

Learning AIDS in Singapore: Examining the Effectiveness of HIV/AIDS Efficacy Messages for Adolescents Using ICTs

Chib, Arul; Lwin, May Oo; Lee, Zhuomin; Ng, Victoria W.; Wong, Priscilla H. P.

2010

Chib, A. I., Lwin, M. O., Lee, Z., Ng, V. W., & Wong, P. H. P. (2010). Learning AIDS in Singapore: Examining the Effectiveness of HIV/AIDS Efficacy Messages for Adolescents Using ICTs. *Knowledge Management & E-Learning: An International Journal*, 2(2), 169-187.

<http://www.jourlib.org/paper/2097517#.Vl6TYtIrKUk>;
<https://hdl.handle.net/10356/80643>

© 2010 The Authors. This work is licensed under a Creative Commons Attribution 3.0 License.

Downloaded on 15 Jul 2024 19:45:33 SGT

Learning AIDS in Singapore: Examining the Effectiveness of HIV/AIDS Efficacy Messages for Adolescents Using ICTs

Arul Indrasen Chib*

Wee Kim Wee School of Communication and Information
Nanyang Technological University
31 Nanyang Link, Singapore 637718
E-mail: ArulChib@ntu.edu.sg

*Corresponding author

May O. Lwin

Wee Kim Wee School of Communication and Information
Nanyang Technological University
31 Nanyang Link, Singapore 637718
E-mail: tmaylwin@ntu.edu.sg

Zhuomin Lee

Wee Kim Wee School of Communication and Information
Nanyang Technological University
31 Nanyang Link, Singapore 637718

Victoria W. Ng

Wee Kim Wee School of Communication and Information
Nanyang Technological University
31 Nanyang Link, Singapore 637718

Priscilla H. P. Wong

Wee Kim Wee School of Communication and Information
Nanyang Technological University
31 Nanyang Link, Singapore 637718

Abstract: The objective of this study was to assess adolescents' receptivity to the use of new interactive media for dissemination of sensitive health messages. We propose a conceptual framework based on the Extended Parallel Process Model (EPPM) to design a game-based HIV/AIDS intervention for adolescents. Amongst key findings, we found that Game Play led to changes in attitudes and intentions.

Keywords: HIV, AIDS, Health Communications, Intervention, Games.

Biographical notes: Arul Indrasen Chib is an Assistant Professor of the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore. He received his Ph.D. degree in Communications from University of Southern California, USA.

May O. Lwin is an Associate Professor of the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore. She received her Ph.D. degree in Business Administration from National University of Singapore, Singapore.

Zhuomin Lee is a graduate of the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore.

Victoria W. Ng is a graduate of the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore.

Priscilla H. P. Wong is a graduate of the Wee Kim Wee School of Communication and Information at Nanyang Technological University, Singapore.

1. Introduction

About half the world's HIV positive population today is made up of young people aged 15-24. An estimated 12.5 million adolescents living with HIV/AIDS are expected to escalate, with an increasing proportion of new infections occurring in young people (UNAIDS, 2008). In Singapore, the Ministry of Health (MoH) reports that the numbers of new HIV/AIDS infections reached a record high of 423 in 2007 (357 in 2006), since the first reported case in 1985 (MoH, 2009).

Adolescents are identified as a highly vulnerable group because of their proclivity towards high-risk sexual behaviors (Gubhaju, 2002; Quek & Li, 2002; UNFPA, 2002). Often, such adolescents are not fully aware of the consequences of their actions (Quek & Li, 2002), or have misconceptions towards HIV/AIDS (Gubhaju, 2002). In Asia, changing cultural norms and false media portrayals have also led to a growing trend of early sexual activity and low use of contraception among young people in several countries of the region (UNICEF, 2005). In Singapore, adolescents are becoming sexually active at an earlier age (Quek & Li, 2002); increasingly, they do so without taking protective measures (Hussain & Kwek, 2005). Further, they do not have information on their bodies, the perils of unprotected sex and modes of prevention (Bharwani, 2008).

The centrality of education in prevention and mitigation of the HIV/AIDS epidemic is critical. Unfortunately, the HIV/AIDS programs implemented (Ministry of Education, 2002) have been criticized for lack of consistency (Cormont-Ku, 2008; Tan, 2009). Recently scholars begin to focus on the use of interactive games in educating youth on health behaviors (Bandura, 2004; Brown, Lieberman, Gemeny, Fan, Wilson, & Pasta, 1997; Chib, 2008; Lieberman, 2001; Thomas, Cahill, & Santini, 1997).

We propose a conceptual framework based on the Extended Parallel Process Model (EPPM) to design a game-based HIV/AIDS intervention for adolescents. The objective of this study was to assess adolescents' receptivity to the use of new interactive media for dissemination of sensitive health messages, and secondly, understand the role of threat and efficacy messages in HIV/AIDS interventions.

2. Issues in Current Sexual Health Education

While the literature acknowledges the key role of parental guidance, its effectiveness is often limited by parents' embarrassment when discussing sexual issues with their children (Baldwin, Li, Shah, & Zhang, 2007; Cui, Gao, & Li, 2001). Increasingly, studies have shown that school-based HIV programs are effective in reducing risk-taking behaviors (Abner et al., 2007a; Kyrychenko, Kohler, & Sathiakumar, 2006).

Asian countries began HIV/AIDS educational campaigns (Xinhua, 2003), yet, policy-makers have been slow to act on this recommendation (Aggleton & Warwick, 2002). Taboos and sensitivities surrounding the issue of sex in some communities also make it difficult for people to broach topics related to sexual issues (Hoe, 2007). While the Singaporean Health Promotion Board has prepared the AIDS Education Program and "The Growing Years" series, it is unclear if these programs were successful as implementation is optional (Ministry of Education, 2002).

Further, they may not be well-received as a young, highly media literate generation pay less attention to conventional messages that are largely moralistic and didactic in nature. The new generation of adolescents may instead respond better to information and communication technologies (ICTs) such as videos, digital games and the Internet (Miller et al., 2008; Squire, 2002).

The issues surrounding current sexual health programs suggest the need to revolutionize HIV/AIDS interventions in schools. Miller et al. (2008) point out the benefits of interactive multimedia platforms to reduce adolescent at-risk behavior, which can particularly be harnessed in Singapore. First, computer penetration rates are high in Singapore, with more than 90% of school-going adolescents having access to computers and Internet at home (Infocomm Development Authority of Singapore [IDA], 2008). Moreover, the use of computer and the Internet have become increasingly ubiquitous in the lifestyles of young people, with adolescents between ages 15 and 24 reporting the highest usage of the computer and the Internet (IDA, 2008).

