The relationship between playing video games on mobile devices and well-being in a sample of Japanese adolescents and adults

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Abstract

Objectives: In this study, I have tested the following hypothesis: Playing a mobile game for an appropriate length of time results in a stronger sense of happiness (well-being) than not playing at all.

Methods: I used the questionnaires data from 5000 participants. Well-being was measured using the three following indicators: the Positive and Negative Affect Schedule, satisfaction with life scale, and four-dimensional happiness indicator. I constructed a mathematical model for determining individual well-being. The variable of game playtime was split into two parts, and the split points were selected as the most applicable using Akaike Information Criterion to search for the appropriate length of time spent playing the mobile game.

Results: The results showed that mobile games were significantly and positively correlated with both positive and negative emotions. Playing a mobile game for 2 h or less each day was associated with a significantly higher satisfaction with life than not playing one at all. Further, well-being was significantly higher when there were no time limitations with regard to "relationship and gratitude" and when playing a mobile game for no more than 1.5 h each day with regard to "independence and my own pace" as compared to not playing one at all. Playing a mobile game for more than 2 h each day, however, resulted in lower well-being with regard to "self-realization and growth" and "positive frame of mind and optimism" as compared to not playing one at all.

Conclusion: These findings indicate that playing a mobile game for no longer than 1.5 h each day results in higher well-being than not playing one at all. Conversely, playing a mobile game for more than 2 h each day significantly lowers some aspects of happiness but does not significantly affect the overall satisfaction with life.

Keywords

Mobile games, well-being, satisfaction with life, consumer behavior, video games

Introduction

The purpose of this study is to examine the relationship between time spent playing mobile games and well-being to find the most appropriate approach to playing. Mobile games are video games that are played on mobile devices such as smartphones and tablets. It is a new type of video game, but in recent years it has rapidly penetrated the society and expanded its market. Indeed, a 2018 survey conducted by the Newzoo market research company estimated that the mobile gaming market was worth 70.3 billion dollars, thus accounting for more than half of the total of App market. This continual growth is especially significant in Japan, where the mobile gaming market exceeded 1.2 trillion yen in FY 2017. The sale of home gaming software, however, remained at 244 billion yen.[1]

Mobile games differ from console games in many ways, so they have opened up new markets. Casual players with low gaming interests and who were not inclined to purchase

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gaming-specific hardware were easily attracted to mobile games, thus contributing to the success of the mobile games business model.[2] In addition, the vast majority of mobile gamers were casual players and they were thus prioritized in the business model.[3] It is empirically found that only a very small substitution effect moving from console games to mobile games, thus showing that mobile gaming has developed into an entirely new market.[4]

With the rapid increase in the number of people playing mobile games as described above, various studies show the negative impact of mobile and video games on people. It is pointed out that there are structural similarities between mobile-puzzle gaming dependency and gambling addiction, thus suggesting that excessive use adversely impacts the overall quality of life.[5] Other studies have shown the addictiveness of mobile games and the negative effects of excessive use. A study on the popular online Candy Crush Saga game indicated that many players would leave their children at school or abandon household chores while playing.[6] Chen and Leung[7] empirically showed a positive correlation between feelings of isolation and mobile gaming addiction, thereby warning that social isolation could result from excessive commitment to the digital world.

Even before the arrival of mobile games, many studies had already focused on online gaming with regard to dependency and the adverse effects on life. Griffith, Davies, and Chappell investigated the elements that gamers sacrificed to continue their online gaming habits by distributing questionnaires with the multiplayer online role-playing game (MMORPG) EverQuest. Results showed that 80% of all responding players had sacrificed some element of their daily lives to continue playing. More specifically, 20.8% of all responding adult players had sacrificed relationships with family, friends, and partners, while 22.7% of all responding non-adult players had sacrificed elements of their work or studies. Similar negative effects have been shown in various studies.[8] The studies showed that a positive correlation between online gaming addiction and aggressiveness/narcistic personality in addition to a negative correlation between addiction and self-management capacity,[9] found a positive correlation not only between the length of time spent playing online games and symptoms of Internet addiction, but also with depression, psychosomatic symptoms, and pain scores,[10] and a strong correlation between online gaming dependency and somatic pain.[11] Furthermore, a questionnaire survey among players of both MMORPG and offline video games showed that the length of time spent playing was much longer for the online versions.[12]

However, some studies have also found that gaming has positive impacts on the people. For example, several have argued that action games exert positive influences on both the perceptive and cognitive skills. Playing an action game for 10 days helped improve visual attention, spatial range, and parallel processing skills.[13] Comparing players of an action game with players of other game types, results indicated that those playing the action game exhibited accelerated learning skills.[14] Playing an action game could improve attention and spatial cognition as well as perceptive faculties.[15] Colzato et al.[16] conducted an N-back task (a continuous performance task to investigate brain activity) in which FPS players performed better. Further, First-person shooter (FPS) players more efficiently allocated attentive resources and improved working memory in the prefrontal area by removing inappropriate information.[17]

