The Development of SightHeart: A Gamified Serious Game Training Tool for Analytical Skills and Values Internalization

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Abstract
This paper addresses the development of a two-dimensional (2D) computer serious game prototype named SightHeart as an alternative informal tool for training students' analytical skills and values internalization. The prototype was developed using an extension of the ADDIE model called DGBL-ID and was evaluated based on users' motivation, engagement, acceptance and behaviour intention towards the serious game. The study aims to highlight on developmental issues related to serious games such as lack of entertainment value due to heavily-focused on the learning content. Simultaneously, the game also intends to address learning issues among undergraduate students reported by literature, particularly the lack of critical thinking skills and having poor character that may affect their employability. The concept of gamification, motivation, psychological and other related learning theories were used as a combined approach to overcome these issues to boost their motivation and engagement towards SightHeart. Results suggested that SightHeart is successful in terms of positive influence over users' attitudes and their perceived learning opportunities, which contributed to students' better acceptance towards serious games.
Keywords: Higher Education, Gamification, Serious Games Development, Serious Game Assessment, Student Engagement, Student Motivation

Introduction
The demand to utilize technology for their needs and purposes in 21st century learning continues to increase as it became more and more essential in digital natives' lives (Prensky, 2007; Gunnarsdottir, 2010). Given such tremendous amount spent playing computer games, local studies reported that 53% of social gamers in Malaysia played games in their computers and laptop, and approximately one in every graduate surveyed played computer games more than 17 hours per week (Hussein, Wahid & Saad, 2009; Wong, 2013). Therefore it is only natural that such technology is expected in some ways to be integrated into their learning as well. This can be seen in the increasing number of serious games addressed and developed in order to accommodate to these needs (Niederhauser & Lindstrom, 2006).

However, improper balancing between games, fun, engagement and motivation could disrupt the effectiveness of learning (Deterding, Dixon & O'Hara, 2011) causing the serious game to be just like another drilling learning activity. This resulted to the value and acceptance towards serious games to be negatively low. More research on an appropriate pedagogical strategy is needed to ensure meaningful serious games that can be well accepted by learners (Aris, 2008). Due to games' properties that can be motivating and engaging to learners, they are used to address various learning problems (Mattheiss, Kickmeier-rust, Steiner & Albert, 2010). Problems faced by students today such as lack of critical thinking skills and internalization of values have affected them in terms of having less critical judgment, poor character, attitude and personality that are detrimental in the job world (Ismail, 2011; Malaysian The Star Online, 2012; Eldy & Sulaiman, 2013; Cheah, 2014, Othman & Rahman, 2014). Literature argued that more practices are needed in order for students to be able to critically make judgments and internalize values (Hodhod, Cairns & Kudenko, 2010; Tirri, 2010). Despite conventional values are taught in a hypothetical manner where learners know what they ought to do, apparently the students may still experience trouble of actually doing it (Johnson, 2001). Thus they needed a better medium to safely exercise prosocial behaviours and to reinforce what they believe to be socially morally acceptable (Tangney, Stuewig & Mashek, 2007). By using an approach that is more familiar and receptive to their culture, it is therefore hypothesized that the problems can be focused in a more effective and even interesting way.

Charsky (2010) described games as being goal-driven and competitive, with their own rules, choices and challenges. Therefore games can be as an effective learning tool for complex procedures such as reinforcing mastery skills and active participation on the interactivity and critical decision making contexts (Kebritchi &Hirumi, 2008). Kurshan (2016) supported that the rich environment in games can assist learners to develop their higher thinking abilities such as pattern recognition, deductive reasoning and hypothesis testing, as well as in understanding themselves and their views better (Hemminger, 2009). Consequently, games can provide useful training skills that can be used and even applied throughout their lives. In this paper, gamification was used as an approach in serious games to avoid it from becoming another drilling practice while still maintaining the motivation and engagement (Kapp, 2012). Gamification is the application of game elements to non-game contexts (Kim, 2015). Due to the tendency of serious games to be heavily focused on the learning content and less on the playfulness, gamification may be the key to balance the games to be more motivating and engaging to users.

