

PERCEPTIONS AND IMPACT OF A BRAIN GAME ON COGNITIVE AND ACADEMIC PERFORMANCE AMONG UNDERGRADUATE HEALTH AND MEDICAL STUDENTS AT KING ABDULAZIZ UNIVERSITY

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Abstract

Background: With the advent of mobile apps, there has been a surge of interactive applications for consumers, whether educational or for entertainment. 'Brain games' is a concept delivered through these apps. Usually, these are more geared towards entertainment while including an informative element.

Objectives: This study was designed to determine the perceptions of BTG among medical and rehabilitation students. It also determined if BTG has effects on academic performance of students. Association between GPA and those who tried and not tried BTG before and also between GPA and how often students played BTG were also found.

Methods: This cross-sectional study was conducted at King Abdulaziz University, Jeddah. The study included 221 male and female participants of 19-26 years of age who were undergraduate health and medical students at King Abdulaziz university. Data was analyzed using SPSS version 23.

Results: 70.6% participants (n=156) answered yes and 29.4% participants (n=65) answered no when asked if they have ever heard about BTG. 36.7% participants (n=81) answered yes and 63.3% participants (n=140) answered no when asked if they have ever tried BTG before. 16.3% participants (n=36) answered yes and 20.4% participants (n=45) answered no when asked if BTG has some effects on their academic performance. 20.8% participants (n=46) answered yes and 15.8% participants (n=35) answered no when asked if they noticed any improvement in cognitive skills. Non-significant association was found ($p>0.05$) between GPA and those who tried BTG before and not tried BTG before. Significant association ($p<0.05$) between GPA and how often you play BTG was found using chi-square test.

Conclusion: The study concluded that most students were aware of BTG but they had never tried it before. There was a non-significant association between GPA and those who tried BTG before and not tried BTG before. Significant association was found between GPA and how often you play BTG.

Introduction

Normal aging causes changes in the prefrontal cortex and the medial temporal lobe system, which includes the hippocampus and cerebellum. [1, 2]. These changes are associated with Alzheimer's disease and dementia and cognitive deficiencies in short- and long-term memory, speed, and executive functioning. As a result, cognitive abilities such as attention, memory, and analytical ability decline as we age [3, 4].

Finding new technology to comprehend aging and slow the process of cognitive decline is an important research priority [1]. Brain training games (BTG) are increasingly used in research to study their impact on cognition and the likelihood of transfer to untrained tasks [5, 6]. Thus, brain training refers to intellectually challenging activities to increase mental fitness [7].

With the advent of mobile apps, there has been a surge of interactive applications for consumers, whether educational or for entertainment. 'Brain games' is a concept delivered through these apps. Usually, these are more geared towards entertainment while including an informative element. On the other hand, 'brain training' is a concept that distinguishes itself from 'brain games' in that it is a structured and more methodical program. It involves repeated practice on tasks with intrinsic difficulties or challenges, targets one or more specific cognitive domains, and tries to improve, maintain, and repair general cognitive functioning.

With proper training, brain workouts are intended to increase neuroplasticity, resulting in improved cognitive abilities, including characteristics like perception, attention, memory (short-term and long-term), motor, language, visual processing, and executive functions. A handful of research concludes that brain training apps are an efficient modality to improve the mental performance of patients with cognitive decline, e.g., Alzheimer's disease [8-10]. A study by Wexler et al. demonstrated that cognitive priming improves learning immediately and that longer-term brain training has far-reaching or positive effects on academic achievement [11]. Students from all academic spheres are typically educated

discretely in an institutional setting. Most forms of teaching address one or more elements of cognition. As student ages, physiological alterations occur in the brain that increase the capacity for cognitive performance; however, numerous factors can influence this, such as nutrition, exercise, educational level, emotions, and even gender [8-14].

Although there is conflict about whether brain training game apps have an effect or not, few previous studies believe that it plays a significant role in improving cognitive skills. In addition, the improvement of cognitive skills may have a positive correlation to academic performance. Numerous BTG intervention studies have found improvements in cognitive performance in speed and accuracy, visuomotor coordination, attention, memory, working memory, and global cognitive function [15-21]. However, some research reported no significant advantages of BTG on cognitive functions, casting doubt on the efficacy of such systems as cognitive intervention tools [22, 23].