Positive psychological and educational effects have also been shown. Casual video games could encourage positive feelings.[18] Middle school students who learned with a mobile game, which is designed to encourage active learning and knowledge about Medieval Amsterdam, acquired more knowledge.[19] Playing games during childhood can aid in the development of cooperative, social, and cognitive skills.[20] Video games benefit children's intelligence.[21]

Furthermore, a small number of studies suggested the existence of optimal video game-playing time. Allahverdipour et al.[22] analyzed the relationship between video game playing and mental health in the Islamic Republic of Iran. The study showed that both non-gamers and excessive gamers overall reported poorer mental health compared to low or moderate players. Przybylski conducted an empirical analysis of youth aged 10–15 years in the United Kingdom. The results showed that low levels (<1 h daily) as well as high levels (>3 h daily) of game engagement were linked to key indicators of psychosocial adjustment. Low engagement was associated with higher life satisfaction and prosocial behavior and lower externalizing and internalizing problems, whereas the opposite was found for high levels of play.[23]

The current literature indicates that many studies have identified both negative and positive aspects to video gaming. For studies finding negative aspects, much of the focus has been on excessive play (addiction), while those finding positive aspects have indicated that appropriate playing times may result in beneficial skill enhancements. It has been suggested that social media use similarly has both a positive and a negative impact on self-esteem, and that the impact varies from person to person.[24]

Considering those studies, certain lengths of playing time can result in various benefits, while excessive play entails negative consequences. Many of these preceding studies have focused on linear or comparative analyses involving either individuals who play excessively or those who play for appropriate amounts of time. If overplaying video games produces negative effects and playing them appropriately produces positive effects, an appropriate playing time may exist. A few studies[22,23] suggested it is close to that. Even in those studies, however, the following points were not made: First, they classified the game-playing time from the beginning and did not explore the appropriate length of time spent playing the mobile game. Second, they focused on traditional video games and not on mobile games, which have become mainstream in recent years.

Based on the above, this study developed the following hypothesis focusing on the rapidly growing mobile gaming industry:

Playing a mobile game for an appropriate length of time results in a stronger sense of well-being than not playing at all.

A distinctive feature of this hypothesis is its focus on well-being. If mobile game playing results in increased physical ability, positive emotional development and social skills, such as those shown in previous studies, it may also have a positive impact on people's overall well-being. On the other hand, if mobile game playing results in sacrificing some element of daily life, addiction, and falling into depression, such as those shown in previous studies, it may also have a negative impact on people's overall well-being. In light of the above, it is also important to examine the relationship between mobile games and society and people in terms of its impact on overall well-being. In fact, the impact of entertainment on people's well-being is even more evident in a study.[25] For these reasons, this study examined the overall impact of mobile gaming on well-being.

The novelty of this study is threefold: (1) to explore the appropriate length of time spent playing the mobile game; (2) to analyze the relationship between overall well-being and mobile game playing time, rather than people's abilities; and (3) to focus on mobile games, a rapidly growing market in recent years.

The rest of this article proceeds as follows. Section "Introduction" explains the questionnaire survey and how well-being (an important variable in this study) was measured, while Section "Methods" describes the estimation model, Section "Results" presents the results, Section "Discussion" describes the contributions of this study and the relationship between previous studies and this study and Section "Conclusion" presents the conclusion.

Methods

This study used data collected through an online questionnaire survey conducted in Japan. It was conducted from May 24 to June 1, 2019. Survey subjects were drawn from monitors registered with MyVoice Communications, Inc. (an Internet research company) and its affiliates. Participants were between 15 and 69 years who lived in Japan. The reasons for targeting people of a wide range of ages are that they play mobile games at least in Japan. According to a survey by the Japan Online Game Association, the playing population is roughly evenly split from late teens to 50s, with an average age of about 40 years.

The sample was obtained through stratified sampling in proportion to the Japanese populational ratios of both gender and generation. More specifically, I determined the gender

Table 1. Sample size.

Age group	Male	Female	Total
15–19	179	170	349
20–24	195	183	378
25–29	190	179	368
30–34	207	200	407
35–39	229	223	453
40–44	268	261	529
45–49	292	286	577
50–54	252	250	503
55–59	226	227	453
60–64	221	227	448
65–69	259	276	535
Total	2518	2482	5000

and generational population ratios in 5-year intervals based on an estimate published by the Ministry of Public Management, Home Affairs, Posts and Telecommunications, and extracted samples accordingly. I randomly sent the questionnaire to obtain responses so that the target number of responses was 5000 and the population ratio by sex and age was the same as in Japan. Further, those with extremely short response times (less than 1 min) were excluded from the sample. All subjects have been informed about the study before participating. They were also explained that if they answered the questionnaire, it would suggest they have consented to its contents. The number of samples by gender and age is shown in Table 1.

