A Digital Games Design for Children Health Promotion and Education

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***Abstract*—Children health promotion and education relies currently on school promotion and mass media. With the increasing popularity of youngsters' digital game playing phenomenon, a growing possibility of utilizing educational games (Serious Games) for health promotion and education has become promising. Prior research have anticipated that serious games can be a powerful channel that can benefit the young generation, not only for entertainment, but also for communicating health values to change their behaviors in reality. This project investigated the communication design and effects of serious games for promoting and educating health concept with children. Two studies were conducted in this research. In Study 1, the research team investigated how public health message was assimilated into serious games, which affect the health behaviors of children. In Study 2, the team investigated the effects of the serious games on children through a between-group experiment. A 'pre-test/post-test control group' experiment with 180 primary school children in Hong Kong (aged 9 to 12) was conducted. The findings has showed the use of serious games is promising in deliver health promotion and education to children. The result also contribute to academic, professional and educational values for serious game design, health promotion and education.**

CCS Concepts
Applied Computing---Computers in other domains---Personal computers and PC applications---Computer games

***Index Terms*—Serious Games, Digital Games, Health Promotion and Education, Communication Design**

I. INTRODUCTION

Prior research [1] have anticipated that digital games can be a powerful channel that can benefit the young generation, not only for entertainment, but also for communicating health values to change their health behaviors in reality. In views of Hong Kong, children health promotion and education had been relying on school promotion and mass media. With the increasing popularity of youngsters' digital game playing phenomenon, a growing possibility of utilizing educational games (Serious Games) for health promotion and education has become promising. This study extends the existing body of knowledge about serious games design for public service promotion through exploring the design process and evaluation of the effectiveness of a series of designed serious games. Two key studies were conducted, they are (a) Study 1 was investigating how public health message was assimilated into serious games, which affect the health behaviors of children. By examined the communication strategy of serious games design through delineating the design process together with the designer' experience. A puzzle game namely 'the drug detective' (See Fig 1) was designed and produced for this research; and (b) Study 2 investigated the effects of the designed serious game on children through a between-group experiment. A 'pre-test/post-test control group' experiment with 180 primary school children in Hong Kong (aged 9 to 12) was conducted. Both groups require to do a self–completed pre-test and post-test questionnaire for assessing their knowledge, attitude, perceived control and perceived severity toward health concepts; while the treatment group were invited to play 'the drug detective' serious game on an individual basis before they conduct the post-test questionnaire. The pre-test and post-test results of the two groups were compared and tested its effects on children.

Fig. 1. The serious game "The drug detective".

II. GOVERNMENT CAMPAIGNS ON HEALTH PROMOTION AND EDUCATION

The Hong Kong government is continuously putting effort into various research and campaigns for promoting and educating citizens about the public health, in particular to the problem of drug-taking and related diseases. According to the e-report from the HKSAR Department of Health, it indicated that digital games as entertainment have become very popular among teenagers and children. Children aged 10 to 14 year old had spent more than 50 hours per week in using computer and mobile devices. They spent 4 days per week on average, and 90 or more minutes per day in playing digital games. The idea of utilizing serious games for health communication for young people has, therefore, become more promising. Some studies [2] [3] have suggested beneficial effects of playing video games on psychological and physical health. Digital games can be a powerful channel for bringing benefits to the young generation, to encourage them to learn about values and change their health behaviors

in reality [1], as well as enhancing their knowledge and skills as players [4], bringing both entertainment and educational benefits into health communication [5].

III. Digital Games for Promotion and Communication

Prior research on utilizing games for communication has focused on the commercial branding and promotion areas, and is regarded as advergames [6] and casual games [7]. These digital games are usually free of charge, engage for short playing durations and are easy to play [8]. Previous research on digital game has mainly tried to measure and understand the relationship between playing these games and game players' attitudes toward brands and products [9] [10]; brand consciousness [11] [12]; brand placement and prominence in players' memories [13] [14] [15]; game and product congruity [16] and digital game content and brand [17] [18]. Numerous research studies [19] [20] have suggested that digital games have a positive influence on brand image and brand recall. In addition, Bandura's [21] [22] social cognitive theory implies that learning of habitual models and behaviors can become established during digital games playing [23]. Rewards for completing desirable activities in game playing can also reinforce learned behavior [24]. In this research, the above insights implied that the use of digital game, as a form of serious game, to promote public health, such as anti-drug abuse, might possibly help to construct children's learning about drug prevention through game playing.

