

# The Status of Paid and Free Star Chart Game Applications: Focus on Google Play in Korea

**Sang-Zo Nam**

Department of Service Management  
Mokwon University, Daejeon, Korea

## ABSTRACT

*The objective of this study was to determine the status of star chart game applications in the Google play store in Korea. The share of game genres in paid and free star charts of game applications was searched. Also, the average reviewer's rating, average number of reviews, and average age rating based on the genre of paid and free star charts of game applications, and the average price of paid applications based on genre were analyzed. Hypothesis tests for the differences in average reviewer's rating, average number of reviews, average age rating according to the genre of game applications were performed. Also, hypothesis tests for the differences in average reviewer's rating, average number of reviews, average age rating between the paid and free game applications along with the hypothesis test for the differences in price according to the genre of paid game applications were performed. Lastly, hypothesis tests for the correlation between the start chart ranking and number of reviews in association with the correlation between the start chart ranking and reviewer's rating were performed. Statistically significant differences in average reviewer's rating, average number of reviews, average age rating according to the genre of game applications, and between the paid and free game applications were verified. However, the correlation between the start chart ranking and number of reviews in association with the correlation between the start chart ranking and reviewer's rating were not statistically significant.*

**Key words:** Game Applications, Star Chart, Paid Application, Free Application, Apps.

## 1. INTRODUCTION

Nowadays, it is natural to see people watching smartphone anywhere. Google's report said on September 2015 that Korea had been ranked fourth among all counties in smartphone penetration [1]. In 2013, it is reported that the average smartphone user in top 10 countries with the highest average number of installed applications per smartphone user installed 26 applications including 6 paid applications. The average Korean smartphone user installed 40 applications including 2.7 paid applications [2]. Wiseapp reported that the average smartphone using time in Korea is 3 hours and 13 minutes; the number of installed applications is 90.1; number of using applications per day is 11.6 during Jan. 22 to Jan. 28 in 2018. Also, they reported that the top three popular categories of using applications are communication (23.1%), video player and editor (20.4%) and game (17.7%) [3]. It proves that people do something a lot of times with smartphone using applications. Among the smartphone applications, the game application would be one of the most popular applications. Also, the game application would be one of the top selling brand, which means people are willing to pay money to use. Usually, people can notice reviews and evaluation for the concerning application in

app store. Those reviews and evaluations can influence to download free applications and to purchase paid applications. We have questions about the difference of reviewer's evaluations, number of reviews and age rating between the free and paid applications and according to the genre of game applications. Furthermore, we have questions about the correlations of the reviewer's evaluation, the number of reviews with the star chart ranking.

However, it is not easy to find studies which analyze the status and implications of comparison in star chart game applications.

The goal of the present study is to carry out the investigation into the current status of star chart game applications. First, we searched the price, reviewer's rating, number of reviews, age rating, and genre of the star chart game applications in Google Play Store in Korea. Second, we performed hypothesis tests for the price, reviewer's rating, number of reviews, age rating, and genre. Third, we performed hypothesis tests for the correlation between the star chart ranking and reviewer's rating together with the correlation between the star chart ranking and number of reviews. We analyzed and discussed the implications of investigation.

---

\* Corresponding author, Email: [namsz@mokwon.ac.kr](mailto:namsz@mokwon.ac.kr)  
Manuscript received May. 08, 2018; revised Aug. 13, 2018;  
accepted Aug. 13, 2018.

## 2. RESEARCH BACKGROUND

### 2.1 Studies for Game Applications

Studies for game application can be categorized by technical studies and behavioral studies. One of the major technical studies would be the presentation of developed game application for various domain [4]-[9].

Other type of technical studies can be development of new methodology for game application. Chae et al. presented gesture recognition based on convolutional neural network for game application [10]. Lee and Sung presented experiment of motion recognition sensor [11]. Kim and Lee built a localization platform for smart device game application development [12]. Kim and Oh presented 3D fish design for smart device [13]. Lee et al. developed a card game using electrical activity generated by the brain [14].