What is important in this study is the measure of well-being. Since the 1970s, accumulated research on the concept of well-being has made it clear that income and well-being do not necessarily correlate.[20,26] Recent research into the factors that influence well-being has empirically determined that not only economic wealth, but interpersonal resources such as friendship and partnership also increase well-being.[27] There is a U-shaped relationship between psychological well-being and age.[28] The use of social platforms such as Facebook tend to reduce subjective well-being among young people.[29] Some research has also proposed the use of four interacting scales comprised of mental, physical, social, and psychological well-being as an overall approach to measuring subjective well-being.[30]

In this study, I used the following three indicators to examine the impact of video gaming on well-being:

Emotional well-being (PANAS)

Research into subjective well-being and how and why people feel it is typically conducted from two perspectives (i.e., emotional responses and cognitive judgment).[31] Here, emotions are known to exert significant influences on well-being.[32] In other words, positive (as opposed to negative) emotions enhance one's sense of well-being. Many argue

that this concept is suitable for measuring short-term well-being (e.g., over a few months). It is thus referred to in these studies as emotional well-being.[33,34]

There are many ways to measure emotional well-being. This study, however, used the Japanese version[35] of the Positive and Negative Affect Schedule (PANAS),[33] which is widely used throughout the world. For both positive and negative emotions, this study used eight items that respondents assessed on a six-point scale (1=not applicable at all, 6=very applicable) to determine the total score. To eliminate bias, 16 items were randomly presented to each respondent. Details on the questionnaire can be found in Supplemental Appendix 1.

Satisfaction with life (research by the Japanese Cabinet Office)

With regard to emotional well-being, the only relationship I could analyze was that between emotion and game playing. That is, I could not analyze its relationship with life in general. I expanded my analysis of this relationship by asking a similar question about satisfaction with life to the one asked in the "opinion poll survey on national life" conducted by the Japanese Cabinet Office of Japan. Specifically, respondents were asked the following: "Overall, to what extent are you satisfied with your life at present? Please choose the answer that is closest to your feelings." This was answered on a five-point scale (1=dissatisfied, 5=satisfied); the number of each chosen response was then converted into a score. More details are available in Supplemental Appendix 2.

Four-dimensional indicator of subjective wellbeing

Previous studies have found that several kinds of well-being exist. To accurately investigate which kinds were influenced by gaming, I thus used the four-dimensional indicator of subjective well-being constructed by Maeno,[36] which is widely used in Japan. The indicator is comprised of four factors (i.e., self-realization and growth, relationships and gratitude, positive frame of mind and optimism, and independence and my own pace). Each factor contains four subscales. For each, respondents were asked to rate statements such as "I am capable" along a seven-point scale (1=do not think so at all, 7=I very much think so). Total scores were thus determined and used as subjective well-being indicators. As abovementioned, this indicator is widely used to measure well-being in Japan. For example, it has been used in a questionnaire survey to determine the relationship between environmental loads and well-being,[37] a study based on a project designed to revitalize local industry (participation in the project and well-being attributes),[38] and a study among students that investigated instances of national well-being that could not be explained by GDP or income.[39] Details are available in Supplemental Appendix 3.

I have thus far reviewed the various methods of measuring well-being. Many previous studies have revealed several factors that influence well-being. This study used some of these as control variables to quantitatively test the relationship between the length of time spent playing mobile games and well-being (i.e., a regression analysis). First, previous research has determined the high likelihood that income is correlated with well-being.[26] This study used household income as a variable. Next, it is well-known that both friendships and partnerships influence well-being.[27] I thus added the three variables of marital status (the dummy variable that is 1 if married), number of friends, and satisfaction with social relationships. The number of friends was surveyed on a 9-point scale (1=0, 2=approximately 3 or less, 3=approximately 5, 4=approximately 10, 5=approximately 15, 6=approximately 20, 7=approximately 30, 8=approximately 40, 9=approximately 50 or more). I determined respondent satisfaction with social relationships based on their evaluations of "overall relationship with everyone: friends, acquaintances, work colleagues, classmates, and partners" according to a five-point scale (1=not satisfied at all, 5=very satisfied).

Many previous studies have analyzed well-being; one such study of 5000 adult males in Sweden showed that health influenced well-being.[40] I added degree of health as a variable that represented respondents' subjective evaluations of their health according to a five-point scale (1=not healthy at all, 5=very healthy).

Recent research has found that self-determination influences well-being. Self-determination was important in motivation, which in turn influences well-being.[41] Self-esteem increased well-being.[42] Building on these studies, Nishimura and Yagi empirically analyzed the relationship between self-determination and well-being, thereby finding a strong correlation.[43] As such, this study also used self-determination as a variable. Following this study,[43] self-determination was operationalized according to respondents' evaluation of the following: "About choices that have been important in life, such as going to university and finding a job." This was answered according to a five-point scale (1=it was not my wish at all but I made that decision because others recommended it, 2=it was not exactly what I wanted but I made that decision because others recommended it, 3=neither, 4=it was my own decision to a certain extent, and 5=I made the decision based on my wishes). Responses were used as direct indicators.

Following the above, the analytical model contained six total variables (marital status (dummy variable)), household income (10,000 yen), health (1–5), number of friends (persons), social relationships (1–5), and self-determination (1–5)). Further, the basic attributes of gender and age were added. In addition, for mobile game playing time, I surveyed the average daily playing time per day in the last week on an 8-point scale (1=not playing at all, 2=less than approximately 15 min per day, 3=approximately 30 min per day, 4=approximately an hour per day, 5=approximately 1.5 h per day, 6=approximately 2 h per day, 7=approximately 3 h per day, 8=more than approximately 4 h per day).