IV. The Need of Designing Digital Health Games

Health games have received considerable attention from the public and academics in recent years. For instance, research on health games [25] claimed that digital health games have assumed growing importance in improving players' health beliefs and behaviors. In 2009, the Robert Wood Johnson Foundation (RWJF) in the US gave more than US$1.85million in grants to explore how digital games might improve health behaviors and outcomes. The US government has also sponsored research on the use digital games to improve health and health care across a number of important areas such as food safety, nutrition and obesity, HIV prevention, early pregnancy and tobacco usage [26]. Although we found many ongoing game projects and research activities about health games, most of them focus on education, such as educating people about food and nutrition (e.g. 'Pyramid Pile up'), attention training (e.g. 'Inside and Outside', 'Birdwatching'), or encouraging physical exercise (e.g. 'Active Life Outdoor Challenge'). Limited research is available on understanding how digital games could be used for public service promotion and persuasive purposes in disease prevention, such as drug-abuse prevention for children and teenagers.

V. Research Design

This research extended the knowledge of designing and evaluating digital games for delivering health messages; in particular, it has contributed to advancing the knowledge of strategic use of digital games for health education and communication design. It also helped to bring students and social awareness about drug-related disease to children in Hong Kong through the benefits of innovative media and technology adoption.

The aims and objectives of this research project are (a) investigating the strategic use of digital games for health promotion and education; (b) exploring the design theories and principles of designing digital games for health promotion and education; (c) comparing the effects of digital for education and public services applications; and (d) identifying the potentials of digital games for promoting anti-drug prevention to children in Hong Kong

Thus, this research had carried out in two studies. Study 1: the design of an anti-drug serious game and Study 2: the evaluation of the effect of the game.

A. Study 1: Research through design – Designing an anti-drug serious game

In this part of the study, the serious game, namely, the 'drug detective' were designed (See fig 2) and produced with guiding by the planning and evaluation framework [27] (See fig 3). The key promotional message, i.e. stay away from drugs, will be conveyed through the storyline of the game.

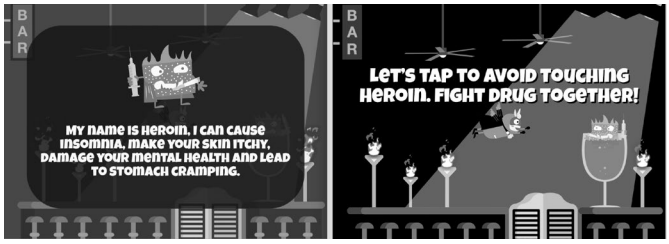

Fig. 2. The serious game "the drug detective"

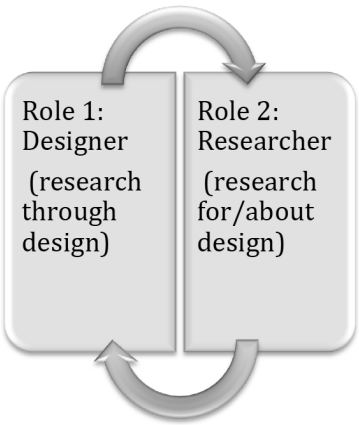

Fig. 3. Theoretical framework: 'Research through, for and about design' (Frayling, 1993)

B. Storyline of the games

The game story begin with a detective (i.e. the player's role) who will receive a secret notice about some illegal drugs, such as ketamine and cough medicine, has been hidden in the playground and school areas by some bad guys. The player had been invited to play as a 'Drug Detective' in the story and his/her role is to uncover the hidden drugs in different scenarios. Players had been assigned with a mission and they have to uncover the hidden drugs under a given time frame; otherwise the drugs would have had a chance to be transported to other children. The information of different forms of drugs and their harmful effects were communicated

to children during the game-play process through different missions. The format of a puzzle game has been chosen as it involves children' focus on logic and conceptual challenges. During the immersive game-play process, children are taking an active learning process to solve the problem in the story. They are allowed to tailor the design of the character of the detectives through some tailoring features, such as color of the clothes and accessories. Previous study suggested that tailoring features in games could helped to encourage players' engagement in problem solving in game-play experience [27].

C. Study 2: Evaluation of the effect of the designed serious game

In part 2, the serious game 'Drug Detectives' were evaluated to gauge its persuasive effects on knowledge, attitude, subject norm and perceived severity of children toward drug-abuse through a two-group pre-test/post test between-group experiment design. The factors of game effects evaluation are guided the Theory of Planned Behavior (TPB) [28] and the Health Belief Model (HBM) [29]. The Theory of Planned Behavior (TPB) and the associated Theory of Reasoned Action (TRA) explore the relationship between behavior and beliefs, attitudes, and intentions. According to these models, behavioral intention is influenced by a person's attitude toward performing a behavior, and by beliefs about whether individuals who are important to the person approve or disapprove of the behavior (subjective norm). In addition, the HBM theorized that people beliefs' about whether or not they were susceptible to disease, their perception of the benefits of trying to avoid it, influenced their readiness to act. In other words, the TPB suggest us that children' drug-taking behavior would be affected by their beliefs and attitude towards drugs. In addition, children' belief on the serious consequences (perceived severity) of drug taking will also affect their perception of trying to avoid taking it.