One of the most popular behavioral studies for game application would be the choosing factor. Moon suggested accessibility and stability for user's own H/W as the positive choosing factors [15]. Park et al. suggested the most important internal and external selection factors for game application were story and fame respectively [16]. Choi suggested that price and capacity had significant impact on consumer response. However, genre and ratings had no impact on consumer response, but had impact on developer's performance [17]. Jeoung et al. suggested fun factors of game applications [18].

The other type of behavioral studies for game application would be the tendency and perspective analysis. Kim and Kim researched the emotional adjectives and colors of high ranked game applications [19]. Kim researched interface design [20]. Jung et al. analyzed the Christian perspectives of game application [21]. Cho and Kim researched the effects of perceived quality of baseball game applications on recognition over the baseball club's value [22]. Lee researched the influence of users' character on mobile game type use intention [23].

### 2.2 Studies for Mobile Applications

As for the choosing factors of mobile applications, H. Kim et al. proposed factors of purchase intention according to the types of mobile applications [24]. Linked to the choosing factors, there are studies for the review's influence. Lee proposed that the reliability of review and source of review influenced on choosing mobile applications [25]. Lee and Choi suggested that the number of customers' review had significant impact on developer's performance [26]. Kang compared the difference of impacts of review between the Korean and Chinese consumers, and asserted that Korean consumers were influenced more by the friend's recommendation [27].

There are studies for the quality evaluation for mobile applications. Suh et al. proposed a model for the quality evaluation [28]. Im et al. surveyed the relevance of quality of service and customer satisfaction [29]. Qin et al. surveyed the service satisfaction of Chinese mobile applications [30].

Thanks to the fact that mobile applications, especially, game applications become more popular and have a large number of users, it is worth to investigate the current status and differences such as reviewer's rating, number of reviews and age rating between the free and paid game applications or

according to the genre in star chart game applications. Also, it is worth to investigate the correlation between evaluation factors such as reviewer's rating, number of reviews, and star chart ranking. However, it is not easy to find such study. Therefore we investigate and analyze the current status, implications of comparison and correlations of star chart game applications.

Table 1. Summary of previous studies

Ref. No.	Summary
[4]	Twenty-question game app development
[5]	Fighter game app development
[6]	Multi player game app development
[7]	Treasure hunter game app development
[8]	Mobile vehicle simulation game development
[9]	Virtual crop production game app development
[10]	Gesture recognition for game app
[11]	Motion recognition sensor for game app
[12]	Localization platform model for game app
[13]	Artificial 3D fish design for mobile game
[14]	Card game
[15]	Choosing factors of mobile game
[16]	Purchase decision factor of mobile game app
[17]	Effects of product characteristic and promotion
[18]	Fun factors in game app for children
[19]	Game app tendency based on color adjective
[20]	Interface design
[21]	Christian perspective on the game app for children
[22]	Effects of quality perceived in baseball game app on baseball club's value
[23]	Influence of mobile game users' characteristics on game type use intention
[24]	Determinants of mobile app purchase
[25]	Effects of online review on selecting apps
[26]	Impact of consumer and expert review on the app developer's performance
[27]	Impacts of review on consumer's intention to download app
[28]	Quality evaluation model for mobile app
[29]	Relevance of mobile app quality of service and customer's satisfaction
[30]	Service satisfaction of Chinese mobile apps

## 3. RESEARCH METHOD

### 3.1 Survey Methodology

Star chart game applications in Google Play Korea which are top ranked popular game applications based on Google Play Store's internal criteria have been surveyed in an effort to verify the differences of reviewer's rating, number of reviews and age ratings between the paid application and the free applications together with those differences according to the

genre of game applications. Also, we verified the correlation between star chart ranking and reviewer's rating together with the correlation between star chart ranking and number of reviews. We surveyed Google Play Game star chart at February 17th in 2018. Based on 1,078 data which excluded 2 improper data from star charts of both paid and free game applications which contain 540 applications each, the reviewer's rating, number of reviews, age ratings and genre of games are evaluated.