Notwithstanding inconsistencies among studies, these data indicate that BTG is a viable intervention approach for cognitive enhancement. A study conducted in 2012 by Yassien et al. concluded that there was no statistically significant difference between the two groups regarding academic performance and no statistically significant change in the experimental group. In conclusion, a web-based brain training program successfully enhanced cognitive abilities, indicating that this progress was carried over into the academic life of SCD students. Another study concluded that the three experiments they performed did not demonstrate "Kawashima's Brain training's" effectiveness for a wide range of tests from numerous cognitive domains, including school memory (History, Geography, Science, and Math), visual and spatial memories, attention and processing speed, and reasoning (Matrix and Kohs cubes) [8, 13].

This research aimed to determine the perceptions of BTG among students. It also determined if BTG has effects on academic performance of students. Association between GPA and those who tried and not tried BTG before and also between GPA and how often students played BTG were also found.

METHODS

Participants

This cross-sectional study was conducted at King Abdulaziz University, Jeddah, during the education year 2022-2023. The study included male and female participants of 19-26 years of age who were undergraduate health and medical students at King Abdulaziz university. 221 participants completed the questionnaire..

Tools/Questionnaire

A 16-point questionnaire designed by Torous J, Staples P, Fenstermacher E, Dean J, Keshavan M.,2016 Jun9 out of the 16 questions were used for this research. This questionnaire covered many aspects, all aimed at evaluating the perception of medical and rehabilitation students about brain training games and the potential outcome it has on their academic performance.

The first five questions were demographics and have they ever heard about brain training games and have they tried them before; the remaining questions were divided into two categories first category was considered the students who 'don't use brain training games, and the second category was considered the students who were using brain training games, the first category information was collected to identify the possible barriers for not use brain training games and GPA, the second category information was collected to identify the most popular brain training apps, how often they engaged in these games and the most prolonged duration, they played brain training games if ' 'it has any effect on their cognitive enhancement and in which aspect(thinking, memory, attention, speed), or any impact on academic performance and their GPA.

Procedure

Ethical approval for the study was obtained from the Ethical Committee of King Abdulaziz University. This survey was voluntary, and all answers were kept strictly confidential. An online questionnaire was developed utilizing Google Forms and published on social media platforms. The first page included an informed consent form that participants have read and agreed to. The questionnaire was separated into three sections and consisted of fourteen items in total. The first part included five multiple-choice questions about their gender, age, which college or department they are from, and have they had ever heard about brain training games and have they ever played it. The second section, considering their answer was no, consisted of two items, two multiple-choice; the third section, considering their answer was yes, consisted of seven items; seven multiple-choice questions. All the questions allowed the participants to choose one answer except two, which allowed more than one answer.

Data Analysis

Data was entered and analyzed through SPSS version 23. First of all normality of the data was checked so that the tests could be decided. Descriptive statistics was applied, and the chi-square test found the association.

Results

Descriptive Statistics

Demographics

Out of 221 participants, 41.2% (n=91) were males and 58.8% (n=130) were females. 34.8% participants (n=77) were in the age group 19-20 years, 51.6% participants (n=114) were in the age group 21-22 years, 12.2% participants (n=27) were in the age group 23-24 years and 1.4% participants (n=3) were in the age group 25-26 years. 32.1% participants (n=71) were from medical rehabilitation sciences department, 14% participants (n=31) were from medicine department, 19% participants (n=42) were from applied medical sciences department, 12% participants (n=28) were from nursing department, 14% participants (n=31) were from pharmacy department and 8.1% participants (n=18) were from dental department.

Brain training games

70.6% participants (n=156) answered yes and 29.4% participants (n=65) answered no to the question “Have you ever heard about brain training games?” 36.7% participants (n=81) answered yes and 63.3% participants (n=140) answered no to the question “Did you try it before?”. **Table 1** shows the factors that prevented the participants from trying the brain game apps. 22.2% participants (n=49) reported شغلة, 3.2% participants (n=7) reported lumosity, 4.1% participants (n=9) reported لمحة, 5.0% participants (n=11) reported elevate and 2.3% participants (n=5) reported درب التحدي when asked about *which games do you play?*.

GPA

1.8% participants (n=4) had GPA between 2.5-3, 2.7% participants (n=6) had GPA between 3.1-3.5, 13.6% participants (n=30) had GPA between 3.6-4, 39.8% participants (n=88) had GPA between 4.1-4.5, 17.2% participants (n=38) had GPA between 4.6-4.74 and 24.9% participants (n=55) had GPA between 4.75-5.