Recognizing human capital as a valued asset of the country, the Singapore government integrated interactive multimedia ICTs into the school curriculum, leading to schools sufficiently equipped with necessary and modern facilities to enable digital-based learning (Mokhtar, Foo, & Shaheen, 2007).

Health communication scholars have begun to focus on the use of interactive games in influencing health behaviors (Bandura, 2004; Brown et al., 1997; Chib, 2008; Lieberman, 2001). Unlike commercial games, which are purely entertainment products, health games are designed to achieve specific health outcomes, and thus are lower in production qualities such as resolution and usability (Rizzo & McLaughlin, 2006).

Although still in its early stages, computer-based applications have been used to educate youth on a wide range of health issues such as substance abuse (Aryl, Beauchamp, Duncan, Duncan, & Wells, 2000; Glassman, Noia, & Schinke, 2004), alcohol use (LaChausse, 2006), and sexual and reproductive health matters (Abner et al., 2007a; Abner, Carlyle, Roberto, & Zimmerman, 2007b). Among some successful game based applications, Lieberman (2001) found a considerable improvement in the self-care skills of sufferers of chronic diseases such as asthma after playing a series of interactive Nintendo games. In another study on post-stroke rehabilitation, it was found that serious games with virtual reality helped improve patient movements such as reaching (Holden, Todorov, Callahan, Bizzi, 1999), hand movements (Merians et al., 2002) and walking (Deutsch, Latonio, Burdea, & Boian, 2001; You et al., 2005).

Despite the growing body of literature supporting the effectiveness of serious games in learning and health outcomes, research on digital game-based learning has been criticized for its emphasis on effects of intervention and failure to develop valid theory explicating the mechanisms behind the effects (Singhal & Rogers 2001). Thus, we propose to address this gap by developing a HIV/AIDS game-intervention based on strong theoretical underpinnings. This study integrates the benefits of digital gaming with EPPM in influencing attitudes and intentions towards HIV/AIDS protective measures.

3. Conceptual Framework

Fear appeals are persuasive messages that mix threat messages with recommended measures to promote protective behaviors, and are based on assumptions about the role of fear arousal in motivating protective behaviors (Rogers, 1983). Although fear appeals have been widely employed in HIV/AIDS preventive campaigns over the last two decades (Ross & Rigby, 1990), proof of effectiveness remains inconclusive, with some studies reporting the success of fear appeals in precautionary motivation, and others failure (Beaudoin, 2002; Cho & Salmon, 2006; Murray-Johnson, Witte, Liu, & Hubbel, 2001; Witte, 1992).

Leventhal (1970) explanation is that fear arousal triggers two parallel processes in individuals, namely danger and fear control processes. When danger control processes dominate, individuals develop protective strategies to alleviate the danger. When fear control dominates as a result of excessive fear arousal, individuals actively alleviate fear through message denigration (Bargh, 1989; Lazarus, 1991a; 1991b).

In view of this advancement, researchers began imbuing fear appeals with specific protective behavior guides in order to mitigate the influence of fear arousal (Eiser & Pligt, 1989). According to Sarafino (1990), emphasizing the role of efficacy through specific advice and prevention strategy boosting one's confidence, thus increasing the effectiveness of fear appeals' in motivating behavior change.

Thus far, fear appeals theories such as Protection Motivation Model (PMT) and Extended Parallel Process Model (EPPM) have incorporated the component of efficacy in their revised frameworks. The PMT is a revised fear appeals theory that combines efficacy components with threat components. However, despite improvisations, the PMT still fails to explain why message rejection occurs and how threat appraisal and coping appraisal interact to influence consequent behavioral changes (Witte, 1992).

EPPM was chosen as the overarching theoretical framework to explicate the mechanisms behind the effects of game-based interventions, because it integrates the parallel process model and PMT (Nabi, Roskos-Ewoldsen & Carpentier, 2008), filling in gaps left by both theories (See Figure 1). Specifically, EPPM addresses limitations of previous fear appeals theories on three fronts.

First, unlike previous theories, EPPM expands on fear control processes, explaining when and why message rejection occurs. Next, it explains the interaction of threat and efficacy in fear appeal studies. Lastly, EPPM allows for distinction between individuals engaging in fear or danger control processes through a discriminating value formula, making it an excellent predictive model for further theorizing (Witte, 1992).

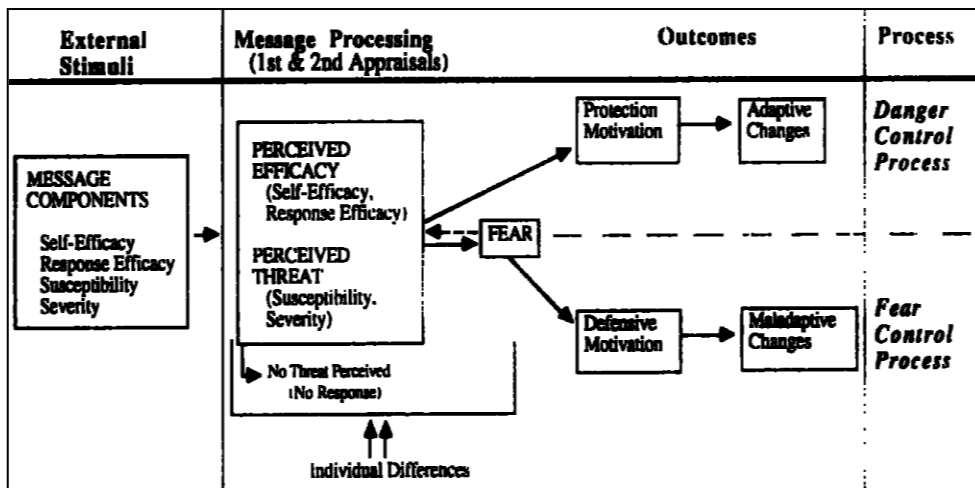
EPPM examines the conditions under which fear appeals may succeed or fail in persuading the audience (Witte, 1992; 1998; Witte, Meyer & Martell, 2001). It comprises two main variables—perceived threat and perceived efficacy. Perceived threat consists of two variables—perceived susceptibility and severity. Perceived susceptibility to threat is

a person’s perceived likelihood of the risk happening to the individual (e.g. ‘You are at risk of getting HIV’). Perceived severity is a person’s perception of how serious the risk is (e.g. ‘You can die from AIDS’). Perceived efficacy comprises of two components, namely self-efficacy and response efficacy. Self-efficacy refers to an individual’s belief in his capacity to perform a recommended behavior (e.g. ‘I am confident of resisting sexual pressure’), while response efficacy refers to an individual’s belief in the usefulness of the message recommended behavior in reducing the threat (e.g. ‘I believe that condoms can prevent HIV/AIDS’).