### 3.2 Analysis of Current Status of Game Applications

**3.2.1 Statistics of data:** As we can see from Table 2, the simulation genre shows the highest share of 12.2% in star chart of game application followed by role playing, arcade, action, casual, adventure and puzzle game genres of which shares are 12.0%, 11.0%, 10.9%, 10.8%, 9.6% and 9.6% respectively. Also, the music game genre shows the lowest share of 1.7% in star chart followed by card and casino, racing, board, sports, educational and strategy game genres of which share are 2.1%, 2.2%, 3.0%, 3.9%, 5.3% and 5.7% respectively. The numbers of paid music game, and card and casino game genre application are only 1 and 4 respectively, which can be implying the rough circumstance to sell music game, and card and casino game application. The simulation, adventure and strategy game genres of paid games applications show predominant in numbers over free games of which differences are 85:47, 78:25 and 42:20 respectively. The casual, arcade, action, puzzle and music game genres of free games applications show predominant in numbers over paid games of which differences are 76:40, 73:46, 67:51, 57:46 and 17:1 respectively.

Table 2. Frequency in star chart based on genre

Genre	Frequency (Paid : Free)	% (Paid : Free)	Frequency : %
Action	51 : 67	9.5% : 12.4%	118 : 10.9%
Adventure	78 : 25	14.5% : 4.6%	103 : 9.6%
Arcade	46 : 73	8.5% : 13.5%	119 : 11.0%
Board	18 : 14	3.4% : 2.6%	32 : 3.0%
Card and Casino	4 : 19	0.7% : 3.6%	23 : 2.1%
Casual	40 : 76	7.4% : 14.1%	116 : 10.8%
Educational	28 : 29	5.2% : 5.4%	57 : 5.3%
Music	1 : 17	0.2% : 3.2%	18 : 1.7%
Puzzle	46 : 57	8.5% : 10.6%	103 : 9.6%
Racing	11 : 13	2.0% : 2.4%	24 : 2.2%
Role Playing	67 : 62	12.4% : 11.5%	129 : 12.0%
Simulation	85 : 47	15.8% : 8.7%	132 : 12.2%
Sports	22 : 20	4.1% : 3.7%	42 : 3.9%
Strategy	42 : 20	7.8% : 3.7%	62 : 5.7%
Total	539 : 539	100% : 100%	1,078 : 100%

**3.2.2 Average data:** As we can see from Table 3, racing and strategy genres of game applications show highest average reviewer's rating of 4.41 out of 5 point Likert scale. Sports genre shows the lowest average reviewer's rating of 4.14. The paid music game application shows the highest average reviewer's rating of 4.8. However, free music game applications show relatively low average reviewer's rating of 4.17, which is the second lowest rating in free games succeeding 4.11 of free board genre's average reviewer's rating. The lowest genre of paid game applications is sports genre of

4.06. The average reviewer's rating of paid game applications is higher than that of free game applications.

Table 3. Average and variance of reviewer's rating based on genre (5-point Likert scale)

Genre	Paid	Free	Total (A : V)
Action	4.33	4.26	4.29 : .115
Adventure	4.37	4.18	4.33 : .158
Arcade	4.19	4.36	4.30 : .131
Board	4.36	4.11	4.25 : .158
Card and Casino	4.30	4.21	4.23 : .117
Casual	4.48	4.33	4.38 : .113
Educational	4.27	4.36	4.32 : .127
Music	4.80	4.17	4.21 : .444
Puzzle	4.45	4.32	4.38 : .111
Racing	4.41	4.41	4.41 : .036
Role Playing	4.42	4.20	4.31 : .144
Simulation	4.34	4.34	4.34 : .134
Sports	4.06	4.23	4.14 : .177
Strategy	4.45	4.32	4.41 : .060
Total average	4.36	4.29	4.32
Total variance	.136	.126	.132

The average number of reviews of free game applications is 809,981, which is far more than 17,113 of paid game applications as we can see from Table 4. The highest genre of average number of reviews is free strategy genre of 3,666,082 reviewers, while the lowest genre of average number of reviews is paid music game genre of 967 reviewers. The highest paid game genre of average number of reviews is arcade genre of 74,297 reviewers. The lowest free game genre of average number of reviews is educational genre of 93,211 reviewers, which is the lowest genre among the total paid and free game applications.