Ultimately, users' strong intention of use signifies the acceptance, quality and usefulness of the proposed technology as perceived by them. It reinforces their desire to engage and play with serious games (Wu & Tsang, 2008). Therefore exploring game acceptance can contribute to the studies on why learners would want to engage in serious games, as well as a valuable source for instructional game designers to improve their system. Hence, this paper intends to illuminate on these issues using a case study related to an educational practice by developing a serious game using gamification, instructional design, psychology and motivation theories to address learners' needs for critical thinking and values internalization practices. Specifically, it aims to identify users' motivation, engagement, gamification preferences and perceived acceptance while engaging with SightHeart. Therefore the objectives of this study are 1) to develop a serious game named as SightHeart for training analytical skills and values

internalization, 2) to identify gamified user types according to their preferences towards certain game elements, 3) to examine the influence of motivation and game engagement towards users' behaviour intention using SightHeart and 4) to identify factors that influence students' behaviour intention in playing serious games. Findings may contribute to a more rigorous and pedagogically sounded serious games in the future, thus facilitating users to a more accepting behaviour towards the innovation.

Content

Product Description: SightHeart Prototype

SightHeart is a 2D role-playing serious game that attempts as an alternative outlet for practising analytical skills and values internalization among undergraduate students in higher learning. It is computer-based and runs in any Windows platform. It consists of five moral dilemmas which require users to make a decision whether to be involve or uninvolved in a conflict that may violate their core moral principles. SightHeart's pedagogical intention is to promote a safe innovative learning material for learners' critical thinking practise and reflection on self-important values. It encourages learners to use situational cues to form, test and refine their hypothetical skills and thus developed stronger knowledge synthesis skills through this self-directed play, similar to the game developed by Medeni et al (2006). This is illustrated by users' understanding of game controls, game rules and their actions in the game. SightHeart is also a practise in both instructional and game design to encourage better information understanding of the environment and tasks through intuitive situational cues. The game takes approximately 35 minutes to play.

Context/ Background Development

Local students of higher learning today were reported to still experience lack of critical thinking skills and possess poor character that affected their future employability (Ismail, 2011; Malaysian The Star Online, 2012; Eldy & Sulaiman, 2013; Cheah, 2014). Consequently, the lack of practices also leads to students' values internalization problem (Othman & Rahman, 2014). This shows that students of higher learning still experience lack of critical thinking practices specifically in values internalization issues which can be detrimental to their personal development.

Developing students' critical thinking skills is crucial in universities as it forms a basis for their informed judgements, matching their values to justify their reasoning, resolving uncertainties as well as connecting learning and practices (Thomas, 2011). They needed to be constantly exposed to situations which require them to practice on what is critically appropriate according to their values. Moral dilemma can be a great source to practice critical thinking as it deals with uncertainties and conflicting situations that have no right or wrong answer, thus learners indulge in self-analyzation and hypothesis testing. It also engages learners to examine on inner values that are important to them and decide on an action that they deemed most appropriate. This will help them build stronger foundations that they can rely on when dealing with conflict situations in the future (Jungermann & Fischer, 2005).

However, conventional methods rely on hypothetical dilemmas told either through moral stories or reading does not make dealing with moral dilemma easy. As students only hypothesized what they ought to do in a situation without the actual doing, lack of relevant and emotional context might cause some values to be less prominent and not fully

internalized. Solving dilemmas require not only good analytical ability, but also self-realization (Dhavale, 2016). Awareness of own principles and the opportunity to assess and act as according to those values can therefore provide a good training ground for students' analytical thinking and values internalization.

In this paper, a serious game called SightHeart was proposed and developed as an innovative way to address university students' lack of analytical thinking and values practice. The purpose of the game is to train their analytical skills in five different dilemmas that might be conflicting to their moral principles. The game also aims to increase awareness and improve through safety experimentation. Serious games was proposed coz could mean something though not direct and explicit. A game authoring tool named RPGMaker VX Ace was used to develop SightHeart. Various free graphics as well as the program's premade resources were combined to develop the game. The main character in the prototype is defined by user/target audience who selects their chosen avatar in the game. Despite many different game genres, the role-playing (RPG) was chosen for SightHeart due to its ability to allow richer interaction by facilitating feedback of actions and reinforcement of hypothesis formulation and testing by taking a role of a character in a story (Mei, Chun-Ming, Hung, Hwang, & Yueh-Chiao, 2011). In terms of perspective-wise, the two-dimensional (2D) was chosen as the perspective or graphical interface used in games today. Though 2D graphics lack the Z axis which gives the illusion of depths and realism to the environment (Thompson, Berbank-Green & Cusworth, 2007) as compared to 3D, they are still widely used in game designs due to its lightweight size, non-high end system requirement and also less cost (Adams, 2009).

