

DOES PRIOR MESSAGE WORK TO PROMOTE MOTIVATION
FOR SERIOUS GAME PLAYING?

by

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Abstract

This study aims to investigate effects of external aid that can enhance motivation and performance of serious game playing to maximize learning effects. Based on self-determination theory, two types of rationales, intrinsic goal framing and extrinsic goal framing, were examined to know which message type is effective. Also, individual's level of issue involvement was tested as a moderating variable. To investigate the effects of goal framing on motivation and moderating effects of involvement, this study designed a 2x2 (goal framing x involvement) between subjects with 120 middle school students in Korea. Three procedures involved for the experiment: 1) receiving message for manipulating involvement and goal framing 2) Playing actual serious game, and 3) answering survey questionnaire. Overall, providing intrinsic goal before a serious game was more effective to increase both motivation and performance than presenting extrinsic goal. However, there was no main effects and interaction effect in terms of issue involvement.

Keywords: serious game, motivation, goal framing

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Chapter 1. Introduction

As interactive games have been found to be superior to traditional teaching methods (Prensky, 2006), serious games, which are for education and training rather than for pure entertainment (Michael & Chen, 2006), are on the rise. To date, more than 300 games exist for health campaigns. For example, over 110,000 copies of *Re-Mission*, a game for cancer education, have been distributed in 78 countries (Wang & Singhal, 2009) since it facilitates children's understanding of diseases (Lieberman, 2001) as well as provide health-related knowledge (Ratan & Ritterfeld, 2009). In particular, young people are a major target of the serious games (Ratan & Ritterfeld, 2009) due to their extensive usage of digital devices (Baranowski et al., 2008) and their love for games (Wang, Shen, & Ritterfeld, 2009).

Eliciting educational effects, however, requires strong motivation among game players (Klimmt & Hartmann, 2006). In general, educational games are not perceived to be as interesting or as fun as entertainment games (Niemic & Ryan, 2009). Furthermore, the games are commonly presented in a formal educational setting like a classroom or a healthcare provider's health education program (Lieberman, 2009). Under such formal educational circumstances, adolescents' motivation for learning decreases because they don't value what they are asked to learn (Legault, Gree-Demers, & Pelletier, 2006; Murdock, 1999; Wigfield & Eccles, 2000). Hence, young people need a compelling reason to learn, which can induce motivation (Bruner, 1960; Locke & Latham, 1990).

According to self-determination theory by Deci and Ryan (1985, 2000), providing rationale that explains the value of the task has the potential to increase motivation. This theory provides two types of message framing in education: intrinsic goal framing stressing individuals' internal value and extrinsic goal framing emphasizing external value. For example, health or

personal growth represents intrinsic goal framing whereas fame or financial success reflects extrinsic goal framing (Williams et al., 2000). In terms of effects of those two goal frames, previous studies (Kernis, 2003; Patrick, Neighbours, & Knee, 2004) consistently revealed that intrinsic goal framing is superior to extrinsic goal framing.

The purpose of this study is to examine how to increase adolescent's motivation, specifically to test efficacy of a rationale designed to promote motivation for serious game playing. In addition, an individual's issue involvement will be considered as a factor that moderates effects of rationale. People process information differently according to their level of involvement (Petti & Cacioppo, 1983). In fact, previous studies (Donovan & Jelleh, 1999; Maheswaran & Meyers-Levy, 1990; Miller & Miller, 2000) have shown that an individual's level of involvement moderates the effects of message framing on motivation. As such, we can posit that different message framing—between intrinsic goal framing and extrinsic goal framing—may work differently according to the individual's involvement.

Chapter 2. Literature Review

Serious Games and Their Impact on Health Education

People are more likely to accept educational information when it is delivered by entertainment media (Singhal & Rogers, 1999; Slater, 2002) because entertainment elements play a role in reducing cognitive conflicts against educational contents in the target audience (Singhal et al., 2004). In this sense, the combination of entertainment and education has emerged to increase knowledge about educational issues, to create attitudes, or to change audience behavior (Singhal et al., 2004). To date, computer games are rising as a tool for entertainment education (Wang & Singhal, 2009) as more than 90 percent of 8 to 18 year olds have a digital game console or computer at home and spend more time on it (Kaiser Family Foundation, 2010).