Table 4. Average and variance of number of reviews based on genre (people)

Genre	Paid	Free	Total (A : V)
Action	27,490	900,377	523,112 : 1.827E+12
Adventure	7,802	787,368	197,017 : 1.140E+12
Arcade	74,297	1,081,227	691,994 : 7.243E+12
Board	3,884	235,466	105,201 : 1.062E+11
Card and Casino	69,078	188,255	167,528 : 1.535E+11
Casual	4,169	1,511,571	991,778 : 9.427E+12
Educational	1,052	93,211	47,940 : 2.360E+11
Music	967	186,595	176,282 : 7.520E+11
Puzzle	19,365	256,985	150,864 : 1.192E+11
Racing	36,475	1,556,760	859,963 : 3.896E+12
Role Playing	8,182	156,432	79,434 : 9.345E+11
Simulation	6,292	239,928	89,481 : 2.000E+11
Sports	9,439	1,041,480	500,887 : 4.254E+12
Strategy	15,941	3,666,082	1,193,406 : 3.63E+13
Total average	17,113	809,981	413,547
Total variance	1.03E+11	8.876E+12	4.596E+12

The highest genre of average age rating is naturally card and casino genre of 15.61. However, the average age rating of paid card and casino genre is 8.50, which is less than 10.27 of paid action genre game applications. All of the music genre game applications show 3 year age rating. Educational genre game applications show the second lowest average age rating of 3.21.

Table 5. Average and variance of age rating based on genre (age)

Genre	Paid	Free	Total (A : V)
Action	10.27	9.25	9.69 : 24.710
Adventure	9.04	5.48	8.17 : 22.636
Arcade	7.35	4.11	5.36 : 15.555
Board	3.94	5.43	4.59 : 16.055
Card and Casino	8.50	17.11	15.61 : 22.431
Casual	4.70	4.17	4.35 : 11.570
Educational	3.14	3.28	3.21 : .812
Music	3.00	3.00	3.00 : .000
Puzzle	5.43	3.16	4.17 : 7.812
Racing	5.36	4.31	4.79 : 9.998
Role Playing	8.48	8.53	8.50 : 21.893
Simulation	6.48	5.70	6.20 : 19.859
Sports	3.64	3.90	3.76 : 8.137
Strategy	6.33	8.45	7.02 : 12.475
Total average	6.91	5.94	6.42
Total variance	21.594	21.526	21.777

The average price of paid game applications is 4,180 won. The average price of music game application is the lowest of 1,400. The second lowest average price of paid game applications is 2,146 won of educational genre. The highest average price of paid game applications is 5,502 won of adventure game genre followed by role playing game genre of 5,420 won.

Table 6. Average and variance of price of paid applications based on genre (won)

Genre	Average : Variance
Action	3,258 : 4333668
Adventure	5,502 : 20712757
Arcade	3,087 : 3577971
Board	4,991 : 10991246
Card and Casino	2,775 : 1402500
Casual	3,709 : 2926444
Educational	2,146 : 1928505
Music	1,400 : 0
Puzzle	2,825 : 3239569
Racing	3,118 : 4280364
Role Playing	5,420 : 34706741
Simulation	4,929 : 21363127
Sports	4,835 : 21243313
Strategy	3,545 : 7182190
Total	4,174 : 14878970

### 3.3 Research Hypotheses

We developed the following hypotheses.

- 1) H1: There is no difference in reviewer's rating according to the genre of game applications.
- 2) H2: There is no difference in number of reviews according to the genre of game applications.
- 3) H3: There is no difference in age rating according to the genre of game applications.
- 4) H4: There is no difference in reviewer's rating between paid or free game applications.
- 5) H5: There is no difference in number of reviews between paid or free game applications.
- 6) H6: There is no difference in age rating between paid or free game applications.

7) H7: There is no difference in price according to the genre of paid game applications.

8) H8: There is correlation between star chart ranking and number of reviews

9) H9: There is correlation between star chart ranking and reviewer's rating

## 4. RESEARCH RESULTS

We verified the differences in number of reviews, age rating and reviewer's rating by adopting t-test for paid or free differences, which have two groups, and by adopting ANOVA test for genre differences which have more than three groups using SPSS 20.

