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Gamification elements for intrinsic motivation approach in psychology

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Contents

Abstract

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When designing a product or a service should lead to the user′ s volunta

ry participation and motivation, "Gamification" can be very powerful techniques. In many industry fields, there are various ways to try to increase between users interaction and activities. Meanwhile, Some researchers have argued that psychological hypothesis about changing human psychological motivation through gamification techniques. And, using various gamification elements didn't affect the user's motivation as intended, moreover that elements dropped the motivation irrelevantly. One such reasons is due to lack of understanding of a process, through which the applications of gamification elements to affect the human psychological works specifically. In this experiment, we used "Tower of hanoi" task. this task usually tested for analysing cognitive problem solving process. Based on this, we set independent variables for two game interface design patterns in gamification elements. Then we figured out relatedness between task performance and motivation belongs subject's extraversion personality element. After statistically analysed, leaderboard(one independent variables) in game interface design patterns affects task performance through subject's extraversion personality degree and intrinsic motivation as moderated mediation effect. As results, user's motivation can interact with human's personality (Big 5 personality). Furthermore, while designing new products or services, we can understand how to apply delicately gamification elements and help to research more practical design considering human psychological aspects.

Keywords : Gamification , Intrinsic Motivation , Tower of Hanoi , Self-determination theory , Moderated mediation effect , Leaderboard , Status , Personality

1. Introduction

On the internet world, trends and trajectory of social gaming had brought many issues to related researchers (Patchin & Hinduja, 2010; Järvinen, 2009). Although, the social and the game is very big topic separately. By combining game in socialised internet world, social game got power. Social game′ s advantage was that strengthening the connection between people, then attracting new gaming users rapidly and easily. Users actively accepted game′ s fun and engagement of elements.

But nowadays, social game′ s trends become silent. People have got fatigue about SNS games (Fields, 2014). It caused by rapid fashion and too much inviting alert messages, also they could only play on the internet. social games can′ t be an example of gamification in the strict sense. because of social game is completed game as using SNS relatedness. But, the new ways of connectivity could drive strong motivation from elements of game, such as competition, relatedness to internet users. Many people take interest in studies about user engagement and motivation from game design elements (Park, 2006). Furthermore they tried to graft some game interface design elements onto non-game context. After 2011 CHI conference (Deterding et al., 2011 a), "Gamification" word officially has used in the fields. It has showed various formats cases applying game interface design elements in online and offline real world (Deterding et al., 2011 b). Furthermore, extended recently IoT technology, there will be many cases for utilising gamification elements outside on the internet (Usko y&Sekar, 2014). It will measure life-logging data which can use gamification elements. And it can be faster feedback using smartphone on mobile. As time goes by, it will be reduce aversion to applying gamification elem

ents since many people who have experienced game from childhood beco me a large number. However, Designing system applying gamification ele ments cannot be guaranteed that improving user engagement and enjoyme nt. There are already many case of failures in "gamifying" applications (Rigby & Ryan, 2011; Montola, 20212).

Implementations and applying technologies rapidly have produced, hu man doesn't definitely understand how to evoke a certain psychological motives of users. Gamification just applied some fields on non-game cont ext from elements immersed in video games. But, we need to research w hy these elements trigger user's engagement (Deterding, 2012. Some pr evious studies were connection between gamification elements and psych ological aspects (Sailer et al., 2013; Antin & Churchill, 2011; Landers et al., 2014; Aparicio & Montes, 2012). But, they researched theoretical poi nt of view gamification through literature review or practical case studies .

In this study, it is not a point of view how to gamification and utilise d. It focuses on how to influence user's intrinsic motivation on cognitive task applied gamification pattern elements through individual personality tendency. After then analysed influencing user's performance.

2. Background

1. Intrinsic Motivation

People have various needs of different ways, then they act for satisfying needs and then the needs produce. This loop structure makes human's motivation. Maslow argued that human needs defined from physiological needs to self-actualisation (Maslow et al., 1970). However, this definition is too general, each hierarchical needs' s satisfaction is not grown up in a neat pile, each needs can complexly interact with themselves, or jump over the hierarchical steps. According to Deic & Ryan, human's motivation divided extrinsic part and intrinsic part. Extrinsic motivation means that it change human's motivation through forced control of external environment. The force can use reward or punishment for changing behaviours (Ryan & Deci, 2000). They argued that extrinsic motivation elements should be handled very carefully. when people facing the extrinsic motivation elements, such as monetary reward, punishment, it would destroyed to have originally intrinsic motivation. Too strong external stimulus for motivation is a view that only hung external stimulus, and it will eliminate the need to rely on implicit and voluntary for goals (Deci & Flaste, 1996). In these reason, if applying gamification have the indiscretion to rewards or specific methods motivating plan such as pointsification, it should damage to their intrinsic motivation. Deci & Ryan proposed self-determination theory (SDT) which explain how to produce the human's voluntary intrinsic motivation. They divided three categories of psychological parts for satisfying needs. such as competence to feel competent in dealing with one's environment), autonomy (to feel self-determining in one's activities rather than feeling controlled or obliged to act), and relatedness (to feel

that one has satisfying and supportive social relationships)(Deci & Ryan , 2002; Ryan & Deci, 2000).

On other perspective, intrinsic motivation is natural mind′ s movements, it can connect fun. Raph Koster argued, fun is essential phenomena during learning process to find some patterns in their brain (Koster, 2013). Although he explained why players feel enjoyment and flow on video games, it can relate point with self-determination theory. Game is based on voluntary participation and activities, and anyone don't force outside. Players make their own loop of needs through intrinsic motivation. According to SDT, human can naturally follow the goal with fun and flow, if they can choice themselves about adequate some conditions. Koster thought they conatively learned pattern in given environment, then they would feel fun and flow. Finally other industry fields recognised these important findings. they need to technique for natural and voluntary motivation, then named gamification, or designing for motivational affordances (Deterding, 2011 c).

2. Gamification

Because many various experts and domains are concern in gamification, related terms are defined and analysed from diverse area and aspects (Seaborn & Fels, 2015). Nevertheless, all of these analyses are based on focusing goal of moving user′ s motivation. Generally, gamification is defined as "an informal umbrella term for the use of video game elements in non-gaming systems to improve user experience (UX) and user engage

ment." (Deterding, 2011) Practically, for changing user's motivation, they led to participate voluntary users, then improved target performance. Combining crowdsourcing with gamification, they should add to annotations in massive documents. It had good accuracy and many willing participants (Eickhoff et al., 2012).