The unique characteristics of digital games strengthen educational effects. First off, interactivity is a key factor for game effects as it reduces the psychological distance between players and the contents in a game (Klimmt, 2009; Lieberman, 1997). The real-time feedback also optimizes educational effects because people are able to actively process information conveyed by the game. Moreover, games have the potential to persuade people to change their positions because they convey messages under simulated situations that help people experience it (Bogost, 2007). It is also easier to customize messages toward individuals in a game than it is other media (Wang & Singhal, 2009).

Because of the optimized educational effect, health educators have used the game to promote health campaigns. Several studies (Brown et al., 1997; Kato et al., 2008; Lieberman, 1997, 2001, 2006) demonstrated that serious games for health have the potential to enhance health knowledge, self-efficacy and behavioral change. For example, children between ages 11

and 17 who played a game designed to teach concussion symptoms showed increased knowledge about the symptoms and higher intentions to follow the instructions than those who did not play it (Goodman et al., 2006). Another series of studies by Lieberman (1997, 2001, 2006) also proved that children ages 7 to 15 who played a game about diabetes had a tendency to show higher self-efficacy in terms of controlling eating habits.

To obtain such educational effect, however, people especially who are young need external aids to promote motivation (Harter, 1981, 1982) because serious games are commonly presented formal educational circumstances like a classroom (Lieberman, 2009). Under the formal setting, students consider the learning activities they encounter as irrelevant and unappealing duty (Hidi & Harackiewicz, 2000; Wigfield & Eccles, 2000). When students fail to value the task as personally meaningful, the level of motivation decreases and it elicits poor concentration and minimal effort to learn (Ntoumanis et al., 2004, Vallerand, Fortier, & Guay, 1997). Therefore, ensuring motivation is a crucial issue to maximize the educational effects of serious games for health as it affects not only participation but also information processing (Klimmt, 2009).

Self-determination Theory and Goal Framing for Motivation

Self-determination theory by Deci & Ryan (1985, 2000) suggests that a rationale explains the value of an activity as an effective way to promote motivation by helping them understand the worth of a task. According to the authors, there are two types of rationale: emphasizing either intrinsic goals or extrinsic goals. The intrinsic goals stress personal health, community contribution, affiliation, or self-development to promote satisfaction of people's natural growth tendencies. Extrinsic goals, meanwhile, focus on appearing physically attractive, image, or financial success to emphasize an outward orientation (Kaser & Ryan, 1996, 2001; Vansteenkiste,

Lens, & Deci, 2006; Williams et al, 2000). In terms of health, ‘Doing an exercise will help you to keep your health’ is an example of an intrinsic goal while ‘Doing an exercise will help you to become an attractive person to others’ is a type of extrinsic goal message.

Previous studies (Kasser, 2002; Kernis, 2003; Patrick, Neighbours, & Knee, 2004; Vansteenkiste et al., 2004, 2006, 2008) consistently revealed that intrinsic goals are, generally, more effective to enhance motivation than extrinsic goals (Kasser, 2002). For example, students in 10th to 12th grades who were told that physical exercise was relevant to attainment of physical health, an intrinsic goal, were more likely to sign up for an exercise program than those who were told to take part in the exercise to attain physical attractiveness, an extrinsic goal (Vansteenkiste et al., 2004).

The significant effect of intrinsic messages also appears in terms of performance of an educational program (Jang, 2008; Vansteenkiste et al., 2004, 2008). Young people between the ages of 11 and 12 who were exposed to an intrinsic message emphasizing personal health showed higher test performance in a class for nutrition programs than those who attended the class with the purpose of increasing physical attractiveness (Vansteenkiste et al., 2005). The results indicate that intrinsic goals as a prior instructional message induces participants’ motivation and higher performance by eliciting positive attitudes toward the topic (Niemiec & Ryan, 2009).

The reason is that intrinsic goals help people to perceive the message as emphasizing inner value that enhances deep information processing. Basically, the intrinsic goal provides direct satisfaction of psychological needs for motivation; autonomy, relatedness, and competence (Deci & Ryan, 2000). Once people endorse the intrinsic goals, willingness and autonomous motivation is increasing (Deci & Ryan, 1985, 2000; Vansteenkiste, Lens, & Deci, 2006) as

people value the task. The autonomous motivation allows people to feel they are attached or related with an activity (Deci & Ryan, 2000) while it elicits task-focused manner with competence (Kasser, 2002; Vansteenkiste et al., 2008).