### 4.1 Analysis of Differences According to the Genre and between Paid of Free Game Applications

**4.1.1 Difference in reviewer's rating according to the genre of game applications (H1):** As we find from the ANOVA test at Table 7 that asymptotic significance (2-sided) is far less than .05, which means there is statistically significant difference in reviewer's rating according to genre due to significant differences such as high rating of music game genre and low rating of sports genre of game applications.

Table 7. Difference in reviewer's rating according to the genre of game applications

F value	Asymp. sig. (2-sided)
2.214	.011

**4.1.2 Difference in number of reviews according to the genre of game applications (H2):** As we find from the ANOVA test at Table 8 that asymptotic significance (2-sided) is far less than .05, which means there is statistically significant difference in number of reviews according to genre due to significant differences such as low number of reviews of educational genre of game applications.

Table 8. Difference in number of reviews according to the genre of game applications

F value	Asymp. sig. (2-sided)
2.4794	.002

**4.1.3 Difference in age rating according to the genre of game applications (H3):** As we find from the ANOVA test at Table 9 that asymptotic significance (2-sided) is far less than .05, which means there is statistically significant difference in age rating according to genre due to significant differences such as high age rating of card and casino genre and low rating of music and educational genres of game applications.

Table 9. Difference in number of reviews according to the genre of game applications

F value	Asymp. sig. (2-sided)
31.552	.000

**4.1.4 Difference in reviewer’s rating between the paid and free game applications (H4):** As we find from the t-test at Table 10 that asymptotic significance (2-sided) is far less than .05, which means there is statistically significant difference in reviewer’s rating between the paid and free game applications due to significant differences such as higher rating of paid game applications.

Table 10. Difference in reviewer’s rating between the paid and free game applications

t value	Asymp. sig. (2-sided)
-3.101	.002

**4.1.5 Difference in number of reviews between the paid and free game applications (H5):** As we find from the t-test at Table 11 that asymptotic significance (2-sided) is far less than .05, which means there is statistically significant difference in number of reviews between the paid and free game applications due to significant differences such as far lower number of reviews of paid game applications.

Table 11. Difference in number of reviews between the paid and free game applications

t value	Asymp. sig. (2-sided)
6.175	.000

**4.1.6 Difference in age rating between the paid and free game applications (H6):** As we find from the t-test at Table 12 that asymptotic significance (2-sided) is far less than .05, which means there is statistically significant difference in age rating between the paid and free game applications due to significant differences such as higher age rating of paid game applications.

Table 12. Difference in number of reviews between the paid and free game applications

t value	Asymp. sig. (2-sided)
-3.437	.001

**4.1.7 Difference in price according to the genre of paid game applications (H7):** As we find from the ANOVA test at Table 13 that asymptotic significance (2-sided) is far less than .05, which means there is statistically significant difference in price according to genre due to significant differences such as high price of adventure genre and low price of music and educational genre of paid game applications.

Table 13. Difference in price according to the genre of paid game applications

F value	Asymp. sig. (2-sided)
3.633	.000

**4.1.8 Correlation between star chart ranking and number of reviews (H8):** As for the total 539 star chart rankers, Pearson correlation coefficient is -0.108 and 2-sided asymptotic significant probability is 0.000, which mean that there is a little and negative correlation between star chart ranking and number of reviews. However, 2-sided asymptotic significant probabilities for top300, top200 and top100 rankers show no statistical correlation between star chart ranking and number of reviews.

Table 14. Correlation between star chart ranking and number of reviews

Star chart ranking	Pearson correlation coefficient	Asymp. sig. (2-sided)
Top539	-.108	.000
Top300	-.075	.067
Top200	-.055	.269
Top100	.096	.175

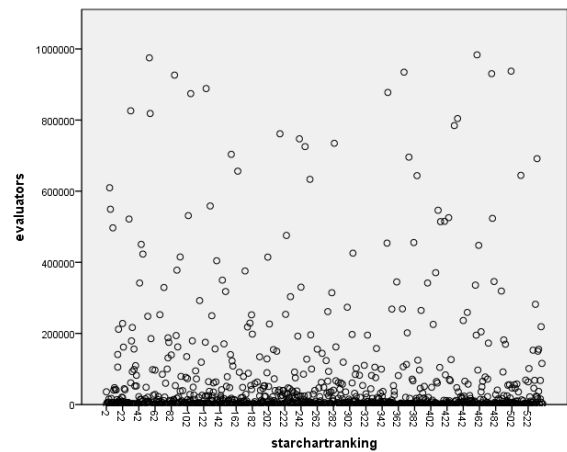


Fig. 1. Scatter diagram between star chart ranking and number of reviews except 75 outliers which have more than 1 million reviews