Importance to Education
SightHeart is a unique serious game due to its user-friendly menu and intuitive navigation even for non-gamers. The role-playing (RPG) genre alleviates users' sense of realism to the issues being discussed (moral dilemma) by being involved in an interactive storyline. The significance of their decisions can be seen through feedbacks and how they affect the game. It helps them build self-confidence in terms of solidifying their reasoning and make best, good and rightful decisions according to their values in moral dilemmas. Additionally, SightHeart has a built-in metrics to record data on users' actions that can inform the study's objectives to improve the game design. Finally, apart from being a standalone Windows program, the 2D perspective makes SightHeart lightweight in terms of size and its minimum requirement to run. This makes it easy to access and store inside a pendrive.

Advantages to Education
SightHeart was developed using a game authoring tool called RPG Maker VX Ace by Enterbrain (2015). The program was chosen to develop SightHeart due to its simplified drag-and-drop interface and vast premade resources, which makes the development process easier even to amateur developers. It also has useful logging capabilities that can record users' actions and interactions within the game. Finally, it provides accessible game project files, in which developers can further use to improve and reproduce.

SightHeart has the advantage of making it easier for users to practise internalizing their values and making critical decisions that they deemed appropriate in a safe environment. It allows them to explore and experiment with different choices without consequences in a real world, according to their own time and pace. The feedbacks from their decisions expose them to the

effects of their actions as well as discover different views beyond their perspectives. The chances for them to make significant decisions that can affect the storyline not only provide a motivational and engaging boost to the task, but also as a creative medium for self-reflection.

Commercial Value

In terms of commercial value, RPG serious games such as SightHeart can appeal to wider audience who entertains and sees computer games as means to improve themselves. Author's previous experience in developing similar games for the hit tv series Supernatural has earned her vast appreciation and recognition, even from some of the guest actors in the show. Therefore SightHeart is reckoned to receive such acceptance for those who perceived the game as useful to them.

Assessment of Sightheart on Students' Motivation, Engagement and Acceptance towards the Serious Game

The actual evaluation involved 97 participants who tested and answered the questionnaire related to students' motivation, engagement and acceptance towards SightHeart. Data were collected using survey questionnaire, informal interview questions and metrics from the game itself. A four-point Likert scale was used for items in the questionnaire ranging from (1) "strongly disagree" to (4) "strongly agree". Descriptive analysis and Pearson correlation were used to analyze the data.

Demographic profile shows that majority of the respondents play games with an average of 1 to 4 hours daily. Most of the respondents were also identified as the philanthropist type, due to their preferences to certain game mechanics that can heighten their altruistic nature and sense of purpose. Results were evident in terms of perceived usefulness (M=3.00, SD=.532), perceived learning opportunities (M=3.18, SD=.539), attitudes (M=3.04, SD=.595) and behaviour intention towards SightHeart (M=3.01, SD=.610). However, SightHeart scored only a fair value on engagement (M=2.88, SD=.577) and motivation (M=2.89, SD=.405). Perceived ease of use was the least scored variable (M=2.86, SD=.505) in the study. Pearson correlation test revealed positive significant relationship between all of the variables studied with respondents' behaviour intention to use SightHeart. Table 1 summarizes the descriptive findings related to the variables studied for SightHeart.