Roger Caillois claimed that playfulness of game had two axis. they were "paidia" and "ludus" concepts. Paidia is more free, expressive, improvise. Besides, ludus is more structural, including complex rules for goals (Caillois, 1961). In this part, game design pattern elements based on ludus concept. That's gamification elements, it is the goal to provide more logical playful experience and motivation using structurally game design pattern elements. So, it can be analysed working mechanisms and interactions to structural rules and have clear goals. So, Understanding for each gamification elements' motivational mechanisms is important to apply gamification design pattern elements. According to Sailer et al., they analysed between gamification elements with motivational mechanisms, then categorised seven elements (Sailer et al., 2013). Although these categories, there are still have problems which disturb user's intrinsic motivation from gamification strategies. If specific gamification design pattern apply to simple situation, it just same as simply behaviourist ways of thinking (Pavlov, 1897; skinner, 1938). But nowadays psychologists argue that there are many complex psychological factors and inner mind's interactions. So we should find what is interaction and factor in human mind. It is important that applying proper gamification elements considering their internal tendencies through meaningful and effective information to users (Nicholson, 2012).

In this study, we considered two factors which influenced by user's personality elements while doing cognitive task.

2-1. Leaderboard

Leaderboard in gamification elements is for triggering competition between players. It provide information about top players' records like the hall of fame. And so player can predict their ranks and given motivation for better records. As game design User Interface(UI), leaderboard can divide individual leaderboard or team leaderboard. Displayed information of leaderboard are differ from each style, it foster competitive spirit and love of fame. Individual leaderboard can arise feeling of competence. Team leaderboard can arise competitive spirit and social relatedness between team members, so they will emphasis collaboration and community activities (Sailer et al., 2013). However, there was a research result that applying leaderboard didn't always affect players' enjoyment. Although the research target was game players in video game, it is evidence that simple competition element doesn't work for perception of fun and motivating competitive spirit to all players (Butler, 2013). Otherwise, leaderboard can add specific details, such as player's photo, ladder position, level of achievement. Then they will help to improve player's motivation (Domínguez et al., 2013).

2-2. Status

"Points" and "Feedback" in gamification elements related with watching one′s status information in real time. Feedback gives effective signals to user for adapting any environment, Then it supports to experience necessary learning steps. So, user gets voluntary motivation (Annett, 1969). most of education domain, "points" in the gamification element is made by calculable numbers for impersonally confirming one′s status (Burgos et al., 2007). For example, they can get some points after answering quiz type questions, through this, this points will utilise for competition with other players. Points can just count one′s correct answers or accumulate points along levels (Cheong et al., 2013; Bustard et al., 2011). In other ways, it grants points along player′s activity in gamification platform. Then points range will be based on assigning one′s status levels (Farzan, 2008). Or, if the goal in work′s target clearly set up, it provide feedback information for checking one′s status and other player′s status to achieve one′s aim. It will help to improve collaborative performance on this system (Jung et al., 2010).

3. Personality

Previous psychology studies, it divided two types of origin personality differences through people′s energy directions; outside or inside, such

as extraversion and introversion (Jung, 1939). Jung reported his empirical study; extraversion and introversion were ego's attitude, and four kinds of psychological functions; that is thinking, sensing, feeling, and intuiting, then these two categories are combined with each other total eight psychological types (Bradway, 1964). This hypothesis was very simple and instinct, but it just empirical study, and all of people′ s comprehensive personality cannot explain the meaning of their tendency. After studied of Costa & McCrae, they claimed Big 5 personality through psychological experiments. This theory explains five independent factors for human′ s personality (McCrae & Costa, 1997). Five personality factors have Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. All of people have these five factors, and the standard is 50%. Those factors categorised ordinary lexical experimental finding, every human born in having a biological tendency. After then, they are influenced from the developmental environment. In addition, they are able to behave differently form their own personality, when drive strong external factor or make their own rational decision. For example, if someone have extraversion in these five factors have low level, many people thought he has high introversion personality. But, it is not true. Fundamentally, suppose every people have normal personality values and interaction with them independently. So, we normally call introversion person, they can be found in high "neuroticism" personality factor, not in low "extraversion" (Nettle, 2009). And this Big 5 personality theory evaluates high reliability and validity, because it has verified in various cultures and languages. Also, many implementations made by personality psychologists (John & Soto, 2008; McCrae et al., 1998).

Game designer found that players didn′ t behave as intended in ga

mes architecture. So, they tried to categorise into player′ s personality, after had analysed characters of player′ s activities. Richard Bartle claim ed four player′ s personality based on their behavioural motivation; such as Achievers, Explorers, Socializers, Killers. And their tendencies divided single player and multi players (Bartle, 2004). However, this online pers onality is activities on multiplayer online game (MMORPGs, MUDs). It is h ard to apply in real worlds and different situations. So, we need to recog nise normal person′ s character in non-game context.

In this experiment, we will discuss extraversion personality of five i ndependent personality factors. Extraversion is related with social interco urse, need to vitality, stimulation, approaching enthusiastically to society, real world. It represents words are: sociable, assertiveness, talkative, ass ertive, adventurous, active, energetic, ambitious (Costa, 1992). We think, t hese points are related with reporting status information and checking lea derboard. Based on approached to theoretically (Sailer et al., 2013), we h ypothesis that status report, leaderboard in gamification elements fundame ntal mechanisms are related with interacting others, fostering competition when moderating their extraversion personality level.