Table 2. Basic statistics.

Category	Variables	M	SD	Range
Emotional happiness	Negative emotions	23.83	7.65	40.00
	Positive emotions	23.51	8.65	40.00
Satisfaction with life	Satisfaction with life	3.36	1.13	4.00
Four dimension of happiness indicator	Self-realization and growth	15.28	4.79	24.00
	Relationship and gratitude	19.52	4.51	24.00
	Positive frame of mind and optimism	15.64	4.52	24.00
	Independence and my own pace	18.19	3.66	24.00
Control variables	Male	0.50	0.50	1.00
	Age	43.93	15.18	54.00
	Age^2	2160.21	1325.42	4536.00
	Married	0.50	0.50	1.00
	Household income (million yen)	5.97	4.35	25.00
	Health (1–5)	3.39	0.98	4.00
	The number of friends (persons)	8.11	10.68	60.00
	Social relationship (1–5)	3.38	0.91	4.00
	Self-determination (1–5)	4.15	0.98	4.00

Table 3. Frequency for length of time spent playing mobile games.

The length of time spent on playing the mobile game	N	Relative N
0 min (not playing at all)	3065	0.613
About 15 min or less	519	0.104
About 30 min	529	0.106
About 1 h	422	0.084
About 1.5 h	141	0.028
About 2 h	152	0.030
About 3 h	89	0.018
About 4 h or more	83	0.017
Total	5000	1

Table 2 presents the basic statistics. Table 3 shows the frequency for length of time spent playing the mobile games. Here, respondents were asked to choose one of eight options concerning the average length of time they spent playing mobile games each day over the past week. Table 3 shows that most did not play mobile games at all; the longer the length of time spent playing mobile games, the fewer the respondents. However, 83 respondents spent 4 h or more playing the game.

I then examined the relationship between well-being and the length of time spent playing mobile games according to the retrieved data. The above hypothesis posited that those who played mobile games for appropriate lengths of time would feel happier than those who do not play at all, however, those who played mobile games for excessive amounts of time should feel less happy.

I examined this issue using the "satisfaction with life" variable, which was designed to capture the overall picture among the abovementioned well-being indicators; I plotted the relationship between the length of time spent playing mobile games and well-being in Figure 1. Figure 1 shows the

mean and the range of standard deviations. Those who played mobile games for approximately 2 h or less were more satisfied with life than those who did not play at all. As the hypothesis suggested, playing mobile games for a certain duration positively influenced well-being.

Because well-being is influenced by a variety of factors, I needed to analyze its relationship with the length of time spent playing mobile games after controlling for factors (e.g., gender, age, income, etc.). Section "Results" discusses how I quantitatively tested the relationship between the length of time spent playing mobile games and well-being through a regression analysis using the well-being determination model.

The following formula (1) represents the model used in this study. Here, it was assumed that length of time spent playing mobile games and other control variables influenced the various indicators of well-being discussed above:

$$well_i = \alpha + \beta Play_i + \gamma Characteristics_i + \varepsilon_i \qquad (1)$$

$well_i$ represents each indicator of well-being for individual i, $play_i$ represents the vector of the length of time individual i spends playing the mobile games, $Characteristics_i$ represents the attributes vector of individual i, $\alpha, \beta, and \gamma$ represent the parameters of each vector, and ε_i represents an error term. The attributes vector contained: gender, age, marital status (dummy variable), household income (10,000 yen), health (1–5), number of friends (persons), social relationships (1–5), and self-determination (1–5). Incidentally, as Blanchflower and Oswald[28] demonstrated a U-shaped relationship between well-being and age, I add squared ages as a variable.

This study was particularly interested in vector $Play_i$ and its parameter β. As discussed earlier, a simple linear regression
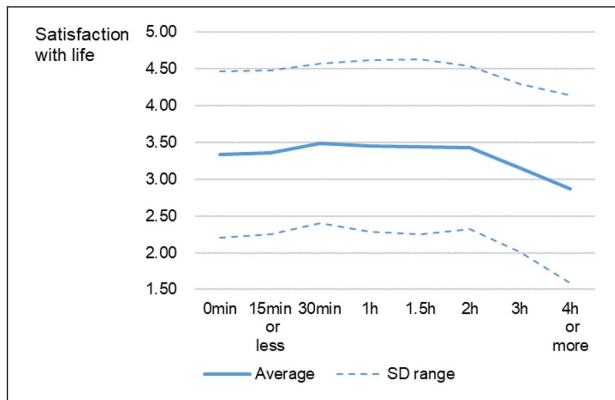
Figure. 1. The relationship between length of time spent playing mobile games and satisfaction with life.

Figure. 2. AIC: Positive emotions.