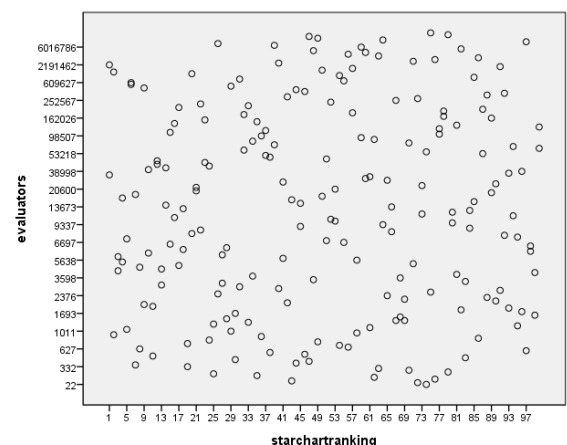


Fig. 2. Scatter diagram between top100 star chart ranking and number of reviews

#### 4.1.9 Correlation between star chart ranking and reviewer's rating (H9):

As for the total 539 star chart rankers, Pearson correlation coefficient is  $-0.074$  and 2-sided asymptotic significant probability is  $0.015$ , which mean that there is a little and negative correlation between star chart ranking and reviewer's rating. However, 2-sided asymptotic significant probabilities for top300, top200 and top100 rankers show no statistical correlation between star chart ranking and reviewer's rating.

Table 15. Correlation between star chart ranking and reviewer's rating

Star chart ranking	Pearson coefficient	correlation	Asymp. sig. (2-sided)
Top539	-.074		.015
Top200	-.058		.247
Top300	-.067		.099
Top100	-.005		.946