4. Tower of Hanoi

4-1. Academic Uses

When human decision makes from external information and knowledge , or solve some problems, their cognitive ability works. For this work, w e should know that how to save and represent external information, throu gh compositive operation, then how to withdraw stored knowledges. Ande rson and colleagues, argued human have procedural knowledge, declarativ e knowledge. And they explain that using Tower of Hanoi task, human ca n construct means-ends analysis when process procedural knowledge pro cessing (Anderson, 2005). French mathematician Édouard Lucas presented Tower of Hanoi task in 1883. It had been utilised for understanding mat hematical recursive algorithm. In addition, it should learn for understandin g recursive call of function in computer science. Basically, there are thre e rods and different kinds of disks, disks piled in one rods in a neat pile. And there are three rules. First, only one disk can be moved at a time. Secondly, Each move consists of taking the upper disk from one of the s tacks and placing it on top of another stack i.e. a disk can only be move d if it is the uppermost disk on a stack. Lastly, No disk may be placed o n top of a smaller disk. This is actually a simple structures and rules. Ho wever, it can measure human cognitive ability. So, this task used for user ′ s cognitive ability testing tool in non-game context.

4-2. Self Efficacy

There were some studies that self-efficacy have significant effects on solving a mathematical problem like the Tower of Hanoi which needs cog nitive ability (Pajares & Miller, 1994). According to Bandura's study, self-efficacy means that expectation and belief that one′ s can do an appropri

ate action in any situation. And, self-efficacy is strongly related with effo rt and task endurance in social cognitive theory. When high self-efficacy person is confronted with difficulties, they do one′ s best. If they can ha ve enough abilities for solving problem, they will make challenge strong a nd sticky (Bandura, 1989). We considered self-efficacy can affect perfor mance of cognitive task, except one′ s cognitive abilities, learning achiev ement.

3. Research Question and Hypotheses

We shouldn't apply simple and indiscreet pointsification, then applying proper gamification elements. And we analysed how to stimulate human ′ s intrinsic motivation moderating personality then evaluate their perform ance. In this studies, we hypothesis:

H1. It will affect the subject of performance along independent gamif cation elements.

H2. It will affect the subject of intrinsic motivation moderating extra version personality.

H3. It will affect the subject of performance through moderated medi ating effect: related with extraversion personality and intrinsic motivation.

4. Method

4-1. Experimental design

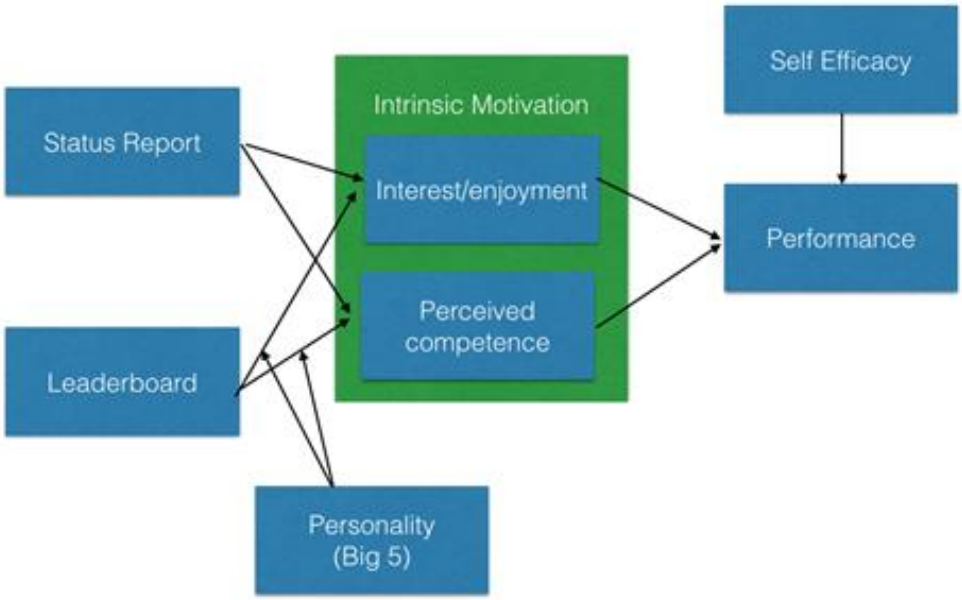

Figure 1. Experimental hypothesis design

Experimental design constructed to confirm hypotheses, the design was following a 2 (status report : show vs. hide) X 2 (leaderboard: show vs. hide) between-subjects, which is designated to be analysed as two-way repeated analysis of variance. And moderator was level of extraversion personality, mediator measured by intrinsic motivation included sub-scale : interest/ enjoyment, and perceived competence (using Intrinsic Motivation Inventory form self-determination theory translated Korean). And depen

dent variable was Tower of Hanoi task performance: the sum of movements disks and play time. Control variable set self-efficacy Korean scale (김아영 & 박인영, 2001). We analysed statistical tools via PROCESS form SPSS (Hayes, 2013).

4-2. Participants

Sungkyunkwan university students(Humanities and social sciences campus) total is 65.(male = 32, female = 33, after born in 1995 before 1986, age mean = 23.40, SD = 2.180) All participants randomly assigned one condition. And outliers (male = 4, female = 1) eliminated five participants. There were criteria: it occurred that tablet monitor or computer frozen bug while doing experiment, and the participant weren't follow directs of experimenter (for example, reveal the black cover papers in experiment setting, watching smartphone, sending a messages).

4-3. Material

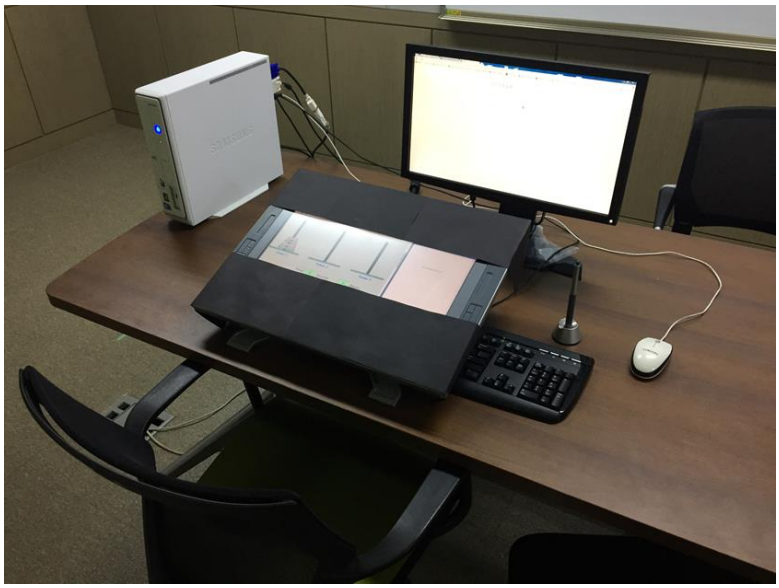

Figure 2. Experimental environment setting

In front of the screen, it showed slide that three rules of the tower of Hanoi (Figure 3). Under the gaze on participant, there was tablet monitor which execute tower of Hanoi task using tablet pen. Independent variables (leaderboard) showed message from telegram web messenger, experimenter sent a messages (process notice, leaderboard) while doing task behind a mirror room (Figure 4).