In contrast, extrinsic goals prevent deep absorption in an activity because it shifts people's attention from learning a task to external indicators of success or self-worth like physical appearance (Vansteenkiste et al., 2005). The limited attention to the learning material causes less elaboration so it forestalls the active approach to learning activity (Nicholls et al., 1990). Therefore, the intrinsic goal framing promotes higher motivation and performance than extrinsic goal framing.

Involvement as a Moderating Variable

The message effects, however, do not always occur equally. Variations in people's involvement with an issue can affect how they process and respond to given information (Kardes, 1988; Maheswaran & Meyers-Levy, 1990; Petty & Cacioppo, 1983; Petty, Cacioppo, & Schumann, 1983). According to ELM (Elaboration Likelihood Model) by Petty and Cacioppo (1983), highly issue involved people mainly process issue-relevant information to increase motivation as they consider a certain situation as personally relevant. Conversely, people under low involvement conditions are susceptible to peripheral cues like wordings in a message (Petty & Cacioppo, 1983). In other words, content of a message is a key factor that can affect information processing of people under different levels of involvement.

In terms of health issues, as per Petty and Cacciopo (1986), providing people with plenty of health related information is an effective way to promote motivation of those who are highly involved and interested in health issues. In contrast, providing other elements to attract attention is more efficient for people who are under low involvement condition. In line with the

assumption, it is possible to predict that highly issue-involved people prefer intrinsic messages than extrinsic ones as it not only delivers core meanings of personal health but also promotes deep information processing (Vansteenkiste et al., 2005). In addition, extrinsic messages may be more effective for people under low involvement condition because it provides outward oriented facts like physical attractiveness that can be interpreted as peripheral cues.

Although empirical studies investigating interaction effects between goal framing and involvement are rare, several studies (Donovan & Jelleh, 1999; Maheswaran & Meyers-Levy, 1990; Miller & Miller, 2000) already demonstrated that people under different levels of involvement condition prefer different types of message. For example, between negative and positive messages for promoting safe driving, people under high involvement conditions are more likely to be motivated by negative messages while people under low conditions prefer positive messages (Miller and Miller, 2000). The negative messages convey details of an issue that help people scrutinize a message's content to judge validity of an advocacy (Maheswaran & Meyers-Levy, 1990). That said, depending on the level of issue involvement, the effects of goal framing may differ. Given the wide range of issues available for health education, it is critical to test the role of issue involvement to find a best way to communicate with the target population.

Therefore, the current study aims to test effects of goal framing on motivation in serious game playing and also attempts to find out interaction effects between issue involvement and goal framing. To test these effects, the study poses the following hypotheses and a research question.

H1. (Autonomous motivation)

Students who are exposed to intrinsic messages prior to playing a serious game for health will be more likely to show higher autonomous motivation than those who are exposed to extrinsic messages.

H2. (Performance)

Students who are exposed to intrinsic messages prior to playing a serious game for health will be more likely to show higher performance than those who are exposed to extrinsic messages.

RQ1.

Will the effect of goal framing differ according to the level of issue involvement?

Chapter 3. Method

Study Design and Sample

The study designed a 2 x 2 (goal framing x issue involvement) between-subjects. Based on convenience sampling, a total of 120 first and second year middle school students participated in the experiment as cell sizes of previous studies in self-determination theory using 2 x 2 design were vary between 20 to 30. Middle school students were chosen as a sample because children over 12 can process information freely and are able to think strategically without any help while those under the age of 12 cannot process information by themselves (Roedder, 1981). Using children with higher information skill was necessary for this study because participants need to apply prior message contexts to their game playing without guidance.

To conduct the experiment, middle school students in Korea were selected as a sample because of their homogeneity regarding computer usage since almost 99 percent of adolescents use computer at home and 89 percent of them use it for game playing (Korea Internet & Society Agency, 2010). Their socioeconomic status is also similar since they live in same geographic area. In addition, there is a demand for games for health because obesity is becoming a serious health issue in Korea since obese teenagers are gradually increasing every year (Ministry of Education, Science and Technology, 2009), but empirical studies to prove the effects of serious game playing are relatively rare compare with the U. S. Also, the current study was able to control for pre-exposure as it used the actual U.S. game in Korea.