According to EPPM, threat stimuli are crucial to message processing because they result in fear arousal, causing one to feel more involved and pay attention to the message. When fear arousal is low, individuals disregard the relevance of risks, thus impeding message processing (Witte, 1992). Conversely, fear arousal will trigger the second appraisal-an assessment of the efficacy of recommended responses in persuasive communications only when perceptions of threat are medium or high (Easterling & Leventhal, 1989; Lang, 1984).

EPPM postulates that when confronted with a health threat, individuals minimize their fears either by controlling the danger or controlling their fear. Danger controls are cognitive processes where individuals develop protective strategies to alleviate the danger. Whereas, fear control processes are described as emotional processes that promote defensive avoidance, which in turn leads to maladaptive behaviors (Bargh, 1989; Lazarus, 1991a; 1991b).

Perceived efficacy plays a critical role in determining whether individuals engage in *danger* or *fear* control (Witte, 1992). EPPM predicts that when both perceived threat and efficacy are high, *danger control* processes dominate; conversely when perceived threats are high and perceived efficacy is low, *fear control* processes dominate (Witte, 1992).



¹Figure 1. Extended Parallel Process Model (EPPM)

¹ From “Fear Control and Danger Control: A Test on The Extended Parallel Process Model (EPPM)” by Witte, K, 1994, *Communication Monographs*, 61, p. 115.

Several studies have demonstrated robust evidence of the role of perceived efficacy in influencing behavior change. For example, Beck & Lund (1981) found strong interactions between at least one component of threat dimension and efficacy dimension in influencing intentions to adopt protective measures. Similarly, Abner et al. (2007) found that fear appeals are useful in affecting behavior change when accompanied by components of efficacy. Yet other scholars have shown support for efficacy in health intervention programs (Abner et al., 2007; Kyrychenko et al., 2006). In view of the crucial role of efficacy in health communications, we posit the following research question.

Research question: Given high perceived threat of HIV/AIDS, what is the role of efficacy in HIV/AIDS intervention programs in prompting danger control (adaptive) or fear control (maladaptive) processes?

Although EPPM has been used in various HIV/AIDS campaigns, most studies using EPPM have focused on these two divergent processes of fear and danger control (Witte & Allen, 2000). While cognitive processes occurring in danger control processes may influence attitudes, intentions and behavior changes (Witte, 1992), there seems to be a lack of research exploring this (Stephenson, Holbert & Zimmerman, 2006). The relationship between EPPM variables (i.e. severity, susceptibility, and self-efficacy and response efficacy) and attitudes, intentions and behavior changes remains underexplored, and this thus provides an opportunity for research. Based on the existing EPPM framework, we propose a testing model as shown in Figure 2.

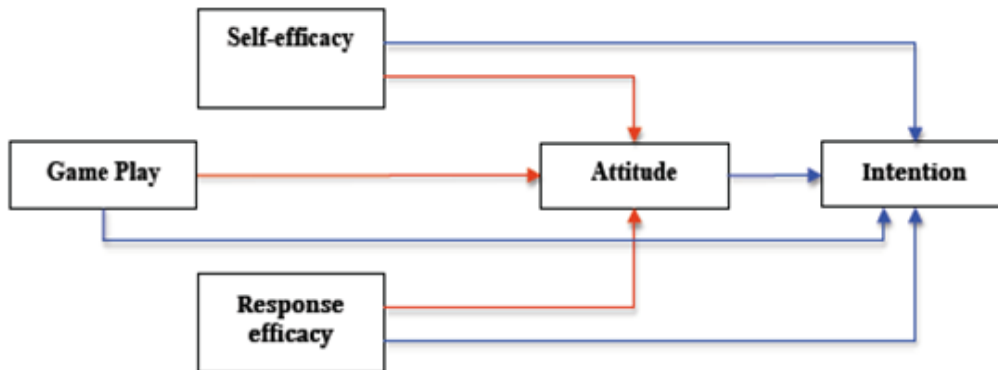


Figure 2. Proposed Conceptual Framework for HIV/AIDS Attitudes-Intention model

The present study tests the relationships in the proposed model. Attitudes and intentions are vital determinants for behavior change to occur (Ajzen, & Fishbein, 1980; Ajzen, & Madden, 1986). A large body of literature examining the effects of individuals' attitudes and intentions (Albarracin, Johnson, & Zanna, 2005) found that when one's attitude towards a certain behavior is positive, intention to act on the recommended behavior is likely to be positive.

Accordingly, in order for adolescents to reduce sexual risk behavior, attitudes and intentions towards taking on preventive measures have to be altered. Hence in the proposed conceptual framework, attitudes and intentions are added to investigate their relationship with EPPM variables. In light of the objectives of the study, the following hypotheses were tested.

H1: Game Playing will lead to a positive increase in attitudes (**H1a**) and intentions (**H1b**) towards HIV/AIDS protective measures.

H2: Given the same level of threat messages, participants who are exposed to high efficacy messages will display a greater increase in attitudes and intentions towards HIV/AIDS protective measures, than participants who are exposed to low efficacy messages

H2a and H2b: Given the same level of threat messages, participants who are exposed to high response efficacy messages will display a greater increase in attitudes (**H2a**) and intentions (**H2b**) towards HIV/AIDS protective measures, than participants who are exposed to low response efficacy messages

H2c and H2d: Given the same level of threat messages, participants who are exposed to high self-efficacy messages will display a greater increase in attitudes (**H2c**) and intentions (**H2d**) towards HIV/AIDS protective measures, than participants who are exposed to low self-efficacy messages

H3: An increase in attitudes will lead to a positive change in intentions (Ajzen & Madden, 1986).

This research project occurred in two phases. Formative research was exploratory in nature and employed as part of a larger game-based HIV/AIDS intervention program. The principle objective was to understand the optimal level of threat and efficacy messages to develop into message components and game design principles for adolescents. Findings from formative research were used to develop an interactive multimedia game. The evaluative study employed a quantitative approach through a quasi-experiment to test the effectiveness of efficacy components in the interactive game.

4. Formative research

A qualitative approach to the formative research was suitable because of its exploratory nature, and it allowed the researchers to gain a better understanding of adolescents' perceptions. The researchers utilized the semi-structured interview method guided by an interview guide.

4.1. Sample

Data for the formative research was obtained from fifteen in-depth interviews conducted from September to November 2008 with gender-mixed participants from boys only, girls only and mixed schools.

Singaporean adolescents aged between 14-16 years were recruited through a snowballing technique. Participants received no monetary payment. Each interview took about 90 minutes and was voice-recorded for transcribing purposes. Due to the sensitive nature of the topic, a memorandum of understanding was highlighted to ensure confidentiality.