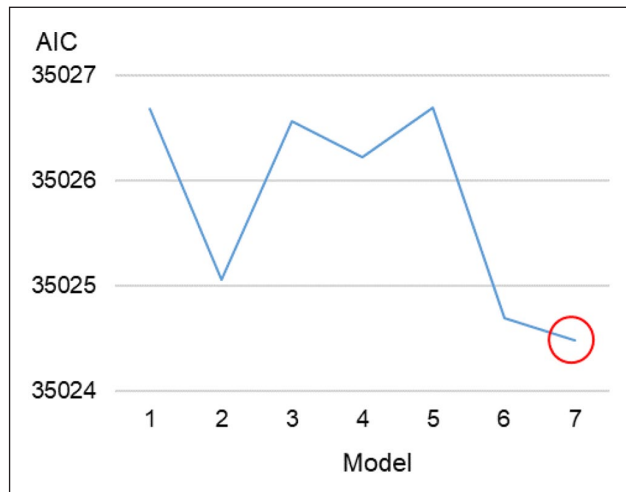**Figure. 3.** AIC: Negative emotions.

would be unable to obtain a correct implication following the hypothesis. On the other hand, this does not suggest that a quadratic function type would fit (Figure 1). Having set those who did not play the mobile games as the standard, $Play_i$ was operationalized as a vector for a dummy variable dividing the length of time spent playing the mobile games up to a certain point and above. For example, if the hypothesis posited that up to 2 h of mobile gaming would enhance well-being, then two blocks would be created (i.e., "From about 15 min or less to about 2 h" and "about 3 h or more"). A such, $Play_i$ was the vector of each dummy variable.

I, however, could not determine the appropriate cutoff point in terms of the length of time spent playing the game until completing the analysis. I thus constructed a model for all cases in which responses of "about 15 min or less," "about 1 h," "about 1.5 h," "about 2 h," "about 3 h," and "4 h or more" were divided into two and subjected to a regression analysis. I then determined a cutoff point by selecting the best-fitting model in reference to the information criterion. For this, I followed the Akaike Information Criterion (AIC).[44] Because it was also plausible that both shorter and longer lengths of mobile gaming would similarly influence well-being, I conducted a regression analysis using a model with an undivided dummy variable. I therefore tested the following seven models in reference to the AIC. Here, $play\,(\leq x)_i$ stands for individual i playing mobile games for x min per day:

- Model 1: $well_i = \alpha + \beta_1 play(\leq 15)_i + \beta_2 play(\geq 30)_i$
$$+\gamma Characteristics_i + \varepsilon_i$$

- Model 2: $well_i = \alpha + \beta_1 play(\leq 30)_i + \beta_2 play(\geq 60)_i$
$$+\gamma Characteristics_i + \varepsilon_i$$

- Model 3: $well_i = \alpha + \beta_1 play(\leq 60)_i + \beta_2 play(\geq 90)_i$
$$+\gamma Characteristics_i + \varepsilon_i$$

- Model 4: $well_i = \alpha + \beta_1 play(\leq 90)_i + \beta_2 play(\geq 120)_i$
$$+\gamma Characteristics_i + \varepsilon_i$$

- Model5: $well_i = \alpha + \beta_1 play(\leq 120)_i + \beta_2 play(\geq 180)_i$
$$+\gamma Characteristics_i + \varepsilon_i$$

- Model6: $well_i = \alpha + \beta_1 play(\leq 180)_i + \beta_2 play(\geq 240)_i$
$$+\gamma Characteristics_i + \varepsilon_i$$

- Model 7: $well_i = \alpha + \beta_1 play(\leq 240)_i$
$$+\gamma Characteristics_i + \varepsilon_i$$

Results

Following the above, I estimated formula (1) using the least square method with seven indicators for each of three types. First of all, I needed to select the best-fitting model from the seven shown above, so I estimated models 1–7 and AIC (shown as graphs in Figures 2–8).

Tables 4 and 5 show the results of estimating the selected models due to their minimum AICs. Table 3 specifically
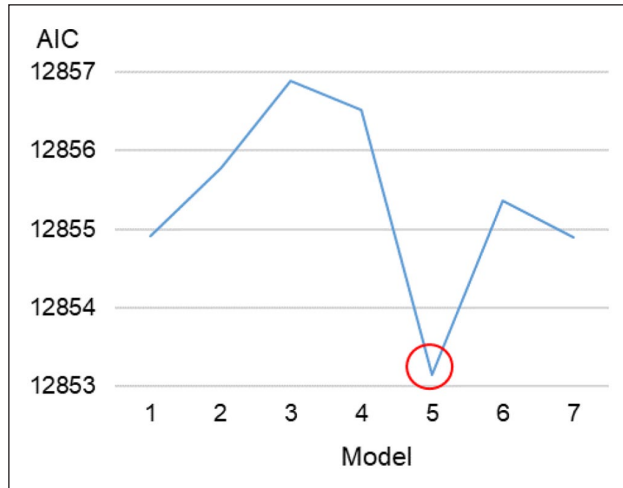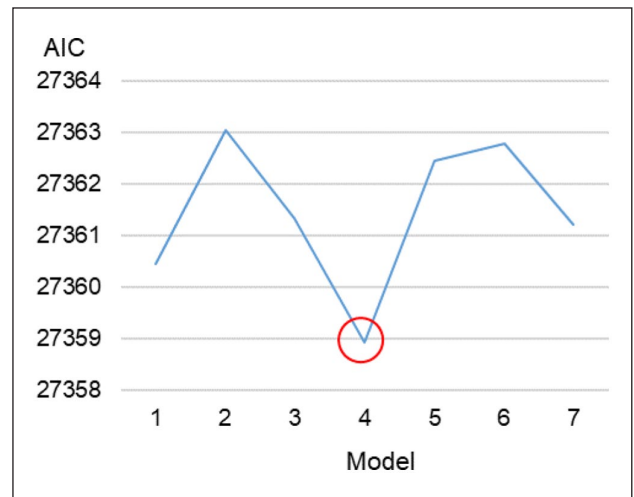
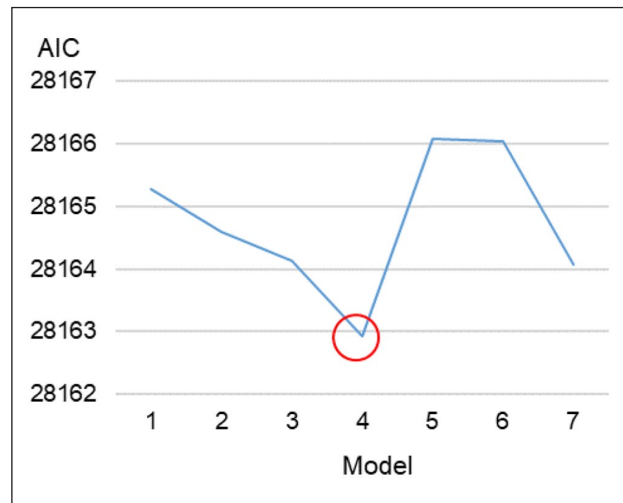**Figure. 4.** AIC: Satisfaction with life.