The serious game for health, ‘Nutrition Decision’, (see figure 1) was obtained from the NMSU’s (New Mexico State University) partnership program, media production. The program created a series of serious games for children and youngsters and the game ‘Nutrition Decision’ (<http://www.nutritiondecision.org>) was funded by the U.S. Department of Agriculture. The game

targeted middle school students to help them understand the importance of knowing nutrition facts to enhance balanced eating. In the game, students are told to learn how to read nutrition facts labels first. Students play five mini games throughout the whole procedure that teach the importance of balanced eating, reading nutrition facts, proper amount of each nutrition, and method to calculate calories. The words in the game were translated into Korean by two bilingual researchers (see figure 2 for the Korean version). All the visuals are identical except wordings and the game was presented with a PowerPoint program including message manipulation.

Stimuli

As mentioned earlier, this study followed a study by Vansteenkiste et al. (2005) because message manipulation for goal framing was already validated in their study. For issue involvement, this study used message stimuli by influencing participants to believe the outcomes of an issue would impact or not as following previous studies (Maheswaran & Meyers-Levy, 1990; Petty & Cacioppo, 1979, 1990).

Goal framing.

Intrinsic goal framing.

Doing your best to know information regarding nutrition in a game will help you to stay healthy and prevent you from becoming fat. Adolescents who know nutrition are much more likely to remain physically fit than youngsters who have no information about nutrition.

Extrinsic goal framing.

Doing your best to know information regarding nutrition in a game will help you to become physically appealing to others and prevent you from becoming fat. Adolescents who know nutrition are much more likely to remain attractive to others than youngsters who have no information about nutrition.

Involvement.

High issue involvement.

To date, adolescents in South Korea have a high risk of getting fat that can lead to serious obesity. Especially, the risk of obesity is increasing among middle school students in South Korea. Susceptibility of obesity in life is established early when people are in their teens. Thus, the risk of becoming a victim of obesity is real, increasing, and important to be aware of, for those who are attending middle school in South Korea.

Low issue involvement.

To date, adolescents in other countries such as the U.S.A. have a high risk of getting fat that can lead to serious obesity. Especially, the risk of obesity is increasing among middle school students in other countries like U.S.A. Susceptibility of obesity in life is established early when people are in their teens. Thus, the risk of becoming a victim of obesity is real, increasing, and important to be aware of, for those who are attending middle school in other countries.

Manipulation Checks

Manipulation checks for goal framing used 5-point scales ranging from *not true at all* to *very true* regarding autonomous motivation in the post exposure questionnaire based on Ryan and Conell's (1989) Treatment Self-Regulation Questionnaire (TSRQ) to see whether the message manipulation worked to increase autonomous motivation. For message manipulation for involvement, this study followed Maheswaran and Meyers-Levy's (1990) test for involvement using 5-point scales to query how interesting, involving, and personally relevant the material was.

Results showed that there was a significant difference between those exposed to the intrinsic goal and those exposed to the extrinsic goal in terms of autonomous motivation ($t=2.791$, $df=18$, $p=.01$), with higher score for intrinsic goal ($M=3.42$, $SD=.38$) than extrinsic one ($M=2.95$, $SD=.37$). In terms of interests in an issue, students exposed to a high involvement message showed a higher score ($M=3.5$, $SD=.16$) than those exposed to a low involvement message ($M=2.3$, $SD=.15$) at significant level of .00. Also, students under the high involvement condition were more likely to consider the issue as involving ($M=3.6$, $SD=.16$) compared to those under the low involvement condition ($M=2.8$, $SD=.13$). In addition, students under high involvement condition showed higher score for issue relevant ($M=3.5$, $SD=.16$) than those exposed to a low involvement message ($M=2.6$, $SD=.16$). Therefore, the message manipulation for both goal framing and involvement was validated.

Procedure

A total of 120 adolescents attending first and second grade of public middle school in a suburb of Seoul participated in the experiment. When students came to the computer lab, they were randomly assigned to four types of computer programs conveying manipulated messages and translated games. The four types of computer programs were based on a combination of message framing for motivation, intrinsic and extrinsic, and level of involvement, high and low. 30 students participated in the experimental group of intrinsic messages under high involvement conditions while 31 students participated in a group of intrinsic messages under low involvement conditions. Also, 29 students engaged in a group of extrinsic messages under high involvement condition whereas 30 students engaged in extrinsic messages under low involvement.

Except for the messages before playing the game, the procedures, game, and survey questionnaires were identical. The first step involved reading message manipulation to set the level of involvement for five minutes. Then, each group was exposed to a message manipulation that included either an intrinsic goal or extrinsic goal for five minutes. After reading all messages, students were told to play the serious game for about 15 minutes and then they were asked to fill out a survey questionnaire for 10 minutes. The whole procedure took 30 to 40 minutes.