4.2. Measures and Analysis

The interviews covered three topic areas. These included how Singaporean adolescents felt towards current HIV/AIDS education programs, the kinds of HIV/AIDS messages

perceived to be high/low threat and efficacy, and the different elements of interactive multimedia that prove engaging.

In order to elicit responses on threat and efficacy levels, interviewees categorized a dozen posters according to varying levels of fear and efficacy, and elaborated on their choices. In order to identify elements of interactive multi-media games that were engaging, interviewees were exposed to various activities, videos and quizzes related to sexual health. Thematic coding was used to analyze data collected (Boyatzis, 1998).

4.3. Game Design

Formative research showed that adolescent participants enjoyed interactive experiences with role-playing, emotional narrative, feedbacks and quizzes in comparison to traditional one-way learning formats.

A common theme raised was that sexual health programs were often integrated through subjects such as biology and moral education with one-way and results-oriented teaching styles. Independent workshops on HIV/AIDS, when available, were usually in the form of mass lectures and video screenings. As a result, students often “tuned out”.

“Once, they called us to the auditorium, and there’s this speaker who talked about pre-marital sex and its consequences. It’s supposed to be interactive but it turned out to be like a lecture telling you what you should do and what you shouldn’t. I think it’s a waste of time. For those Science classes, teachers teach only those topics that will come out in the exams. Boring!”

-Female, 15; all girls’ school

Another recurring issue was an overemphasis on factual information, resulting in the neglect of emotional and psychological aspects of sexual health issues. Specifically, students felt that educators often failed to address coping behaviors.

“On the Internet I help people to deal with their relationships, like a love counselor kind of thing and there was this case where the guy wanted sex and the girl kept rejecting. So I told her to think about the consequences and leave him if he forces her. Not only girls, even boys feel pressure from their peers to have sex. So, I think schools should teach us how to handle situations like these.” - Male, 15; mixed school

Posters that emphasized on the effectiveness of protective measures in preventing HIV/AIDS were perceived to be highly efficacious. Respondents perceived posters to be highly threatening when the message was targeted specifically at adolescents. For example, most interviewees perceived poster 2 [‘Every minute, five young people get HIV’] as highly threatening because of the relevance.

“By saying that ‘Every minute, five young people get HIV’, I think about myself and how the consequences impact me. Makes it quite scary!” - Female, 14; all girls’ school

Posters that emphasized the long-term consequences of contracting HIV/AIDS were also perceived as highly threatening, particularly when occurring within a social context. Most adolescents perceived poster 8 as highly threatening due to its portrayal of HIV/AIDS as a stigmatized disease leading to ostracism.

“The person in this poster is sitting alone in the shadows and it sort of says that when you get AIDS, everyone will ditch you. Very poor thing!” – Female, 15; all girls’ school

Adolescents were receptive to interactive multimedia, with role-playing games preferred. Choice of characters and decision-making were important, and the storyline of a love triangle was fun and engaging. Role-playing games simulated real-life situations where adolescents could learn by observing how decision-making altered outcomes.

“I like this [role playing] game better. There are more things to do like I can guess and press next and guess and press next. This one helps me tell the process, like maybe if I press next again, I can see the girl slap the guy. It’s also better because it is quite real, not like what we see in school textbooks.” – Female, 14; mixed school

Most adolescents enjoyed challenging quizzes for making the learning process fun and interesting. They preferred the immediate feedback response quizzes offered, because it helped them learn from their mistakes.

“And have explanations for right or wrong answers. Like if I got the answer wrong, the right answer will pop out. Even if I got it right through a lucky guess, an explanation pops out. It saves me the trouble of looking for the answer myself.” – Female, 15; all girls’ school

In summary, the formative research revealed that sexual health programs in Singapore were linear and results-oriented, with students often dis-engaged. With new generations expecting greater interactivity in classroom experiences (Deubel, 2006), it was clear that Singaporean adolescents required innovative methods of learning (Miller et al., 2008). These results suggest merit in using digital-game based learning for sexual health matters.

Based on the formative research, researchers developed an interactive multimedia game entitled *Med Detective*, in which threat and efficacy were closely tailored to what adolescents perceived as high threat and efficacy. High threat was achieved by achieving high personal relevance by showing videos of adolescents contracting HIV/AIDS, including disturbing images of STDs and associating them with long-term health complications. High efficacy was achieved through statements emphasizing the effectiveness of protective measures, as well as through videos describing condom negotiation and condom usage.

Enhanced learning of HIV/AIDS was achieved through story telling. *Med Detective* was designed after a mystery model allowing players to take on the role of a detective. Extant literature shows that story telling contributes to a sense of immersiveness, enjoyment and curiosity, thus serving as an impetus for the disinterested to learn (Lepper & Henderlong, 2000; Reigeluth & Squire, 1998). Further, a role-playing game involving a love triangle was included where players decide the outcome of subjects based on their decisions.

Simulations in role-playing enhance learning as it allows adolescents to make decisions and observe consequences without any real-world implications (Lieberman, 2008). Lastly quizzes were added in the game with answers rendered immediately to aid enable information-retention (Reigeluth & Squire, 1998).

5. Evaluative Research Methodology

5.1. Sample

One hundred and thirty six participants aged 13-16 were recruited from a secondary school in Singapore from January to February 2009. Standard demographic information such as age, gender, race, religion and socioeconomic status were collected. In sum, a total of 136 secondary three female and male students completed the intervention and all questionnaires. Students were randomly assigned to two different conditions for the intervention—high threat and high efficacy ($n=70$; Condition 1); high threat only ($n=66$; Condition 2). High levels of threat were maintained in both conditions, while levels of efficacy were manipulated in the multimedia game.

The gender ratio was even (53.7% males, 46.3% females). The median age was 14 years. The sample was predominantly Chinese (76.3%) followed by Malay (20.7%) and Indians (0.7%). Buddhism was the predominant religion (41.2%), followed by Christianity (14.0%), Islam (12.5%) and Taoism (12.5%).

5.2. Procedure

Participants were briefed on answering Likert-type scales, before completing a pre-survey questionnaire. The following week, participants individually played the multimedia game for 30 minutes according to the randomly assigned conditions. Later, participants completed a post-survey with media queries omitted. Pamphlets and souvenirs from an NGO, Action for AIDS Singapore, were distributed at the end of the study, and participants were urged not to disclose any information about the study to their schoolmates to avoid contamination of control groups.

5.3. Measures

All constructs were measured using multi-item scales a seven-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree).