Figure. 5. AIC: Four dimensions of well-being (self-realization and growth).

Figure. 6. AIC: Four dimensions of well-being (relationship and gratitude).

Figure. 7. AIC: Four dimensions of well-being (positive frame of mind and optimism).

Figure. 8. AIC: Four dimensions of well-being (independence and my own pace).
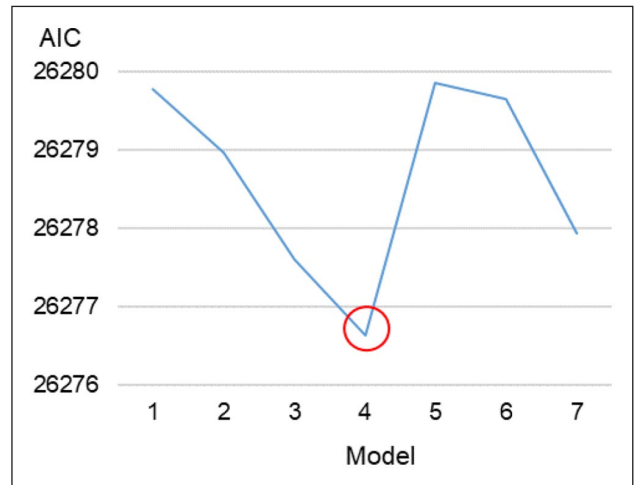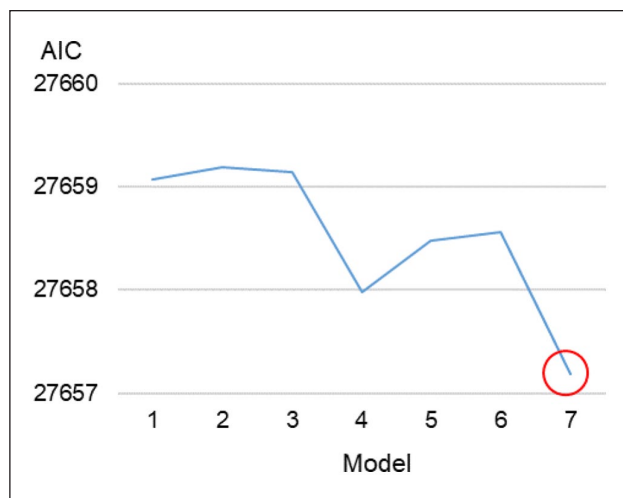
shows the estimation results for emotional well-being and satisfaction with life, while Table 5 shows the estimation results for the four-dimensional well-being indicator. Column ⟨1⟩ in Table 4 shows the estimation results for the positive emotions of emotional well-being, while Column ⟨2⟩ shows negative emotions, and Column ⟨3⟩ shows satisfaction with life. Column ⟨4⟩ in Table 5 shows the estimation results for self-realization and growth, while Column ⟨5⟩ shows relationship and gratitude, Column ⟨6⟩ shows positive frame of mind and optimism, and Column ⟨7⟩ shows independence and my own pace. For all results, p was determined based on heteroscedastic and consistent standard error.[45] Estimations were conducted using statistical package STATA; values that were significant at 5% are marked with asterisks in both tables.

First, I can confirm that many of the control variables were significant in all estimations. For example, Column ⟨3⟩

Table 4. Results for emotional well-being and satisfaction with life.