Effects on academic performance and cognitive skills

16.3% participants (n=36) answered yes and 20.4% participants (n=45) answered no to the question: *Do you think it has some effects in your academic performance?*. **Table 2** shows how often you play brain training games. **Table 3** shows the longest duration of playing brain training games. 20.8% participants (n=46) answered yes and 15.8% participants (n=35) answered no to the question: *Do you notice any improvement in your cognitive skills?*. Areas of improvements are mentioned in **Table 4**.

Normality of data

Shapiro-walk test was used for testing normality of data. Data was not normally distributed ($p=0.000$) therefore we will apply chi-square test to find the association between variables.

Association between Variables

Association between GPA and those who tried and not tried BTG before

Association of GPA and those who tried and not tried BTG before is illustrated in **Figure 1**. Non-significant association was found ($p>0.05$) between GPA and those who tried BTG before and not tried BTG before.

Association between GPA and how often you play BTG

Association of GPA and how often you play BTG is illustrated in **Figure 2**. Significant association ($p<0.05$) between GPA and how often you play BTG was found using chi-square test.

Discussion

Literature shows that brain training games (BTG) significantly enhance cognitive abilities [24]. Study analysis showed that 36.3% medical students had tried brain games before and 63% had never tried it before. These results were similar to the results of previous study in which more

participants were non-gamers and less participants were gamers [25]. In the present study, a non-significant association was found between academic performance, those who had tried and not tried brain training games before. The results of present study were inconsistent with the results of previous study which showed that there non-gamers achieved more grades and had better academic performance as compared to gamers as there was a significant association between grades, gamers and non-gamers [25]. Our study results were different from previous study due to difference in types of brain training games used.

According to the results of present study, more students playing brain training games noticed improvement in cognitive skills. These results were consistent with findings of previous study which demonstrated an improvement in students' cognitive functioning and academic self-efficacy with cognitive training through different games [26].

Another study concluded that students have more learning chances with memory games like the matching pair cards game. In comparison with the traditional learning approach, it is better and more effective in improving academic performance as it offers the students various kinds of experiences [27]. These results were consistent with the results of present study in which brain training games had positive effects on academic performance.

A study was conducted to further understand how the BTG application Lumosity can enhance cognitive function. The study's findings indicated that BTG Lumosity had a good impact on young adults' cognitive abilities [24]. These findings were inconsistent with the findings of our study in which other brain gaming applications were used more by participants as compared to Lumosity but this app showed effectiveness in improving academic performance and cognitive function. The difference in results could be due to the fact that Lumosity was only included in the study criteria whereas in our study, five different types of games were used. Previous study showed that the improvements in cognitive processes in executive functions, working memory, processing speed, and attention were attained through brain training games [24]. These results were somewhat similar to the results of our study in which there was more improvement in thinking, memory, attention and speed as compared to other cognitive functions.

The results of a randomized control trial showed that when compared to Paper Pencil training or the Control group, there was no apparent positive transfer impact of the "Kawashima's brain training" or "Mario" group. It was concluded in the study that broad programs like Brain Training can't enhance cognitive capabilities or academic learning abilities. Worldwide programmes like "Kawashima's Brain training" are basically games or commonly produced distractions and cannot take the place of the educational system is the real cognitive training program because of its long duration in years and variety of things are included in the education system [8]. These results were inconsistent with the results of present study in which there were positive effects of brain training games on academic performance and cognition. Results could be different due to different study protocol and study design. Our

study was a cross sectional survey whereas previous study was experimental in which recreational video games were compared with brain training games.

Conclusion

The study concluded that most students were aware of BTG but they had never tried it before. Improvement in cognitive skills was noticed by most students after playing BTG. There was a non-significant association between GPA and those who tried BTG before and not tried BTG before. Significant association was found between GPA and how often you play BTG.