Attitudes and Intentions. Measures were adapted from Witte, Berkowitz, Cameron, & Lillie (1998). Five items were used to measure attitudes (i.e. 'Having multiple sex partners is cool') ($\alpha=.89$), and were reversed coded. Intentions were measured using four items (i.e. 'I intend to use condoms when I am sexually active') ($\alpha=.62$).

Perceived Threat and Efficacy. Measures were developed and validated by Witte, Cameron, McKeon and Berkowitz (1996). Threat was measured using 10 items, with five items each measuring perceived susceptibility (i.e. 'I am at risk of getting HIV') and perceived severity (i.e. 'I believe that HIV is a serious threat to my health'). A rotated component matrix was used to eliminate factors that loaded poorly, or factors that loaded across components. After elimination, the final scale for perceived susceptibility comprised of three items ($\alpha=.79$) whereas perceived severity comprised of six ($\alpha=.71$).

Efficacy was measured using eight items, with four items each measuring perceived self-efficacy (i.e. I am confident that I can say no to sex) and response efficacy (i.e. I believe I can prevent HIV by not having sex). After elimination, perceived self-efficacy yielded four items ($\alpha=.63$) whereas perceived response efficacy yielded three ($\alpha=.36$). Alpha coefficients are shown in Table 1.

Manipulation checks. Manipulation checks tested whether perceived efficacy was successfully manipulated. Independent samples t-tests were run for both self-efficacy [$t(134)=-.09$ $p<.05$] and response efficacy [$t(134)=-.75$ $p<.05$] measures in the pre-test, with no significant differences observed in the means. A similar test was run for both

self-efficacy [$t(123)=.01$ $p<.05$] and response efficacy [$t(116)=.00$ $p<.05$] in the post-test. Results showed a significant difference in the means.

Table 1. Reliability and Means of Scale Items

Scale	# items	Mean of item	Mean of item SDs	Cronbach's Alpha (α)
Self-efficacy	4	5.22	1.12	.63
Response efficacy	3	4.59	1.23	.36
Susceptibility	3	2.29	1.34	.79
Severity	6	5.49	1.05	.71
Attitudes	5	5.65	1.40	.90
Intentions	4	6.09	0.88	.62

6. Results

Hypothesis 1 predicted that Game Play would lead to a positive increase in attitudes and intentions. The regression results showed that H1a was supported; Game Play was a significant predictor of attitudes [$R^2= .09$, $F(5, 124)= 2.44$, $p< .05$]. This means that a positive attitude towards protecting oneself is highly related to playing the multimedia game. H1b was not supported; Game Play was not a significant predictor of intentions.

H2a and H2b predicted that high response efficacy would lead to a positive increase in attitudes and intentions respectively. From the regression results, H2b was supported, indicating that response efficacy was a significant predictor of intentions towards protective measures of HIV/AIDS [$R^2= .09$, $F(5, 124)= 2.44$, $p< .05$]. This means that high response efficacy was positively and significantly related to intentions. H2a was not supported, reflecting that high response efficacy did not lead to a positive increase in attitudes.

H2c and H2d predicted that high self-efficacy would lead to a positive increase in attitudes and intentions respectively. Regression results showed that both hypotheses were supported. Self-efficacy was a significant predictor of attitudes and intentions towards protective measures of HIV/AIDS [$R^2= .29$, $F(6, 123)= 8.34$, $p< .05$]. In sum, results seem to suggest that efficacy is critical in order for adolescents to adopt recommended measures.

H3 predicted that attitudes would lead to a positive increase in intentions. Regression results showed that the hypothesis was supported. Attitude was a significant predictor of Intention [$R^2= .29$, $F(6, 123)= 8.34$, $p< .05$]. Table 2 and Table 3 shows the standardized coefficient Betas, and the zero-order and partial correlations for the predictor variable of 'Attitude' and 'Intention' respectively. Figure 3 shows the resulting relationships of the variables in the conceptualized model.

Table 2. Standardized Coefficients, Bivariate and Partial Correlations of Predictors with Intentions Factor

Predictors	Beta	Zero-Order Correlation	Partial Correlation
Attitude	.24	.31	.26*
Self-efficacy	.33	.44	.34*
Response efficacy	.17	.32	.18*
Susceptibility	.02	.03	.02
Severity	.08	.10	.01
Game Play	.12	.01	.12

* $p < 0.05$

Table 3. Standardized Coefficients, Bivariate and Partial Correlations of Predictors with Attitudes Factor

Predictors	Beta	Zero-Order Correlation	Partial Correlation
Self-efficacy	.21	.23	.20*
Response efficacy	.09	.08	.04
Susceptibility	.08	-.02	-.03
Severity	.02	.02	.02
Game Play	-.11	-.20	-.20*

* $p < 0.05$

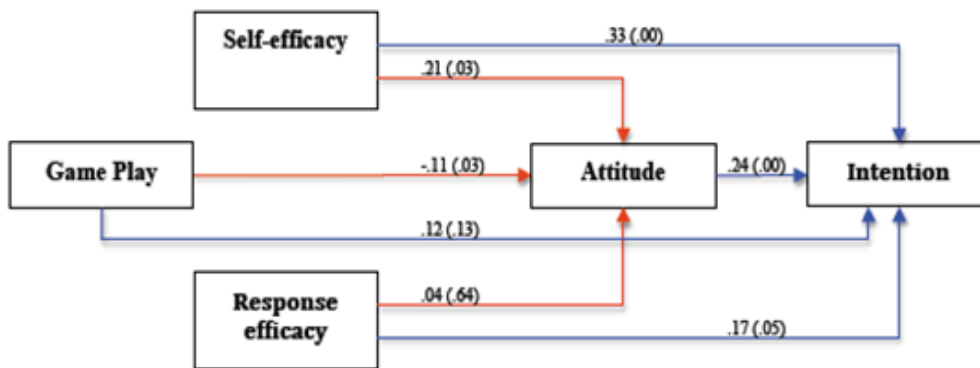


Figure 3. Proposed Conceptual Framework for Attitude-Intention Model

7. Discussion

This chapter will present key theoretical significance of the findings, and conclude with several important implications for academics, health and education professionals, and policy-makers. Unlike past studies, this research not only identifies *what* works for adolescents but *why*.

While game play directly led to an increase in attitudes, it was not statistically significant in leading to a positive increase in behavioral intentions. Prior studies have found that intervention programs may not lead to a direct change in behavioral intentions. Rather, these intentions are mediated by attitudes (Ajzen, & Madden, 1986). In fact, many studies have shown empirical evidence of the effectiveness of attitudes in predicting intentions over a wide range of behaviors (Albarracin, Johnson, Fishbein, & Muerllerleile, 2001; Godin, & Kok, 1996; Hausenblas, Carron, & Mack, 1997; Sheeran, & Orbell, 1998). Although linear KAP models have been criticized (Valente, 1996), these findings suggest the strong mediating role of attitudes in changing intentions. This finding presents various implications for health and education professionals.