VI. THE EXPERIEMENT

To text the above hypothesis, a between-group 'pre-test/post-test control group' experiment will be adopted. A total of 180 children (n=180) aged 6-12 will be recruited from local primary schools in Hong Kong. They will be randomly allocated to the experimental group and the control group with similar numbers of children in each group. The participants in the experimental group will be invited to play the game 'Drug Detectives' in a classroom setting for 30 minutes while participants in the control group will receive no treatment (See Fig 4).

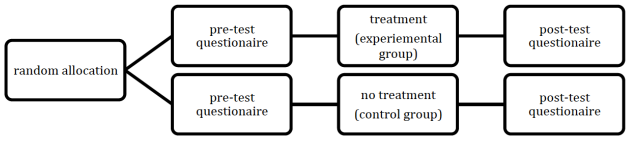

Fig. 4. The randomized between-group pre/post-test experiment design

The pre-test and post-test questionnaire used a self-completion questionnaire. The questionnaire has composed of quantified measures in 4 categories: (1) demographic information such as student age, gender, frequency of computer use at home and in school, previous game-play experience (frequency of use, types of game-played, skill-level). (2) knowledge about drug; (3) attitude towards drug and (4) perceived severity towards drug-abuse. A pre-test questionnaire was administered 2 days before the intervention while the post-test questionnaire was administered 2 day after the intervention. With the consideration of the age and difference in reading literacy on questions of the children, the pre- and post-test questionnaire will be administered in their mother language (i.e. Chinese/Cantonese) in a classroom event, with the researcher facilitating the process by reading the questionnaire aloud. Participants were asked to fill in some required information as well as to give rating on questions on knowledge, attitude and perceived risk and consequences on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

VII. DATA ANALYSIS AND DISCUSSION

One-way analyses of variance (ANOVA) will be performed to compare the data collected from the control and the treatment groups. Since some of the major data is still under analysis, this paper is going to report the initial findings of the research. The aforesaid pre-test and post-test questionnaires were distributed to the control group in able to gather their knowledge and understanding of (2) knowledge about drug; (3) attitude towards drug and (4) perceived severity towards drug-abuse.

Table 1. The results of the pre-test and post-test

		Pre-test (n = 180)	**Post-test** (n = 180)
(a) Knowledge about drug	m	2.38	4.34
	s.d.	0.56	0.61
(b) Attitude towards drug	m	3.31	4.07
	s.d.	0.62	0.55
(C) Perceived severity towards drug-abuse	m	2.66	2.71
	s.d.	0.41	0.46

According to the result, participated children were significantly satisfied with the designed serious game (post-test) with positive feedback when comparing to the pre-test result. Children showed a better understanding of knowledge about drug in the post-test (m = 4.34, s.d. = 0.61) when comparing to the pre-test (m = 2.38, s.d. = 0.56). The participated children were also performed a slightly better result (+0.6) in changing the attitude toward drug in the post-test (m = 4.07, s.d. = 0.55) when compared to pre-test (m = 3.31, s.d. = 0.62). These two significant results implied that the use of serious games in health promotion and education is positive. The vividness and entertaining presentation of game-play is promising to deliver health communication to our children. However, in views of the Perceived Severity towards Drug-abuse, the result of pre-test (m = 2.66, s.d. = 0.41) and post-test (m = 2.71, s.d. = 0.46) are similar. These similar results could be explained that the concept of perceived severity might be very difficult to deliver neither through traditional media and school promotion nor the new way of serious games.

VIII. CONCLUSION AND IMPLICATIONS

This project investigated the communication design and

effects of serious games for promoting and educating health concept with children. The findings echo to some prior research which has indicated the use of game-based learning approach is positive on deliver declarative knowledge [30] and develop learners' motivation [31]. The results also interestingly reviewed that players are enjoying lower-skill level games rather than higher level one as some prior research did [32]. Overall speaking from this initial result, the use of serious game has strong potentials in motivating children learning which has been proven by many previous research [33] [34]. From educators' perspectives, it is because the use of serious games allows teachers to develop a flexible curricular design as well as unique and tailor-made learning outcomes [35]. Nonetheless, as Kharazzi [36] highlighted earlier that the design of health care games based on behavioral models can increase the usability of the game in order to improve the effectiveness of the game's desired health care outcomes. The future research focus of our team should pay attention on children's subject norm and perceived severity toward drug-abuse through serious game design.

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