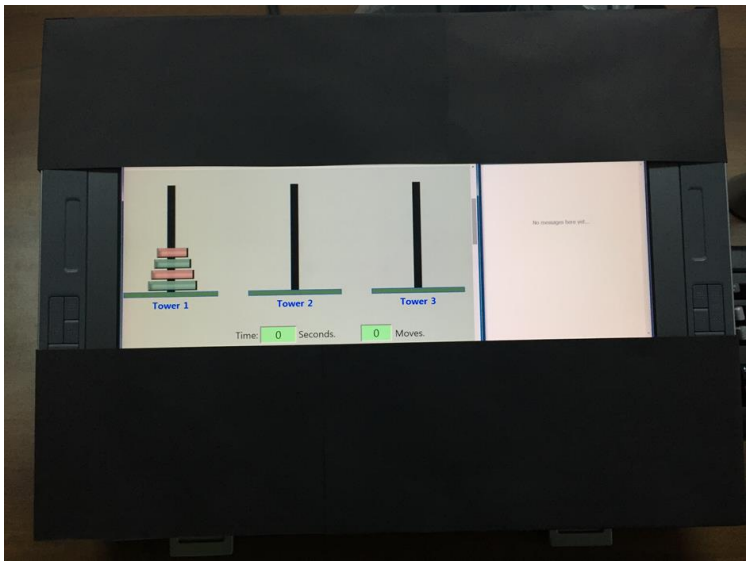

Figure 3. Tablet monitor for tower of Hanoi task

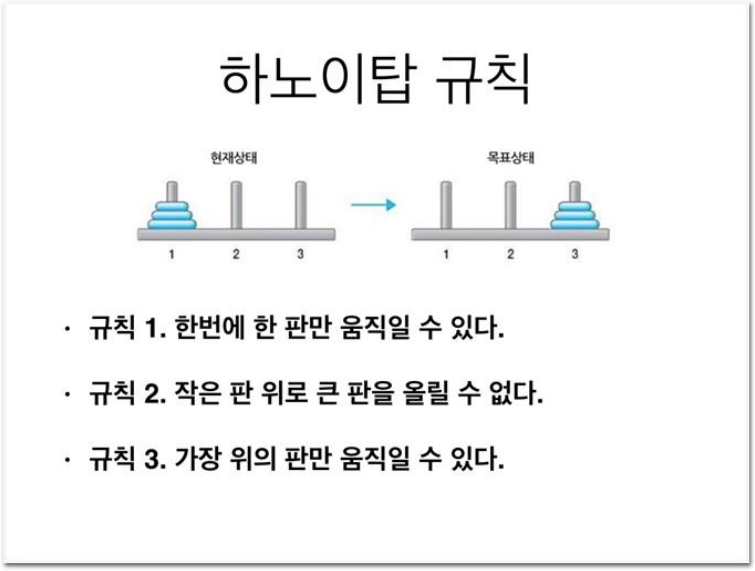

Figure 4. Rules of tower of hanoi slide

And after tutorial stage (3 disks (level 1) of task), participant moved other computer sit and wearing headphone. In there, it showed legend of tower of Hanoi: consist of six slides and audio files (Figure 5).

Figure 5. Legend of tower of hanoi slide

Leaderboard was shown following images:

Figure 6. Leaderboard stimulus

Each 3 disks for tutorial (= level 1), 4 disk for main (= level 2) show

ed twice, the title was university name. each rank, name, affiliate, spendi ng time, disks movements showed, and all elements were virtual name, af filiate and results of pilot test.

4-4. Process

All of participants were recruited voluntarily via online notice bulletin of Sungkyunkwan university′ s website. All participants chose their expe riment time, and data gathering from google service. After processed exp eriment, provided a gift certificate.

First of all, participant wrote an experiment consent, and did Big 5 personality survey on computer. After survey, did other pre-survey: inclu ded self efficacy, previous experience and knowledge about Tower of Ha noi. Then participant moved on tablet monitor PC, in there listened and w atched rules of tower of Hanoi task. Next, experimenter simply explained using tablet pen, then went out the room. Completed Level 1 stage (= tu torial), returned experimenter who was behind mirror room, participant m oved on survey PC and participant wore headphone, watched legend of H anoi tower. After, moved on Tablet monitor PC then started Level 2 stag e (= main). Also, experimenter went out same as Level 1 stage. Complet ed that, lastly participant answered intrinsic motivation survey on survey PC.

While participant did the task using tablet pc, the experimenter woul dn't be noticed watching situation behind mirror room. And the experimen ter sent messages to process task. Leaderboard showed method as follow s:

1. Now it will be record your task (movements, time) and show lea

derboard about rank top 5 until yesterday task records.

2. Now record results have scored, then show tomorrow as well.

3. It will be utilised in "creative problem-solving skills centre" fo r cognitive ability assessments among the university students.

(after stage)

4. click leaderboard and check it.