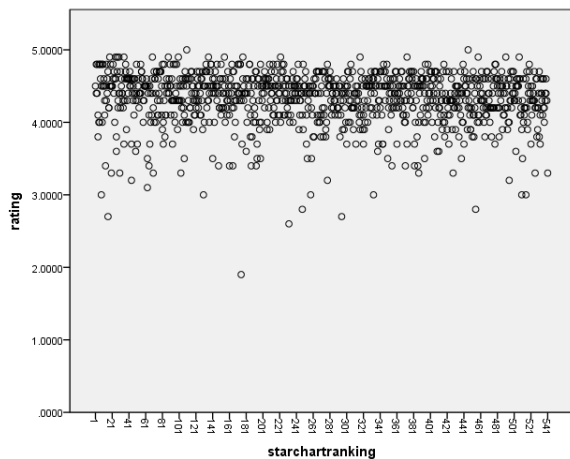


Fig. 3. Scatter diagram between star chart ranking and reviewer's rating

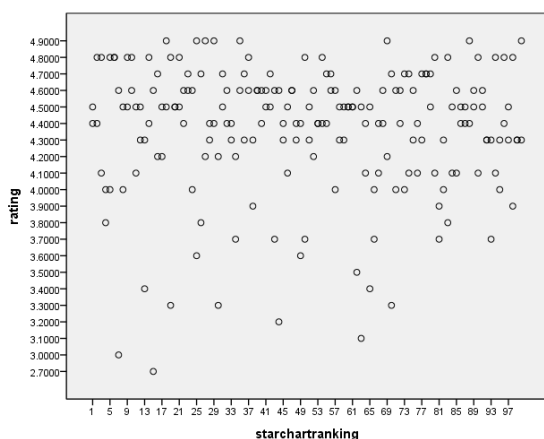


Fig. 4. Scatter diagram between top100 star chart ranking and reviewer's rating

## 5. CONCLUSION

The most popular genre in star chart of game application is the simulation genre followed by role playing, arcade, action, casual, adventure and puzzle game genre. Also, the music game genre shows the least popularity followed by card and casino, racing, board, sports, educational and strategy game genre. The simulation, adventure and strategy game genres of paid games applications show predominant in numbers over free games of same genre, which shows more preferred genres of customers' willing to pay. The casual, arcade, action, puzzle and music game genres of free games applications show predominant in numbers over paid games of same genre, which shows more preferred genres of customers' unwilling to pay. The racing and strategy genre of game applications show highest average reviewer's rating of 4.41. Sports genre show lowest average reviewer's rating of 4.14, which requires sports game developers' improvement. The average reviewer's rating of paid game applications is naturally higher than that of free game applications. The average number of reviews of free game applications is 809,981, which is far more than 17,113 of paid game applications. It means that it is not easy to open customers' wallet. The highest genre of average age rating is naturally card and casino genre of 15.61 followed by action genre game applications. All of music genre game applications show 3 year age rating. Educational genre game applications show the second lowest average age rating of 3.21.

Statistically significant differences in reviewer's rating, number of reviews and age rating according to the genre are verified. Also, statistically significant differences in reviewer's rating, number of reviews and age rating between the paid and free game applications are verified too.

It is verified that there seems no correlation between star chart ranking and number of reviews. Also, it is verified that there seems no correlation between star chart ranking and reviewer's rating.

This research verified the differences in reviewer's rating, number of reviews, age ratings among the genres of and between the paid and free game applications statistically. It is anticipated that this research will provide basic information for ascertaining the current status of star chart game applications. The limitation of this study can be the analysis using only the 1,078 star chart game applications.

Further complementary study can be carried out by researching game applications in specific genres or applications other than the game applications.

## ACKNOWLEDGMENT

This study was financially supported by the research year fund of Mokwon University in 2017.

## REFERENCES

- [1] Retrieved from [https://apac.thinkwithgoogle.com/intl/ko\\_ALL/articles/measuring-asias-mobile-transformation.html](https://apac.thinkwithgoogle.com/intl/ko_ALL/articles/measuring-asias-mobile-transformation.html)
- [2] Retrieved from