	⟨1⟩		⟨2⟩		⟨3⟩	
	Positive emotions		Negative emotions		Satisfaction with life	
	β	p	β	p	β	p
15 min or less	−0.177	0.61	0.729	0.00**	0.060	0.03*
30 min	0.597	0.02*				
1 h						
1.5 h						
2 h						
3 h					−0.075	0.34
4 h or more						
Male	1.505	0.00**	0.937	0.00**	−0.123	0.00**
Age	−0.098	0.02*	−0.002	0.96	−0.036	0.00**
Age^2	0.001	0.02*	−0.001	0.02*	0.000	0.00**
Married	0.859	0.00**	0.658	0.01*	0.249	0.00**
Household income (million yen)	0.128	0.00**	−0.047	0.10	0.020	0.00**
Health (1–5)	1.182	0.00**	−1.467	0.00**	0.277	0.00**
The number of friends (persons)	0.070	0.00**	−0.003	0.79	0.004	0.00**
Social relationship (1–5)	1.556	0.00**	−1.738	0.00**	0.513	0.00**
Self-determination (1–5)	0.351	0.00**	−0.694	0.00**	0.093	0.00**
Constant	12.339	0.00**	39.246	0.00**	0.765	0.00**
N	5000		5000		5000	
R^2	0.1393		0.1408		0.4061	

p is worked out from heteroscedastic and consistent standard error.
*$p < 0.05$. **$p < 0.01$.

Table 5. Results for the four-dimensional well-being indicator.

	⟨4⟩		⟨5⟩		⟨6⟩		⟨7⟩	
	Self-realization and growth		Relationship and gratitude		Positive frame of mind and optimism		Independence and my own pace	
	β	p	β	p	β	p	β	p
15 min or less	−0.119	0.37	0.358	0.00**	0.076	0.53	0.198	0.07
30 min								
1 h								
1.5 h								
2 h	−0.558	0.03*			−0.396	0.10	−0.174	0.43
3 h								
4 h or more								
Male	0.465	0.00**	−1.308	0.00**	0.288	0.01**	−0.068	0.47
Age	−0.021	0.38	−0.066	0.00**	−0.052	0.02*	0.032	0.12
Age^2	0.000	0.13	0.001	0.00**	0.001	0.00**	0.000	0.52
Married	0.651	0.00**	0.583	0.00**	0.547	0.00**	−0.306	0.01**
Household income (million yen)	0.103	0.00**	0.030	0.02*	0.071	0.00**	0.019	0.11
Health (1–5)	0.911	0.00**	0.386	0.00**	0.933	0.00**	0.411	0.00**
The number of friends (persons)	0.061	0.00**	0.067	0.00**	0.054	0.00**	0.025	0.00**
Social relationship (1–5)	1.508	0.00**	1.555	0.00**	1.582	0.00**	0.944	0.00**
Self-determination (1–5)	0.614	0.00**	0.447	0.00**	0.523	0.00**	0.469	0.00**
Constant	2.992	0.00**	11.349	0.00**	3.937	0.00**	9.772	0.00**
n	5000		5000		5000		5000	
R^2	0.2909		0.2764		0.3211		0.1673	

p is worked out from heteroscedastic and consistent standard error.
*$p < 0.05$. **$p < 0.01$.

shows satisfaction with life (Table 4). Here, satisfaction with life is low for males and age has a U-shaped relationship with satisfaction with life (high among the young and elderly); satisfaction with life is also higher among the married. Satisfaction with life becomes higher as income, and/or degree of health increases. Further, satisfaction with life becomes higher when respondents have more friends, are satisfied with their relationships, and when self-determination is enhanced. These findings support those of previous studies,[27,28] suggesting overall model validity.

I then determined the coefficients for the length of time spent playing the mobile games. Columns ⟨1⟩ and ⟨2⟩(related to emotional well-being) clearly indicate that the results for both positive and negative emotions did not support the hypothesis that "up to a certain amount of time, it decreases, but subsequently decreases." More specifically, if the length of time spent playing the mobile games was "about 30 min or more," then those who played it reported higher emotional well-being than those who do not. For negative emotions, I used an undivided model; there was a tendency for those who played the mobile games to feel happy as a result of any amount of time spent playing.

Following this, the results in Column ⟨3⟩ (Table 4) show satisfaction with life as an overall indicator. Column ⟨3⟩ suggested that respondents who spent about 2 h or less playing the mobile games per day were more satisfied with life (significantly positive). Specifically, those who play mobile games for less than 2 h per day have a 0.060 higher level of life satisfaction. These findings support this study's hypothesis.

Looking at Table 5, which shows the analysis results for well-being according to the four-dimensional well-being indicator, it is evident that there is a positive correlation between the length of time spent playing mobile games and an indicator "relationship and gratitude," though there was no meaningful relationship between the length of time spent playing the mobile games and "relationship and gratitude." Specifically, playing mobile games significantly increases the indicator "relationship and gratitude" by 0.358. If people played mobile games for more than 2 h per day, however, their indicator "self-actualization and growth" would be significantly reduced by 0.558.

Discussion

As for emotional well-being, those who played the mobile games had stronger emotions (both positive and negative) than those who did not. While video games have both positive and negative influences on one's emotional state,[11,16] reports have also indicated that it can turn negative emotions into positive experiences.[46] This suggests that playing the mobile games influences emotions both positively and negatively and that, consequently, players report higher degrees of emotion than non-players. PANAS regards the state in which positive emotions are high and negative emotions are low as a higher state of emotional well-being. The above findings suggest, however, that playing the mobile games can either result in positive or negative influences. From this result, it is impossible to determine whether the hypothesis is supported or unsupported.