Figures

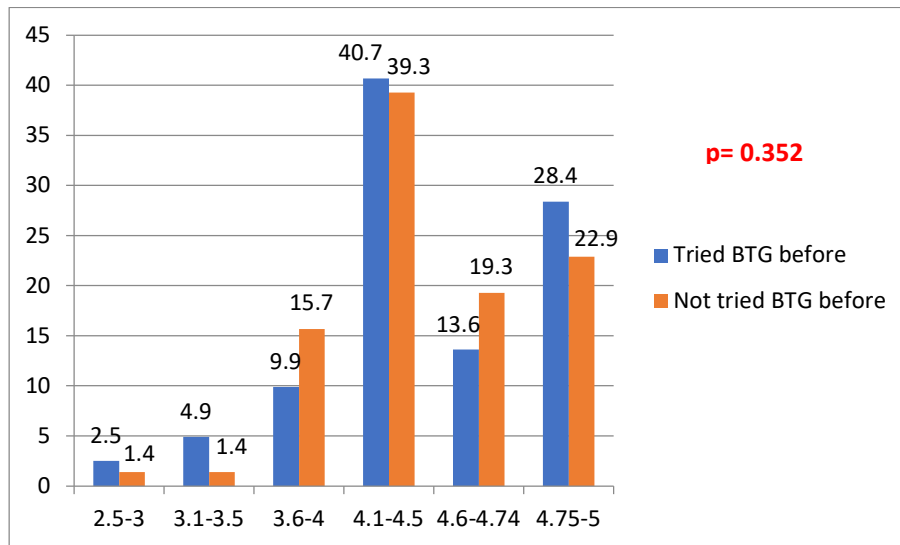


Figure 1: Illustrates non-significant association ($p=0.352$) between GPA and those who tried and not tried BTG before

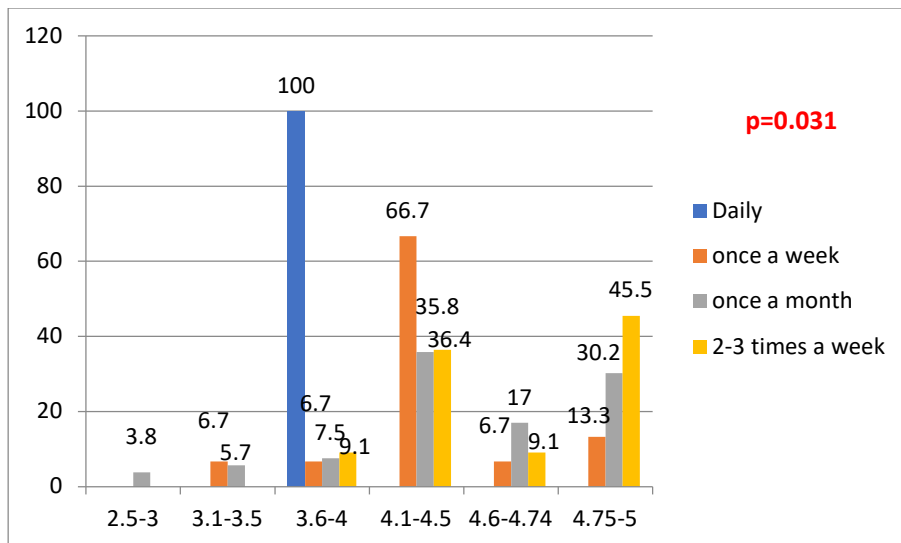


Figure 2: Illustrates significant association ($p=0.031$) between GPA and how often you play BTG

Tables

Table 1: If no, what are the factors that prevented you from doing so?

If no, what are the factors that prevented you from doing so?		
	Frequency	Percent (%)
Cost of apps	4	1.8
Time required to use	30	13.6
Unsure if they are effective	78	35.3
Time required to use and unsure if they are effective	15	6.8
Cost of apps and time required to use	5	2.3
Cost of apps, time required to use and unsure if they are effective	5	2.3
Cost of apps and unsure if they are effective	3	1.4

Table 2: How often you play Brain training games?

How often you play Brain training games?		
	Frequency	Percent (%)
Daily	2	0.9
Once a week	15	6.8
Once a month	53	24
2-3 times a week	11	5

Table 3: What is the longest duration you have ever played brain training games?

What is the longest duration you have ever played brain training games?		
	Frequency	Percent (%)
1-2 weeks	34	15.4
1-2 months	25	11.3
3-4 months	9	4.1
6-8 months	8	3.6
1 year or more	5	2.3

Table 4: If yes, which areas do you notice the improvements in?

If yes, which areas do you notice the improvements in?		
	Frequency	Percent
Improvement in memory	1	0.5
Improvement in attention	1	0.5

Improvement in speed	2	0.9
Improvement in attention, Improvement in speed	10	4.5
Improvement in thinking, Improvement in memory, Improvement in attention, Improvement in speed	11	5.0
Improvement in thinking, Improvement in attention	2	0.9
Improvement in memory, Improvement in attention	6	2.7
Improvement in thinking, Improvement in memory	1	0.5
Improvement in memory, Improvement in attention, Improvement in speed	4	1.8
Improvement in memory, Improvement in speed	2	0.9
Improvement in thinking, Improvement in attention, Improvement in speed	3	1.4
Improvement in thinking, Improvement in memory, Improvement in speed	2	0.9
Improvement in thinking, Improvement in memory, Improvement in attention	1	0.5

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