- <https://blog.naver.com/jeffrey0517/70175279560>, source: Google's Our Mobile Planet
- [3] Retrieved from <https://www.wiseapp.co.kr/>
- [4] D. Kim, K. Park, and Y. Kim, "Implementation of android platform based twenty-question game application," Proc. KIIT Summer Conference, 2012, pp. 396-398.
- [5] J. Lee and J. W., "Picture fighter (game app. for android device)," Proc. The Korean Society of Computer Information Conference, 2014, pp. 479-480.
- [6] M. Jung, J. Jin, J. Lee, K. Choo, S. Choi, and S. Ko, "Development of platform-independent multi-play game," Proc. Symposium of the Korean Institute of Communications and Information Sciences, 2016, pp. 217-218.
- [7] D. Lee, J. Choi, Y. Jang, and Y. Kwon, "A Location Based Augmented Reality Game on iPhone: Treasure Hunt," Proc. Symposium of the Korean Institute of Communications and Information Sciences, 2011, pp. 166-167.
- [8] S. Park, Y. Kim, S. Yoo, B. Kim, and J. Lee, "Intersection Traffic Control of Autonomous Vehicle based on Mobile Game," Journal of the Korea Entertainment Industry Association, vol. 11, no. 8, 2017, pp. 369-375.
- [9] Y. Na and Y. Kim, "Social Agriculture," Journal of Convergence, vol. 3, no. 3, 2010, pp. 272-277.
- [10] J. Chae, J. Lim, H. Kim, and J. Lee, "Study on Real-time Gesture Recognition Based on Convolutional Neural Network for Game Applications," Journal of Korea Multimedia Society, vol. 20, 2017, pp. 835-843.
- [11] D. Lee and J. Sung, "Analysis of the Impact of Motion Recognition Sensor on Mobile Game by Compare Valuation Experiment," Journal of Korea Game Society, vol. 9, no. 5, 2009, pp. 63-72.
- [12] D. Kim and S. Lee, "A Study on the Way of Building a Localization Platform for Smart Device Game Application Development," Journal of the Korean Society for Computer Game, vol. 25, no. 4, 2012, pp. 97-106.
- [13] S. Kim and G. Oh, "A Study on Artificial 3D Fish Design for Smart Device," Journal of the Korean Society for Computer Game, vol. 25, no. 2, 2012, pp. 157-169.
- [14] J. Lee, M. Kim, and I. Ko, "Development of the Card Game Based Using Attention and Meditation," Journal of the Korean Society for Computer Game, vol. 25, no. 4, 2012, pp. 27-34.
- [15] J. Moon, "The Causal Relationship of Choosing Factors of Smart Phone Game," Journal of the Korea Contents Association, vol. 14, 2014, pp. 723-729.
- [16] B. Park, J. Lee, K. Song, H. So, I. Sugiyai, and H. Song, "Factor analysis on purchase decision of smart device game applications using AHP," Proc. ICCS, 2012, pp. 189-190.
- [17] S. Choi, *The Effects of Product Characteristic and Promotion on Consumer Response and Business Performance: Focusing on the Game Category*, Theses, Sejong University, 2011.
- [18] H. Jeoung, S. Bang, H. Yoo, and J. Lee "An Analysis of Fun Factors in Game Applications for Children," Korean Journal of Early Childhood Education, vol. 33, no. 6, 2013, pp. 237-262.
- [19] S. Kim and Y. Kim, "Game Application Tendency Analysis Based on Bigdata and Emotional Color Adjective," Journal of the Korean Society for Computer Game, vol. 29, no. 4, 2016, pp. 177-185.
- [20] D. Kim, *Study of the Interface Design Based on SNS Platform Application - Focused on Entertainment Applications*, Theses, Hanyang University, 2010.
- [21] H. Jeoung, J. Lee, S. Bang, and H. Yoo, "The Analysis and Evaluation in a Christian Perspective on the Game Applications for Children," A Journal of Christian Education in Korea, vol. 46, 2016, pp. 353-383.
- [22] Y. Cho and H. Kim, "The Effects of Quality Factors Perceived in Professional Baseball Game Applications on Recognition over a Baseball Club's Value," Korean Journal of Sports Science, vol. 25, 2016, pp. 701-712.
- [23] S. Lee, *Influence of Mobile Game Users' Characteristics on Game Type Use Intention*, Theses, Hoseo University, 2015.
- [24] H. Kim, H. Lee, and S. Choi, "An Exploratory Study on the Determinants of Mobile Application Purchase," The Journal of Society for e-Business Studies, vol. 16, no. 4, 2011, pp. 173-195.
- [25] K. Lee, "The effects of online review on selecting the mobile apps," Proc. The Korean Academic Association of Business Administration Spring Conference, 2015, pp. 389-399.
- [26] D. Lee and S. Choi, "The Impact of Consumer Review and Expert Review on the App Developer's Performance in the App Store," Journal of Korean Marketing Association, vol. 27, no. 2, 2012, pp. 113-136.
- [27] S. Kang, *Impacts of Review on Consumer's Intention to Download Free Smart Phone Applications: Cultural Difference between Korean and Chinese Consumers*, These, Kookmin University, 2015.
- [28] J. Suh, J. Choi, J. Kim, and J. Park, "Design of Quality Evaluation Model for Mobile Application," Journal of the Korea Institute of Information and Communication Engineering, vol. 18, no. 10, 2014, pp. 2451-2461.
- [29] S. Im, J. Lee, and C. Ryu, "The relevance of mobile app quality of service and customer's satisfaction," Proc. KORMS Conference, 2017, pp. 3779-3803.
- [30] Y. Qin, S. Lee, and K. Lee, "A Study on the Service Satisfaction of Chinese Mobile Apps - Comparing Paid and Free services," Journal of Digital Convergence, vol. 15, no. 4, 2017, pp 127-137.



#### Sang Zo Nam

He received the B.A. in Business Administration from Sogang University, Korea, M.B.A. from State University of New York at Buffalo, U.S.A. in 1982, 1988 respectively and also received Ph.D. in management information system from KAIST, Korea in 1996. Since then, he has been with the Department of service management, Mokwon University. His main research interests include e-business, e-learning.