5. Results

5-1. Survey Reliability

5-1-1. Intrinsic Motivation Scale

This scale translated Korean and randomly surveyed and 7 Likert sca le. Interest/ enjoyment and perceived competence Cronbach' s alpha and correlations as follows:

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.760	0.775	7

Table 1. Interest/ enjoyment Cronbach′ s alpha

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.894	0.898	5

Table 2. Perceived Competence Cronbach′ s alpha

Correlations			
		Interest/ Enjoyment	Perceived Competence
Interest/ Enjoyment	Pearson Correlation	1	0.454
	Sig. (2-tailed)		0.000
	N	60	60
Perceived Competence	Pearson Correlation	0.454	1
	Sig. (2-tailed)	0.000	
	N	60	60

Table 3. Intereset/ enjoyment - Perceived Competence correlations

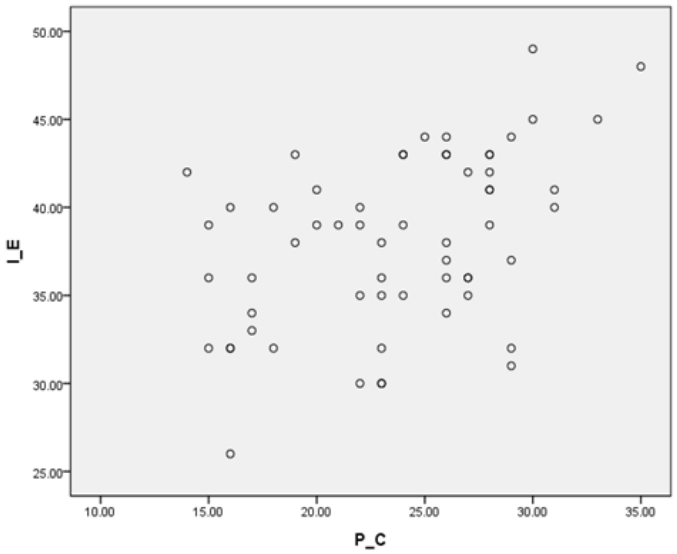

Figure 7. Intereset/ enjoyment (I_E) - Perceived Competence (P_C) correlations

Every each scale reliability was proper value(interest/ enjoyment = 0. 760, perceived competence = 0.894), between sub scales relation report a weak positive correlation.

5-1-2. Personality and Self efficacy

The big 5 personality factors measured survey translated Korean, ext raversion items were six and 5 Likert scale. Self efficacy was general m easurement which developed Korean survey tested validity and reliability.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.779	0.788	6

Table 4. Extraversion personality Cronbach′ s alpha

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.882	0.886	6

Table 5. Self efficacy Cronbach′ s alpha

5-2. Two-way ANOVA

Task performance resulted sum of movements disks and spending time. because when participants carried out the task, someone moved quickly disks several times, another participant deeply think then carefully moved disks. So, we could fix that differences.

5-2-1. Level 1 Task

Level 1 task performance (M = 45.35, SD = 33.200038) reported inte

raction effect between leaderboard and status (F(60) = 9.447, p = 0.003) (Table 6) (Figure 8).

Tests of Between-Subjects Effects					
Dependent Variable:Lv1_sum					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9608.183	3	3202.728	3.236	0.029
Intercept	123397.350	1	123397.350	124.676	0.000
Status	126.150	1	126.150	0.127	0.722
Rank	132.017	1	132.017	0.133	0.716
Status * Rank	9350.017	1	9350.017	9.447	0.003
Error	55425.467	56	989.740		
Total	188431.000	60			
Corrected Total	65033.650	59			

Table 6. Level 1 Task between-subjects effects

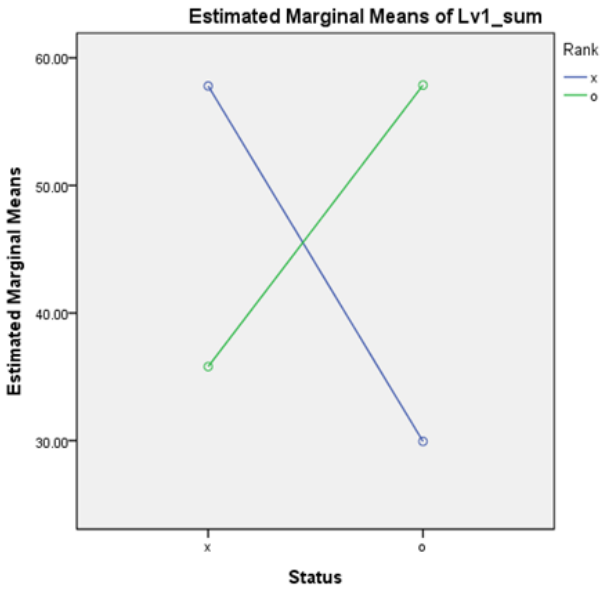

Figure 8. Level 1 Task Interaction effects

As a results of interaction effect, to examine where the significant dif ference among variables is, a simple effects tests were performed via Pai rwise comparisons. (Table 7), (Table 8) it reported significant showing st atus report (F(30) = 5.913, p = 0.018), and reported significant non-show ing leaderboard (F(30) = 5.885 , p = 0.019).

Univariate Tests							
Dependent Variable:Lv1_sum							
Rank		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
x	Contrast	5824.133	1	5824.133	5.885	0.019	0.095
	Error	55425.467	56	989.740			
o	Contrast	3652.033	1	3652.033	3.690	0.060	0.062
	Error	55425.467	56	989.740			

Table 7. Pairwise comparisons compare with Rank(leaderboard)

Univariate Tests							
Dependent Variable:Lv1_sum							
Status		Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
x	Contrast	3630.000	1	3630.000	3.668	0.061	0.061
	Error	55425.467	56	989.740			
o	Contrast	5852.033	1	5852.033	5.913	0.018	0.096
	Error	55425.467	56	989.740			

Table 8. Pairwise comparisons compare with Status

5-2-2. Level 2 Task

Level 2 task performance (M = 113.23, SD = 81.68674) reported marginally significant main effect of leaderboard (F(60) = 3.036, p = 0.087)

Tests of Between-Subjects Effects					
Dependent Variable:Lv2_sum					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	29738.733	3	9912.911	1.525	0.218
Intercept	769307.267	1	769307.267	118.371	0.000
Status	8449.067	1	8449.067	1.300	0.259
Rank	19729.067	1	19729.067	3.036	0.087
Status * Rank	1560.600	1	1560.600	0.240	0.626

Error	363952.000	56	6499.143		
Total	1162998.000	60			
Corrected Total	393690.733	59			