First, it is clear that digital games are an effective tool in encouraging Singapore adolescents' to learn about an issue they are largely unconcerned about. Already, Singapore schools are beginning to integrate new media technologies into the classroom syllabus today (IDA, 2008a), but more can be done to extend this privilege to other sensitive subjects, providing privacy and anonymity to students (Bers, 2006).

Digital games encourage independent and peer learning (Caron, Godin, Otis & Lambert, 2004), thus enabling teens to learn at their own pace. This flexibility addresses the failures of current sexual health programs that take on a conventional linear format and are un-interactive in nature.

In this study, threat was manipulated to be high as the role of fear was to initiate one's involvement and attention towards the health message. However as fear alone may lead to maladaptive behaviors (Witte, 1992), efficacy was added to the equation to test its effects on attitudes and intentions.

As our results turn out, self-efficacy was significantly and positively correlated to attitudes, while no relationship between response efficacy and attitudes was observed. Self-efficacy and response efficacy however were significantly and positively correlated to intentions. These findings suggest that positive attitude and intention change occurs when HIV/AIDS messages contain efficacy to equip adolescents in coping with the threat.

A primary implication for health and education professionals is that HIV/AIDS messages for adolescents should contain efficacy messages, and these messages should be crafted according to the needs of adolescents. Previous Singapore HIV/AIDS campaigns using fear appeals have had little impact on behavioral change (Quek & Li, 2002), and Rimal (2001) attempts to explain this by recommending that on top of enhancing individual's risk perceptions, coping beliefs have to complement them. Instead, as findings from the current study prove, they must also be sufficiently equipped with the skills and belief that they are capable of doing so.

Although no significant relationship between response efficacy and attitudes was established in this study, this may be attributed to the fact that response efficacy is often only apparent in longitudinal studies (Allard, 1989). Catania, Kegeles, & Coates (1990) show support for this assertion stating that response efficacy will be most significant only after decisions to alter sexual behavior has been made. As this intervention was

conducted within a time frame of one week, the strength of response efficacy may have been weakened by the short duration.

Finally, positive attitudes leading to better intentions were supported in this study. Although intention may not necessarily translate into behavior, many theorists have proposed intention as the immediate antecedent of actual behavior (Fishbein & Ajzen, 1975; Fisher & Fisher, 1992; Gollwitzer, 1993; Triandis, 1977). This attitude-intention-behavior relationship has also been validated in the context of HIV/AIDS prevention through condom use, with extensive studies reporting efficacy as a positive influence on condom use (Albarracin, Johnson, Fishbein, & Muerllerleile, 2001; Godin & Kok, 1996; Hausenblas, Carron & Mack, 1997; Sheeran & Orbell, 1998).

There are some limitations to this study. First, we used convenience sampling methods due to the sensitivity of the topic. As a result of the limited sample size, it was difficult to split participants into more than two different conditions. Future studies can further explore the relationship between efficacy and threat by expanding the study into a 2 x 2 factorial design. This would enable researchers to compare the effects of both components, and test if efficacy-only messages can work in bringing about a change in attitudes and intentions without the presence of threat (Wakefield & Durrant, 2006). There are opportunities to use Structural Equation Modeling with a larger sample size to explore the relationship between efficacy, and attitudes and intentions to adopt protective behavior (Stephenson, Holbert, & Zimmerman, 2006).

The rapid increase in HIV/AIDS infections among a sexually active population of Singapore adolescents is an issue that must not be overlooked. Along with its neighbours in Asia, Singapore is in urgent need for a comprehensive youth-targeted HIV/AIDS intervention program. The current study has tested one such intervention and results have shown the potential of using information and communication technologies for this purpose. As with precedent studies, this current study also reiterates the importance of efficacy in HIV/AIDS messages.

References

- 1 Abner, E. L., Carlyle, K. E., Cupp, P. K., Hansen, G. L., Roberto, A. J., & Zimmerman, R. S. (2007a). The effects of a computer-based pregnancy, STD, and HIV prevention intervention: A nine-school trial. *Health Communication, 21*(2), 115-124.
- 2 Abner, E. L., Carlyle, K. E., Roberto, A. J., & Zimmerman, R. S. (2007b). A computer-based approach to preventing pregnancy, STD, and HIV in rural adolescents. *Journal of Health Communication, 12*, 53-76.
- 3 Aggleton, P., & Warwick, I. (2002). Education and HIV/AIDS prevention among young people. *AIDS Education and Prevention, 14*(3), 263-267.
- 4 Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Upper Saddle River, NJ: Prentice Hall.
- 5 Ajzen, I., & Madden, T. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology, 22*, 453-474.
- 6 Albarracin, D., Johnson, B. T., & Zanna, M. P. (2005). *The Handbook of Attitudes*. Mahwah, NJ: Erlbaum.

- 7 Albarracin, D., Johnson, B. T., Fishbein, M., & Muellerleile, P. A. (2001). Theories of reasoned action and planned behavior as models of condom use: A meta-analysis. *Psychological Bulletin*, 127, 142–161.
- 8 Allard, R. (1989). Beliefs about AIDS as determinants of preventive practices and of support for coercive measures. *American Journal of Public Health*, 79(4), 448- 452.
- 9 Aryl, D. V., Beauchamp, N., Duncan, S. C., Duncan, T. E., & Wells, J. (2000). Development and evaluation of an interactive CD-ROM refusal skills program to prevent substance use: “Refuse to use”. *Journal of Behavioral Medicine*, 23(1), 59-72.
- 10 Baldwin, W., Li, X., Shah, I. H., & Zhang, L. (2007). Parent-adolescent sex communication in China. *The European Journal of Contraception and Reproductive Health Care*, 12(2), 138-147.
- 11 Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, 31; 143-154.
- 12 Bargh, J. A. (1989). Conditional automaticity: Varieties of automatic influence in social perception and cognition. In J.S. Uleman & J.A. Bargh (Eds.), *Unintended Thought* (pp. 3-52). New York: Guilford Press.
- 13 Beaudoin, C. E. (2002). Exploring antismoking ads: Appeals, themes and consequences. *Journal of Health Communication*, 7, 123-137.
- 14 Beck, K. H., & Lund, A. K. (1981). The effects of health threat seriousness and personal efficacy upon intentions and behavior. *Journal of Applied Social Psychology*, 11, 401-415.
- 15 Bers, M. U. (2006). The role of new technologies to foster positive youth development. *Applied Developmental Science*, 10(4), 200-219.
- 16 Bharwani, V. (2008, August 26). Young frisky and super blur. *The Electric New Paper*. Retrieved September 20, 2008, from <http://newpaper.asia1.com.sg/>
- 17 Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code*. London: SAGE Publications.
- 18 Brown, S. J., Lieberman, D. A., Gemeny, B. A., Fan, Y. C., Wilson, D. M., & Pasta, D. J. (1997). Educational video game for juvenile diabetes: results of a controlled trial. *Informatics for Health and Social Care*, 22(1), 77-89
- 19 Caron, F., Godin, G., Otis, J., & Lambert, L. D. (2004). Evaluation of a theoretically based AIDS/STD peer education program on postponing sexual intercourse and on condom use among adolescents attending high school. *Health Education Research*, 19(2), 185-197.
- 20 Catania, J. A., Kegeles, S., & Coates, T. J. (1990). Towards an understanding of risk behavior: An AIDS risk reduction model (AARM). *Health Education Quarterly*, 17, 53-72.
- 21 Chib, A., (2008). *Network influences in sexual health: Multimedia games for youth in Peru*. Germany: VDM e.K.
- 22 Cho, H., & Salmon, C. T. (2006). Fear appeals for individuals in different stages of change: Intended and unintended effects and implications on public health campaigns. *Health Communication*, 20(1), 91-99.