Dependent Measure

Motivation.

This study used Ryan and Conell's (1989) Treatment Self-Regulation Questionnaire (TSRQ), which was first used for a health educational program in Williams et al. (1996) and was validated in several studies (Ryan, Plant, & O'Malley, 1995; Williams et al., 2002) to examine motivation. There are two subscales: autonomous motivation and controlled motivation. Eight

questions were presented to investigate autonomous motivation and 11 questions were presented for controlled motivation.

Questions to assess autonomous motivation are followings: I participate in the game for health because ‘I find it a personal challenge to do so’, ‘I personally believe that learning nutrition facts will improve my health’, ‘It is exciting to try to keep balanced meal in a healthy range’. The reason I follow guidelines to eat balanced nutrition in the future is that ‘I personally believe that these are important in remaining healthy’, ‘I carefully thought about my eating habit and believe it’s the right thing to do’, ‘I feel personally that learning nutrition while play game is the best things for me’, ‘Playing game to know nutrition facts is choices I really want to make’, ‘It’s a challenge to learn how to read nutrition facts’.

Questions to examine controlled motivation are below: I participate in the game for health because ‘Other people would be mad at me if I didn’t’, ‘I would feel guilty if I didn’t do what my instructor said’, ‘I want my instructor to think I’m a good student’, ‘I would feel bad about myself if I didn’t’, ‘I don’t want other people to be disappointed in me’. The reason I follow guidelines to eat balanced nutrition in the future is that ‘Other people would be upset with me if I didn’t’, ‘I would be ashamed of myself if I didn’t’, ‘It is easier to do what I’m told that to think about it’, ‘I want others to see that I can participate in the game and stay fit’, ‘I just do it because my instructor said to’, ‘I’d feel guilty if I didn’t participate in the game playing.’

Each question was rated on a 5-point scale ranging from *not true at all* to *very true*. The responses on the items are averaged separately to form the autonomous score and controlled score and the current study focused more on analyzing autonomous scores because the study aims to investigate effects of goal framing on autonomous motivation.

Performance of a game.

The current study followed Vansteenkiste et al.'s (2004, 2005) study in that the studies validated test questionnaires to check performance of learning activity. Participants in this study took a mini-exam in a survey questionnaire to check their learning performance through a serious game. A total of 15 questions were presented. Ten questions asked participants to insert a proper word or number taken directly from a game. The questions are followings: 'How much calcium should we eat? Enough or less?', 'How much sodium should we eat? Enough or less?', 'How much fat should we eat? Enough or less?', 'How much vitamin A should we eat? Enough or less?', 'If you eat 2 cups of milk, how much calorie do you eat? A cup of mile is 150 calories', 'If you eat 3 servings of a cake, how much calorie do you eat? One serving is 320 calories', 'If sodium is below 5% in nutrition facts, is it high or low per serving?', 'If vitamin C is 35% in the nutrition facts, is it high or low per serving?', 'If fiber is over 20% in nutrition facts, is it high or low per serving?', 'If saturated fat is below 2% in nutrition facts, is it high or low per serving?', 'If saturated fat is below 2% in nutrition facts, is it high or low per serving?'.

Other questions were presented to test participants' understanding of the game contents, not their memory. They were asked to 'Explain why we should learn how to read nutrition fact', 'Explain what information you can get when you read nutrition fact', 'Explain why we should know total calorie in nutrition fact', 'Explain why we should know serving size', 'Explain why we should know percentage of each nutrition in nutrition fact'. After the test, the researcher gathered the responses and scored them as 1 if the answer was correct and 0 if the answer was wrong.

Control variables.

To control effects of the third variable, the survey questionnaire included questions asking gender, likability toward the game 'Nutrition Decision', usage of the Internet, prior knowledge, and prior experience. Gender was controlled since boys have a tendency to play games better than girls (Brown, 1997; Okagaki & Frensch, 1994). Likability toward the game 'Nutrition Decision' was evaluated based on a 5-point scale ranging from *not at all* to *totally* with the question, "How much did you like the 'Nutrition Decision' game that you just played?"

Moreover, prior knowledge and experience were also checked because game-playing performance increased as people had prior experience with the game, since they became familiar with its contents (Sherry & Dibble, 2009). Hence, a question to investigate the average time for game playing and prior experience with the game 'Nutrition Decision' were presented. Also, questions examining learning experience regarding nutrition, watching experience of nutrition programs, and interpersonal communication regarding nutrition were included in the survey questionnaire. Two-way ANOVA in SPSS 16.0 was used to compare perceived motivation and performance among four groups.