Table 9. Level 2 Task between-subjects effects

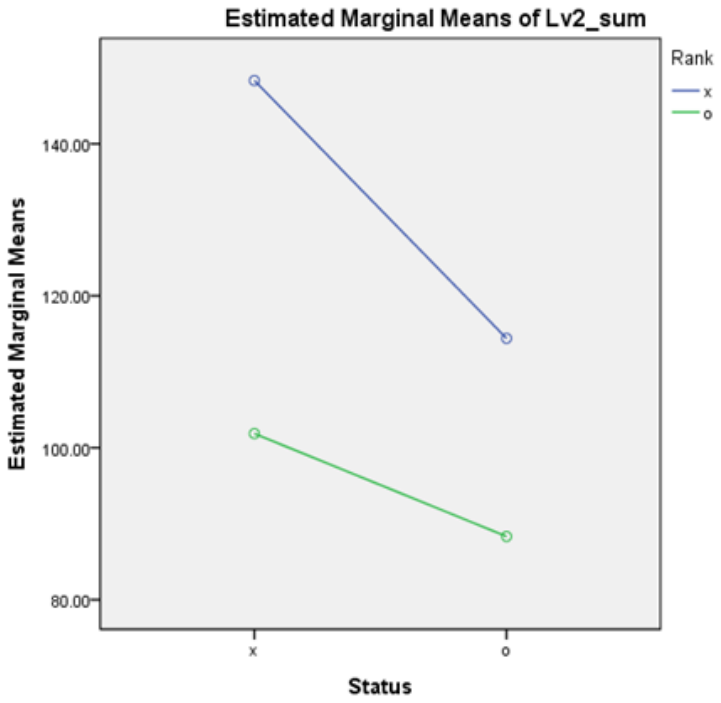

Figure 9. Level 2 Task between-subjects graph

5-3. Moderating Effect

When leaderboard variable affect interest/ enjoyment in intrinsic moti vation sub scales, it is significant that extraversion factor has moderating

effect. (R-sq = 0.1809, F(60) = 4.1213, p = 0.0104) (Table 10), (Figure 10) we analysed moderator effect via PROCESS in SPSS (Hayes, 2013), s et bootstrap 10000. Bootstrapping has been suggested as a method of est imating the sampling distributions of a moderated mediation model in orde r to generate confidence intervals (Preacher et al., 2007).

Moderator PROCESS						
R	R-sq	MSE	F	df1	df2	p
0.4253	0.1809	20.8726	4.1213	3.0000	56.0000	0.0104

Model						
	coeff	se	t	p	LLCI	ULCI
constant	25.4458	3.7433	6.7976	0.0000	17.9469	32.9446
Extraversion	0.6191	0.1834	3.3763	0.0013	0.2518	0.9865
Leaderboard	17.1558	6.6190	2.5919	0.0122	3.8962	30.4153
Leaderboard * Extraversion	-0.8186	0.3200	-2.5576	0.0133	-1.4597	-0.1774

Table 10. Moderator effect on PROCESS

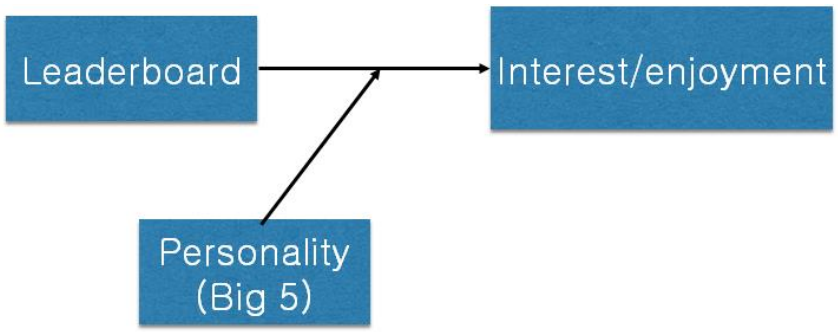

Figure 10. Moderating model in this experiment

5-3. Moderated Mediating Effect

Lastly, we analysed supposed final research model. That hypothesis was through extraversion personality′ s moderating effect, intrinsic motiv ation as mediator, then affect task performance (Figure 11). In this case the effect size was 3.1710, with a 95% confidence interval which did not include zero; that is to say the effect was significantly greater that zero at α = 0.05 (BootLLCI = 0.0303, BootULCI = 10.437) (Table 11). we als o analysed this model via PROCESS in SPSS, set bootstrap 10000 (Hayes , 2013; Preacher et al., 2007).

Mediator				
	Effect	SE(Boot)	BootLLCI	BootULCI
Interest/ Enjoyment	3.1710	2.41769	0.0303	10.437

Table 11. Moderated mediating effect on PROCESS

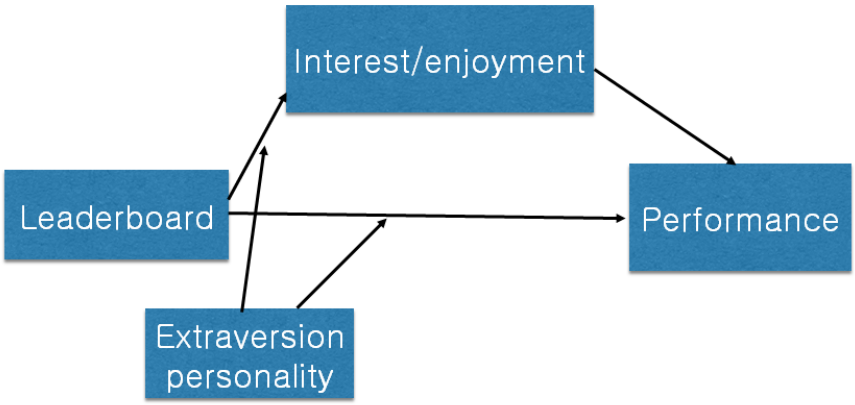

Figure 11. Moderated mediating model in this experiment

6. Discussion

In this study, we discovered that specific gamification design elements affect intrinsic motivation moderating human personality, then it connected cognitive task performance. As a result (5-2 part), we found that when unconsidered extrinsic personality, gamification elements and level1 task performance are not significant any main effect, but there was interaction effect. Showing status reporting of gamification element condition had significant (mean=29.933, p=.018). It is clearly fact because participant didn't have experience using tablet pen task although previous experience about tower of Hanoi. So, they reported better performance on checking their status information. By contrast, it was significant that leaderboard hidden condition. Because participant had never experienced about this exp

erimental leaderboard, they felt pressure via notice of leaderboard conditi on. And we could find another evidence on (5-2-2 part) results, although reported marginally significant, leaderboard variable affected level2 task performance. Participants experienced leaderboard in level1 task, and che ck their records (movements disks, spending time). So, they weakly stimu lated task performance in level2 task condition. However, these ANOVA analysis is hard to explain that gamification elements affect their task per formance. (Hypothesis 1)

In contrast, hypothesis 2 can explain about extraversion personality e ffect. High extraversion person have tendency strong social needs with ot hers, independent variable (leaderboard) was significant to intrinsic motiv ation with moderating effect. Leaderboard was consist of same university students' record with participants. And they could predict their records sharing others. In that information, included one' s name, affiliate, and r ecords. So, they felt interest in intrinsic motivation. Social achievement a nd competition can give strong motivation among highly extravert person. the other way, low extravert person was dropped intrinsic motivation fro m leaderboard element.