- 23 Cormont-Ku, S. (2008, October 22). Sex education for young needs revamp. *The Straits Times*. Retrieved November 28, 2008, from <http://www.straitstimes.com/>
- 24 Cui, N., Gao, E., & Li, M. (2001). Views of Chinese parents on the provision of contraceptive services to unmarried youth. *Reproductive Health Matters*, 9(17), 137-145.
- 25 Deubel, P (2006). Game On. *T H E Journal*, 33(6). Retrieved from Academic Search Premier database.
- 26 Deutsch, J. E., Latonio, J., Burdea, G., & Boian, R. (2001). Post-stroke rehabilitation with the Rutgers Ankle System: A case study. *Presence*, 10, 416-430.
- 27 Easterling, D. V., & Leventhal, H. (1989). Contribution of concrete cognition to emotion: Neutral symptoms as elicitors of worry about cancer. *Journal of Applied Psychology*, 74, 787-796.
- 28 Eiser, J. R., Pligt, J. (1988). *Attitudes and Decisions*. New York: Routledge.
- 29 Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley.
- 30 Fisher, J. D., & Fisher, W. A. (1992). Changing AIDS risk behavior. *Psychological Bulletin*, 111, 455-474.
- 31 Glassman, J. R., Noia, J. D., & Schinke, S. P. (2004). Computer-mediated intervention to prevent drug abuse and violence among high-risk youth. *Addictive Behaviors*, 29, 225-229.
- 32 Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications to health-related behaviors. *American Journal of Health Promotion*, 11, 87-98.
- 33 Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. In W. Stroebe & M. Hewstone (Eds.), *European review of social psychology* (Vol. 4, pp. 141-185). Chichester, UK: John Wiley & Sons.
- 34 Gubhaju, B. B. (2002). *Adolescent Reproductive Health in Asia*. Paper presented at the 2002 IUSSP Regional Population Conference "South-East Asia's Population in a Changing Asian Context". Retrieved from <http://www.iussp.org/Bangkok2002/S30Gubhaju.pdf>
- 35 Hausenblas, H. A., Carron, A. V., & Mack, D. E. (1997). Application of the theories of reasoned action and planned behavior to exercise behavior: A meta-analysis. *Journal of Sport and Exercise Psychology*, 19, 36-51.
- 36 Hoe, Y. N. (2007, October 7). New campaign targets teens, promotes responsible sex. Retrieved from <http://www.channelnewsasia.com/stories/singaporelocalnews/view/304249/1/.html>
- 37 Holden, M., Todorov, E., Callahan, J., & Bizzi, E. (1999). Virtual environment training improves motor performance in two patients with stroke: Case report. *Neurology Report*, 23, 57-67.
- 38 Hussain, Z., & Kwek, K. (2005, November 12). Let's (not) talk about condoms. *The Straits Times*. Retrieved January 13, 2009 from <http://www.straitstimes.com/>

- 39 Infocomm Development Authority of Singapore. (2008b). *Individual usage of selected internet services by age group- working and learning activities*. Retrieved September 1, 2008, from <http://www.ida.gov.sg/Publications/20070822125451.aspx>
- 40 Joint United Nations Programme against HIV/AIDS. (2008). *2008 Report on the global AIDS epidemic*. Retrieved August 12, 2008 from http://www.unaids.org/en/KnowledgeCentre/HIVData/GlobalReport/2008/2008_Global_report.asp
- 41 Kyrychenko, P., Kohler, C., & Sathiakumar, N. (2006). Evaluation of a school-based HIV/AIDS educational intervention in Ukraine. *Journal of Adolescent Health, 39*, 900-907.
- 42 LaChausse, R. G. (2006). The effectiveness of a multimedia program to prevent fetal alcohol syndrome. *Health Promotion Practice, 7*(5), 1-5.
- 43 Lang, P. J. (1984). Cognition in emotion: Concept and action. In C. F. Izard., J. Kagan, & R. B. Zajoune (Eds.), *Emotions, cognition, and behavior* (pp. 192- 226). Cambridge: Cambridge University Press.
- 44 Lazarus, R. S. (1991a). Cognition and motivation in emotion. *American Psychologist, 46*, 352-367.
- 45 Lazarus, R. S. (1991b). Progress on a cognitive-motivational-relational theory of emotion. *America Psychologist, 46*, 819-834.
- 46 Lepper, M. R., & Henderlong, J. (2000). Turning “play” into “work” and “work” into “play”: 25 years of research on intrinsic versus extrinsic motivation. In C. Sansone & J. M. Harackiewicz (Eds.), *Intrinsic and extrinsic motivation: The search for optimal motivation and performance* (pp. 257-307). San Diego: Academic Press.
- 47 Leventhal, H. (1970). Findings and theory in the study of fear communications. In L. Berkowitz (Ed.), *Advances in experimental social psychology*. New York: Academic Press.
- 48 Lieberman, D. A. (2001). Management of chronic pediatric diseases with interactive health games: Theory and research findings. *Journal of Ambulatory Care Management, 24*(1), 26-38.
- 49 Lieberman, D. A. (2008). Reducing risky sexual decision-making in the virtual and in the real world: Serious games, intelligent agents, and a solve approach. In M. Cody, U. Ritterfeld, P. Vorderer (Eds.), *Serious games: Mechanisms and effects* (pp. 34-37). London: Routledge.
- 50 Merians, A. S., Jack, D., Boian, R., Tremaine, M., Burdea, G. C., & Adamovich S. V. (2002). Virtual reality-augmented rehabilitation for patients following stroke. *Physical Therapy, 82*, 898-915.
- 51 Miller, L. C., Christensen, J. L., Godoy, C. G., Appleby, P. R., Corsbie-Massay, C., & Read, S. J. (2008). Reducing risky sexual decision-making in the virtual and in the real world: Serious games, intelligent agents, and a solve approach. In M. Cody, U. Ritterfeld, P. Vorderer (Eds.), *Serious games: Mechanisms and effects* (pp. 34-37). London: Routledge.