Next, regarding life satisfaction, those who played mobile games for 2 h or less per day had higher satisfaction with life than those who did not play. Satisfaction with life is an indicator of overall well-being. Previous studies have shown that playing video games improves abilities[14,15,17,18] have also shown from Electroencephalogram (EEG) and heart rate measurements that game play may promote positive emotions. The overall effect of these factors may be that playing mobile games correlates with higher life satisfaction.

Finally, for the four dimensions of well-being indicators, there was a significant positive relationship between the length of time spent playing mobile games and "relationship and gratitude." Many mobile games involve exchange and team competition by allowing players to collaborate through the Internet and providing digital facilities to exchange items.[47] In other words, when the people play mobile games, they make more friends and expand their relationships. In addition, the process of cooperative play is often gratifying. For these reasons, I can infer that playing mobile games enhances the indicator "relationship and gratitude." On the other hand, playing mobile games for more than 2 h a day significantly decreased the "self-actualization and growth" indicator. As Griffith, Davies, and Chappell argued,[8] people who play mobile games for long periods of time tend to have problems in their lives. If the people are playing so much mobile games that they can't do anything else and it's interfering with their lives, they may have lower "self-actualization and growth" because they feel that their social and organizational needs are not being met.

However, this study also had some limitations. First, it acquired well-being data solely through a self-evaluated questionnaire survey. Second, while several indicators were used to examine its hypothesis, no absolute indicator was available for measuring well-being on a global scale; it is possible that the above situations are different in Japan than in other countries. There is a current research movement in which well-being is measured from different perspectives (e.g., psychological). As such, future studies should analyze how mobile gaming influences well-being according to a greater diversity of measurements. Third, Sauter et al.[48] pointed out that raw playtime is an uninformative predictor of a gamer's mental health and believed that earlier studies with smaller sample sizes may have overestimated its influence. This study has large sample size, but it is a fact that this analysis did not control the social context in which the gamers play. Fourth, this study only analyzed mobile games as a whole, there are no controls for contents of the mobile games. Fifth, there are several analytical issues. Power analysis for sample size calculation was not done and the questionnaire used in this study was not validated and pilot tested.

Sixth, life satisfaction was only assessed with a single item. It is from the survey of Japanese Cabinet Office, but it has not been academically validated. Seventh, the appropriate length and the effects of playing mobile game may also differ for individuals' circumstances, for example, income, stress, and work-life balance. Hopefully, in the future, research on the appropriate length of time spent playing the mobile game will develop that addresses these research issues.

Conclusion

This study analyzed survey data from 5000 online questionnaires to test the following hypothesis: Playing a mobile game for an appropriate length of time results in a stronger sense of wellbeing than not playing at all. The results first showed that playing mobile games was significantly and positively correlated with both positive and negative emotions. Then, playing mobile games for less than 2 h per day has a significant positive impact (0.060) on life satisfaction. Finally, playing mobile games any number of hours per day had a significantly positive impact on indicator "relationship and gratitude" by 0.358. If people played mobile games for more than 2 h per day, however, their indicator "self-actualization and growth" would be significantly reduced by 0.558.

These results suggest that playing mobile games for about 1.5 h or less per day has positive impact on people's well-being. Although playing for about 2 h or more per day significantly decreased an aspect of well-being, overall satisfaction with life did not significantly decrease. Are the numbers 0.060 and 0.358 too small? These values are about 1.79% and about 1.83% for each mean value, respectively. As the impact of only playing mobile games on people's well-being, it would not be small. The results of this study support the hypothesis, showing that people playing mobile games for up to 1.5 h per day increases well-being and life satisfaction. Games are not only consumed as entertainment, but they also contribute to people's well-being.

This study makes an important contribution by suggesting an appropriate length of time to play mobile games with regard to achieving and/or maintaining overall well-being in a field where such discussions are currently polarized: some focus on the negative aspects (e.g., adverse effects related to addiction) of the game, while others emphasize the positive aspects (e.g., improving cognitive capacity). In other words, I got some implications about the role of mobile games in human society and how people are best suited to play them.

Several implications can be drawn from this. First, children or family members playing mobile games do not necessarily mean that they should quit doing so. Rather, moderate mobile game play enhances well-being. Second, excessive government intervention regarding game play can be rather detrimental. In Japan, for example, Kagawa Prefecture made headlines with an ordinance which limits 60 min per day of video game use for those under 18 years old. The action generated significant opposition, including that it was an intervention in the home. The results of this study suggested, however, that even if I focus only on mobile games, a maximum of 1.5 h per day would be beneficial, at least from the perspective of well-being. Government intervention not only incurs administrative costs, but also has the potential to lower social welfare. Third, moderate play of mobile games increased "relationship and graduate." Although this study was conducted before the COVID-19 pandemic, the COVID-19 pandemic limited many people's communication with others. Nowadays, it may be more important to increase "relationship and graduate" by playing mobile games.

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