Results showed that the motivation and engagement constructs received a low score despite some respondents reported to feeling intrinsically motivated and experienced some degree of immersion while playing SightHeart. These findings may have strongly been influenced by respondents' perceived ease of use towards the game, which indicates users are probably more concerned with operating with the system rather than on the learning content. This finding therefore seemed reasonable as explained by Scattergood and Feil (2005) that users' lacking navigation skills and control resulted to less attention on the story presented, thus less engagement on the intended learning. Thus more efforts needed to be addressed in SightHeart in terms of ease of use such as having much clearer guidance and simpler self-explanatory interface to increase users' self-efficacy. Having clear learning goals, the autonomy feeling of being in control and clear feedback enable users to concentrate in the game task (Fu et al, 2009). Overall, respondents have positive attitudes towards SightHeart

and reported to have high behaviour intention towards the serious game due to its high perceived learning usefulness and opportunities.

Table 1:
Descriptive Summary on the Variables Studied for SightHeart

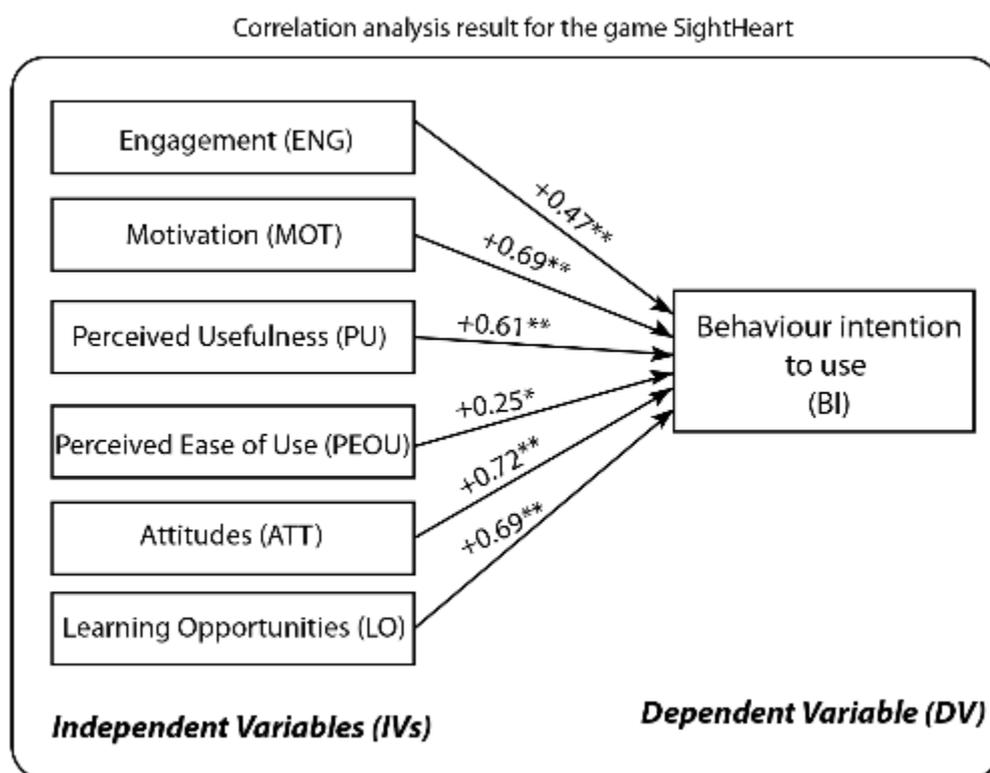| Variables	Mean	Standard Deviation
Motivation	2.89	.405
Engagement	2.88	.557
Perceived Usefulness	3.00	.532
Perceived Ease of Use	2.86	.505
Learning Opportunities	3.18	.539
Attitudes	3.04	.595
Behaviour Intention	3.01	.610

Figure 1: Correlation Analysis Results for SightHeart

As a conclusion, this paper illuminates on the use of gamification and learning theories on serious games towards the acceptance and behaviour intention among students of higher learning. SightHeart attempts to provide a medium for users to exercise their analytical skills and beliefs by increasing their own understanding and awareness based on dilemmas in an experimental and safe way. The study also indirectly contributed to a more innovative and interesting way to address issues such as moral sensitivity, due to the context chosen for the

serious game. Finally, the study hoped to lighten on better pedagogically sound serious games in the future that can benefit learning and accommodate the interests of the diverse contemporary learners.

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