*(2), 83–97. doi:10.1016/j.sapharm.2007.04.003

UNICEF. (2003, May 6). *UNICEF - Nutrition - How are we combating poor nutrition?*. Retrieved May 21, 2013, from http://www.unicef.org/nutrition/index_combat.html

UNICEF. (2012, May 25). *UNICEF - Nutrition - The big picture*. Retrieved May 21, 2013, from http://www.unicef.org/nutrition/index_bigpicture.html

Usability Resources: Usability in the Real World: Business Benefits. (n.d.). *Usability Professionals' Association*. Retrieved May 21, 2013, from http://www.upassoc.org/usability_resources/usability_in_the_real_world/benefits_of_usability.html

Videbeck, S. L. (2008). *Psychiatric-mental health nursing*. Philadelphia, PA: Lippincott Williams & Wilkins.

Walfisz, M., Zackariasson, P., & Wilson, T. L. (2006). Real-time strategy: Evolutionary game development. *Business Horizons*, *49*(6), 487–498. doi:10.1016/j.bushor.2006.04.001

Walton, E., & Allen, S. (2011). Malnutrition in developing countries. *Paediatrics and Child Health*, *21*(9), 418–424. doi:10.1016/j.paed.2011.04.004

World Health Organization (WHO). (2011). *Malnutrition In The Philippines – How Will World Health Organization Deal With It?*. Retrieved May 21, 2013, from http://www.who.org.ph/malnutrition.html

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