- 52 Ministry of Education. (2002). *Release of the Growing Years series for upper secondary: Sense and sexuality*. Retrieved August 5, 2008, from http://www.moe.gov.sg/media/press/2002/pr24082002_print.htm
- 53 Ministry of Health. (2009). *HIV statistics*. Retrieved Jan 2, 2009, from <http://www.moh.gov.sg/mohcorp/statistics.aspx?id=246>
- 54 Mokhtar, I. A., Foo, S., Shaheen, M. (2007). Bridging between information literacy and information technology. *Information Communication Technology*, 1(4). MTV Networks On Campus Inc. (2008). *Posornot*. Retrieved October 10, 2008 from <http://www.posornot.com/>
- 55 Murray-Johnson, L., Witte, K., Liu, W., & Hubbel, A. P. (2001). Addressing cultural orientations in fear appeals: Promoting AIDS-protective behaviors among Mexican immigrant and African American adolescents and American and Taiwanese college student. *Journal of Health Communication*, 6, 335-358.
- 56 Nabi, R. L., Roskos-Ewoldsen, D., & Carpentier, F. D. (2008). Subjective Knowledge and Fear Appeal Effectiveness: Implications for Message Design. *Health Communication*, 23(2), 191-201.
- 57 Quek, J. T., & Li, S. C. (2002). A study of the effectiveness of AIDS health education interventions among the adolescent population of Singapore. *Singapore Medical Journal*, 43(7), 359-364.
- 58 Reigeluth, C. M., & Squire, K. (1998). Emerging Work on the New Paradigm of Instructional Theories. *Educational Technology*, 38(4), 41-47.
- 59 Rimal, R. N. (2001). Perceived risk and self-efficacy as motivators: Understanding individuals' long-term use of health information. *Journal of Communication*, 51(4), 633-654.
- 60 Rizzo, S., and McLaughlin, M. (2006, May 9, 2006). Addressing PTSD, PsychoTherapy, & Stroke rehabilitation with Games & Game Technologies. Paper presented at the Games for Health, University of Southern California.
- 61 Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In J. Cacioppo & R. Petty (Eds.), *Social Psychophysiology*. New York: Guilford Press.
- 62 Ross, M. W., & Rigby, K. (1990). The effect of a national campaign on attitudes toward AIDS. *AIDS Care*, 2(4), 339.
- 63 Sarafino, E. P. (1990). *Health psychology: Biopsychosocial interactions*. New York: John Wiley & Sons.
- 64 Sheeran, P., & Orbell, S. (1998). Do intentions predict condom use? Meta-analysis and examination of six moderator variables. *British Journal of Social Psychology*, 37(2), 231-250.
- 65 Singhal, A., & Rogers, E. M. (2004). The status of entertainment-education worldwide. In Singhal, A., Cody, M. J., Rogers, E. M., & Sabido, M. (Eds.), *Entertainment-education and social change: History, research, and practice* (pp. 3-20). Mahwah, NJ: Lawrence Erlbaum Associates.
- 66 Squire, K. (2002). Cultural framing of computer/video games. *The International Journal of Computer game Research*, 2(1). Retrieved from <http://gamestudies.org/0102/squire/?ref=HadiZayifla.Com>

- 67 Stephenson, M. T., Holbert, R. L., & Zimmerman, R. S. (2006). On the use of structural equation modeling in health communication research. *Health Communication, 20*(2), 159-167.
- 68 Tan, F. (2009, January 18). Teens may be pressured into taking virginity pledges. *The Straits Times*. Retrieved January 18, 2009 from <http://www.thestraitstimes.com>
- 69 Thomas, R., Cahill, J., & Santini, L. (1997). Using an interactive computer game to increase skill and self-efficacy regarding safer sex negotiation: Field test of results. *Health Education & Behavior, 24*.
- 70 Triandis, H. C. (1971). *Attitudes and Attitude Change*. New York: Wiley
- 71 United Nations International Children's Emergency Fund. (2005). *Situation review on Adolescents and HIV/AIDS in East Asia and the Pacific*. Retrieved August 18, 2008 from http://www.unicef.org/eapro/activities_3680.html
- 72 Valente, T. W. (2002). *Evaluating health promotion programs*. Oxford University Press: New York, NY.
- 73 Wakefield, M., & Durrant, R. (2006). Effects of exposure of youths at risk for smoking to television advertising for nicotine replacement therapy and Zyban: An experimental study. *Health Communication, 19*(3), 253-258.
- 74 Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model *Communication Monographs, 59*(4), 329 - 349
- 75 Witte, K. (1998). Fear as motivator, fear as inhibitor: Using the extended parallel process model to explain fear appeal successes and failures. In P. A. Andersen and L. K. Guerrero (Eds.), *The handbook of communication and emotion: Research, theory, applications, and contexts* (pp. 423-450). San Diego, CA: Academic.
- 76 Witte, K., Berkowitz, J., Cameron, K., & Lillie, J. (1998). Preventing the spread of genital warts: Using fear appeals to promote self-protective behaviors. *Health Education & Behavior, 25*, 571-585.
- 77 Witte, K., & Allen, M. (2000). A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health Education & Behavior, 27*(5), 591-615.
- 78 Witte, K., Cameron, K. A., McKeon, J. K., & Berkowitz, J. M. (1996). Predicting risk behaviors: Development and validation of a diagnostic scale. *Journal of Health Communication, 1*, 317-341.
- 79 Witte, K., Meyer, G., & Martell, D. (2001). *Effective health risk messages: A step-by-step guide*. Newbury Park, CA: Sage.
- 80 Xinhua General News Service (2003, December 2). Asia-Pacific nations take measures to prevent AIDS epidemic. Retrieved November 2, 2008 from http://english.peopledaily.com.cn/200312/02/eng20031202_129486.shtml
- 81 You, S. H., Jang, S. H., Kim, Y. H., Hallett, M., Ahn, S. H., & Kwon, Y. H. (2005). Virtual reality-induced cortical reorganization and associated locomotor recovery in chronic stroke: An experimenter-blind randomized study. *Stroke, 36*, 1166-1171.