Hypothesis 3 can also explain that intrinsic motivation effect about m ediating. However, self efficacy didn' t work on control variable. It may be a matter of scale questionnaire. on the other, it was analysed that ga mification element effects stronger than self efficacy. If they under cognit ive problem solving pressure, self efficacy may affect task performance.

There are not possible to apply social cognitive mechanism of users, under the specific domain environment: education, HR, business, managem ent. Because of other unexpected mixing factor. Ironically, user' s psych

ological mechanism is affected from their own personality. And gamification element targets user′ s inner tendency. If the element go to critical user′ s point, it will make a good feedback loop. Human personality is significant factor for motivating their interest. In this experiment, we could check participant′ s personality during short time survey. Before facing gamification strategy, if user check their personality, it will be useful information to apply effective gamification elements. it is possible to naturally provide their service with gamification strategy, and also user can smoothly motivate their voluntary engagement.

7. Limitation

we can find some limitations in this experiment. firstly, we need to construct strictly in non-game context applying gamification elements. Tower of Hanoi task affect their performance along previous knowledge, and depending on the view, it recognises puzzle format. And we just defined two elements, because of statistical analysis. Defining various gamification elements, independently, it will get richness results. Moreover, all of Big 5 personality factors can affect gamification element, then it can be analysed that interacting other personality factors with gamification element.

8. Future Works

Just as everyone expected, it will develop new services and products. Specially, there will are able to make many products and measure bio-data and life logging, activity data in IoT environments. Only online situation, we could collected limited data, such as clicks counts. However, extended virtual and real world′ s data, we can access various data and then design by motivational affordance. And, It is closely associated with the user′ s personality in IoT environments. Also, we can naturally track user′ s activities pattern. Gamification elements are not only stay to provide gameful experience. More effective direction, human′ s behaviour changes lead to applying gamification elements for intrinsic motivation. Therefore, gamification design elements will be key part of designing service and product on IoT environment.

9. References

A. Domínguez, J. Saenz-de-Navarrete, L. de-Marcos, L. Fernández-Sanz, C. Pagés, and J.-J. Martínez-Herráiz, "Gamifying learning experiences: Practical implications and outcomes", Computers & Education, 63, 2013, pp. 380–392.

Anderson, J. R. (2005). Cognitive psychology and its implications. Mac

millan.

Annett, J. (1969). Feedback and human behaviour: The effects of kno wledge of results, incentives and reinforcement on learning and performa nce.

Antin, J., & Churchill, E. F. (2011). Badges in social media: A social psychological perspective. In CHI 2011 Gamification Workshop Proceeding s (Vancouver, BC, Canada, 2011).

Aparicio, A. F., Vela, F. L. G., Sánchez, J. L. G., & Montes, J. L. I. (2 012, October). Analysis and application of gamification. In Proceedings of the 13th International Conference on Interacción Persona-Ordenador (p. 1 7). ACM.

Bandura, A. (1989). Human agency in social cognitive theory. America n psychologist, 44(9), 1175.

Bartle, R. A. (2004). Designing virtual worlds. New Riders.

Bradway, K. (1964). Jung's psychological types. Journal of Analytical Psychology, 9(2), 129-135.

Burgos, D., Van Nimwegen, C., Van Oostendorp, H., & Koper, R. (200 7). Game-based learning and the role of feedback. A case study.

Bustard, DW, Black, MM, Charles, T., Moore, AA, McKinney, MET, & Moffett, P. (2011). GEL: A generic tool for game-enhanced learning. Pap er presented at the Proceedings of International Conference on Engineeri ng Education, Belfast, UK, iNEER.

Butler, C. (2013). The effect of leaderboard ranking on players′ per

ception of gaming fun. In Online communities and social computing (pp. 129-136). Springer Berlin Heidelberg.

C. Cheong, F. Cheong, and J. Filippou, "Quick Quiz: A Gamified Approach for Enhancing Learning", In Proceedings of Pacific Asia Conference on Information Systems, June 18- 22, 2013, Jeju Island, Korea.

C. Eickhoff, C.G. Harris, A.P. de Vries, and P. Srinivasan, "Quality through flow and immersion: gamifying crowdsourced relevance assessments", In Proceedings of the 35th international ACM SIGIR conference on Research and development in information retrieval, August 12-16, 2012, Portland, Oregon, USA, ACM, pp. 871-880.

Costa, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. Personality and individual differences, 13(6), 653-665.

Deci, E. L., & Flaste, R. (1996). Why we do what we do: Understanding self-motivation. London: Penguin books.

Deci, E. L., & Ryan, R. M. (2002). Overview of self-determination theory: An organismic dialectical perspective. Handbook of self-determination research, 3-33.

Deterding, S. (2011, May). Situated motivational affordances of game elements: A conceptual model. In Gamification: Using Game Design Elements in Non-Gaming Contexts, a workshop at CHI.

Deterding, S. (2012). Gamification: designing for motivation. Interactions, 19(4), 14–17. http://doi.org/10.1145/2212877.2212883

Deterding, S., Khaled, R., Nacke, L. E., & Dixon, D. (2011, May). Gamification: Toward a definition. In CHI 2011 Gamification Workshop Procee

dings (pp. 12-15).

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011, May). Gamification. using game-design elements in non-gaming contexts. In CHI'11 Extended Abstracts on Human Factors in Computing Systems (pp. 2425-2428). ACM.

Fields, T. (2014). Mobile & Social Game Design: Monetization Methods and Mechanics. CRC Press.

Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. New York, NY: Guilford.

J.H. Jung, C. Schneider, and J. Valacich, "Enhancing the motivational affordance of information systems: The effects of real-time performance feedback and goal setting in group collaboration environments", Management Science, 56(4), 2010, pp. 724-742.

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm Shift to the Integrative Big-Five Trait Taxonomy: History, Measurement, and Conceptual Issues. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), Handbook of personality: Theory and research (pp. 114-158). New York, NY: Guilford Press.

Jung, C. G. (1939). The integration of the personality.

Koster, R. (2013). Theory of fun for game design. " O'Reilly Media, Inc.".

Landers, R. N., Bauer, K. N., Callan, R. C., & Armstrong, M. B. (2014). Psychological Theory and the Gamification of Learning. In Gamification

in Education and Business (pp. 165–186). Cham: Springer International Publishing. http://doi.org/10.1007/978-3-319-10208-5_9

M. Montola, T. Nummenmaa, A. Lucero, M. Boberg, and H. Korhonen, "Applying game achievement systems to enhance user experience in a photo sharing service", In Proceedings of the 13th International MindTrek Conference: Everyday Life in the Ubiquitous Era, September 30 - October 2, 2009, Tampere, Finland, ACM, pp. 94-97.], [Nicholson, S. (2012). A user-centered theoretical framework for meaningful gamification. Games+ Learning+ Society.

Maslow, A. H., Frager, R., & Cox, R. (1970). Motivation and personality (Vol. 2). J. Fadiman, & C. McReynolds (Eds.). New York: Harper & Row.

McCrae, R. R., & Costa Jr, P. T. (1997). Personality trait structure as a human universal. American psychologist, 52(5), 509.

McCrae, R. R., Costa, P. T., Del Pilar, G. H., Rolland, J. P., & Parker, W. D. (1998). Cross-Cultural Assessment of the Five-Factor Model The Revised NEO Personality Inventory. Journal of Cross-Cultural Psychology, 29(1), 171-188.

Nettle, D. (2007). Personality: What makes you the way you are. Oxford University Press.

Nicholson, S. (2012). A user-centered theoretical framework for meaningful gamification. Games+ Learning+ Society.

Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. Journal of

educational psychology, 86(2), 193.

Park, S. J. (2006). The Study of the Interrelations between Game Components and Flow. In The Korea Contents Association 2006 Fall General Conference Dissertation Collection (Vol. 4, No. 2).

Patchin, J. W., & Hinduja, S. (2010). Trends in online social networking: Adolescent use of MySpace over time. New Media & Society.],[Järvinen, A. (2009, August). Game design for social networks: interaction design for playful dispositions. In Proceedings of the 2009 ACM SIGGRAPH Symposium on Video Games (pp. 95-102). ACM.

Pavlov, I. P. (1897/1902). The work of the digestive glands. London: Griffin.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. Multivariate behavioral research, 42(1), 185-227.

R. Farzan, J.M. DiMicco, D.R. Millen, B. Brownholtz, W. Geyer, and C. Dugan, "When the experiment is over: Deploying an incentive system to all the users" , In Symposium on Persuasive Technology, 2008.

Rigby, S., & Ryan, R. M. (2011). Glued to Games: How Video Games Draw Us In and Hold Us Spellbound: How Video Games Draw Us In and Hold Us Spellbound. ABC-CLIO.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. Contemporary educational psychology, 25(1), 54-67.

Sailer, M., Hense, J., Mandl, H., & Klevers, M. (2013). Psychological

Perspectives on Motivation through Gamification Interaction Design and Architecture(s) Journal(19), 28-37.

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. International Journal of Human-Computer Studies, 74, 14-31.

Skinner, B. F. (1938). The Behavior of organisms: An experimental analysis. New York: Appleton-Century.

Uskov, A., & Sekar, B. (2014, June). Serious games, gamification and game engines to support framework activities in engineering: Case studies, analysis, classifications and outcomes. In Electro/Information Technology (EIT), 2014 IEEE International Conference on (pp. 618-623). IEEE.

김아영, & 박인영. (2001). 학업적 자기효능감 척도 개발 및 타당화 연구. 교육학연구, 39(1), 95-123.

국문요약

게임화 요소를 이용한 인간의 내재적 동기에 대한 심리학적 접근

사용자의 자발적인 참여와 동기를 유발해야하는 제품이나 서비스를 설계하는데 있어서, "게임화" 라는 기법은 매우 유용하게 활용 될 수 있다. 광범위한 산업계에서 사용자와 사용자들 간의 상호작용과 참여 활동을 높이는 방식으로 다양하게 시도되고 있다. 한편에서는, 게임화 기법의 적용이 인간 내면의 심리적 동기를 변화시키는지에 대한 심리학적 가설들이 제기되고 있다. 또한, 다양하게 시도되는 게임화 요소들의 사용이 사용자의 동기에 의도한대로 영향을 주지 못하거나, 오히려 동기를 떨어뜨리는 무의미한 요소가 되는 사례도 존재한다. 그러한 이유 중 하나는 게임화 요소들의 적용이 어떤 과정을 거쳐 인간의 심리적 작동들에 영향을 미치는지에 대한 이해가 부족하기 때문일 것이다. 본 실험연구에서 사용한 하노이탑은 인지적 문제 해결 과정을 밝히기 위해 주로 사용하는 검증된 과제로서, 그것을 바탕으로 게임화 요소들 중 게임 인터페이스 디자인 패턴 2가지를 독립변인으로 도입하여 피험자의 외향적 성격 요소에 따라 수행 능력과 동기에 영향을 주는지 파악하고자 하였다. 이를 통해 독립변인인 순위표 요소가 피험자의 외향성 성격 정도와 과제에 대한 내재적 동기가 조절된 중재(mode

rated mediation)효과를 주어 수행 성과에 영향을 주는 것으로 밝혀졌다. 결과적으로 사용자의 동기가 인간의 5요인 성격적 특성과 영향을 주고, 받을 것이라는 예측을 할 수 있었고, 향후 새로운 제품이나 서비스를 설계하는데 게임화 디자인 요소들이 어떻게 섬세하게 적용되어야 하는지에 대한 필요성을 이해하는데 도움을 줄 수 있다고 생각한다.