Chapter 4. Results

The sample for an experiment was comprised of 120 middle school students, of whom 50 percent ($n=61$) were girls and 48 percent ($n=57$) were boys and two students who did not provide demographic information. The participants were composed of about 50 percent first graders and 50 percent second graders. Among them, 54 percent were 13 years old and 44 percent were 14 years old. Almost 90 percent of the participants can use the Internet at home and their average daily game usage was 1.69 hours ($SD=1.44$).

Their average likability toward the actual serious game ‘Nutrition Decision’ was 3.0 ($SD=.98$) on a scale of 1 (not at all) to 5 (totally), based on the question, “How much did you like the game ‘Nutrition Decision’ that you just played?” In terms of their experience regarding the game ‘Nutrition Decision’, 88 percent of the students had no experience. When asked whether they learned nutrition before, 57 percent of students answered that they learned it while 42 percent of them had no learning experience. Their average discussion time with their peers about nutrition per week is 1.29 ($SD=.50$) and 66 percent of them did not watch any program related to nutrition information.

According to the result, hypothesis 1 is supported. To test the effects of goal framing, a two-way analysis of variance (ANOVA) was run with goal framing and involvement as independent factors and the autonomous motivation and performance as dependent variables (see table 1 and table 2). First of all, the effects of goal framing on autonomous motivation was significant, $F(1,116)=8.88$, $p=.003$, with perceived autonomous motivation scores higher for the intrinsic goal ($M=3.47$, $SD=.71$) than for the extrinsic goal ($M=3.09$, $SD=.69$). However, the

main effect of involvement, $F(1,116)=.68, p>.05$, and interaction effect between goal framing and involvement, $F(1,116)=2.87, p>.05$ were not statistically significant.

Hypothesis 2 is proved as well. The ANOVA revealed a statistically significant main effect for goal framing on performance $F(1,116)=10.53, p=.002$, with performance scores higher than for the intrinsic goal ($M=12.04, SD=2.51$) than for the extrinsic goal ($M=10.42, SD=3.05$). In contrast, the main effect of involvement was not found, $F(1,116)=.45, p>.05$, nor was interaction effect between goal framing and involvement, $F(1,116)=3.64, p>.05$. However, interaction effects between goal framing and involvement on autonomous motivation and performance were not proved.

Regarding control variables, except likability toward the game, none of the control variables including gender, prior experience, or prior knowledge was statistically significant. The motivation and performance were significantly related with likability, $F(1,113)=32.3, p=.00$. However, the main effects of message on autonomous motivation still significantly works after controlled the likability, $F(1,113)=6.78, p=.01$. Also, the main effects of messages was statistically significant for performance, $F(1,113)=8.95, p=.003$.

Chapter 5. Conclusion

This study aimed to examine the effects of prior message to enhance motivation and performance of serious game playing. Also, current study tried to test moderating effects of involvement. As the result shows, adolescents exposed to an intrinsic goal were more likely to participate in the game with higher autonomous motivation than those exposed to an extrinsic goal. The significant effect of intrinsic goal also appears in terms of performance and it implies several benefits this study possesses.

First of all, it is noteworthy that the result proposed a way to enhance motivation and performance of serious game. Serious games are a genre that intentionally focuses on education. It also implies that the outcome of the playing these games is always beneficial for players (Ratan & Ritterfeld, 2009). Hence, developing a tool to maximize the educational effects of serious games while control unexpected interventions such as selective attention and recall (Singhal & Rogers, 2002) are a crucial issue to achieve its purpose. In terms of game, people may pay more attention to characters, sound, or simulation in a game rather than learning materials embedded in it. Hence, a clear guideline is necessary to make people keep focusing the purpose of learning while they play the game.

In addition, external aids such as rationale are necessary to promote motivation especially for adolescents (Harter, 1981, 1982), the main target audience of serious game (Ratan & Ritterfeld, 2009). The reason is that their willingness to take part in an educational program is low (Anderman & Maehr, 1994; Eccles & Wigfield, 1995). The external aid not only helps students understand the value of the task (Vanteenkiste et al., 2008) but also fosters readiness to

game playing that is a key factor of successful information processing in learning (Reninger, Hidi, & Krapp, 1992).

Also, the result gives us a cue of how to develop message strategy to optimize educational effects of serious game playing. In that the study proved significant effects of intrinsic message in terms of motivation and performance, serious game field can utilize the intrinsic message to stimulate player's active participation. Although students motivated by intrinsic message shows increased intention to participate in an educational program and enhanced performance (Grolink, Ryan, & Deci, 1991; Reeve et al., 2002), previous studies (Cordova & Lepper, 1996; Przybylsik, Rigdy, & Ryan, 2010; Ryan, Rigdy, & Przybylski, 2006; Whitehall & McDonald, 1993) have only focused on developing elements in a game like characters, simulations, or narratives.

The attempts to apply motivational theory to serious game field signal that the theory can be successfully employed with the computer game playing although they have been examined in studies about traditional educational setting like a lecture. As the result shows the significant link between motivation and game playing, considering other factors that can enhance motivation is needed to optimize educational effects of serious games. For example, instructor's communication style when they introduce a game to students can affect motivation for serious game playing as previous studies (Jang, 2008, Reeve et al., 2002) already proved its significant effect on motivation.

This study tried to apply level of involvement to self-determination theory to check the impact. However, there was no significant result. In that individual's risk perception plays a role to consider health issue as related or important to them (Brewer et al., 2005), using manipulated message without testing risk perception people possess was a limitation of this study. According

to previous studies, people under high risk perception regarding cancer are more likely to accept health campaign message to prevent cancer rather than those who has low risk perception (Weitzman et al., 2001). Hence, it is possible to posit that real risk perception regarding obesity forestall information processing through message manipulation. In this sense, future study should consider to check risk perception to know exact relation between involvement and message framing in order to investigate more personalized message strategies to enhance effects of serious games.

Also, this study did not consider different age group as a subject because it aimed to test adolescents only as a main target audience of serious game playing. This would be a limitation because different age groups may prefer different type of message according to different level of ability of information processing (Roedder, 1981). Also, youngsters of different age group focus on different part of serious game (Blumberg, 1998) so factors can elicit motivation for game playing may differently appear according to target audience's age.

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Appendix A. Tables and figures

Table A-1. *Main and interaction effects of goal framing and involvement toward autonomous motivation and performance*

	Autonomous	Performance
Main Effects		
Message	$F(1, 116) = 8.88^*$	$F(1, 116) = 10.53^*$
Involvement	$F(1, 116) = .68$	$F(1, 116) = .45$
Interaction Effect	$F(1, 116) = 2.87$	$F(1, 116) = 3.64$

Note:

- $*p < .05$

Table A-2. *Average score of autonomous motivation and performance according to goal framing*

	Intrinsic goal		Extrinsic goal	
	<i>M</i>	<i>sd</i>	<i>M</i>	<i>sd</i>
Autonomous motivation	3.47	0.71	3.09	0.69
Performance	12.04	2.51	10.42	3.05

Figure A-1. The serious game 'Nutrition Decision' (original English version)

simon says

Nutrition Facts on food labels are like clues - they tell you what you need to know about the nutrients in food to make smart choices.

Next

Skip

Nutrition Facts
Serving Size 1/4 cup
Servings Per Container 8

Amount Per Serving	
Calories	110
Calories From Fat	80
% Daily Value*	
Total Fat	9g 14 %
Saturated Fat	6g 30 %
Cholesterol	30mg 10 %
Sodium	170mg 7 %
Total Carbohydrate	0g 0 %
Dietary Fiber	0 0 %
Sugars	1g
Protein	7g
Vitamin A	6 % * Vitamin C 0 %
Calcium	20 % * Iron 0 %

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Figure A-2. The serious game 'Nutrition Decision' (Korean version)

simon says

음식에 붙어있는 영양정보표는 음식에 있는 영양소를 알려줌으로써 우리가 현명한 음식 섭취를 할 수 있게 도와준다.

Next

Skip

영양정보표
인분 수 1/4 cup
용기당 인분 수 8

1인분 당 양	
총 칼로리	110
Calories From Fat	80
% Daily Value*	
총 지방	9g 14 %
포화 지방	6g 30 %
콜레스테롤	30mg 10 %
나트륨	170mg 7 %
총 탄수화물	0g 0 %
식이성 섬유질	0 0 %
당분	1g
단백질	7g
비타민A	6 % * 비타민C 0 %
칼슘	20 % * 철분 0 %

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.