International Journal of Health Sciences and Research
Vol.10; Issue: 4; April 2020
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Effect of Virtual Reality Games on Stress, Anxiety and Reaction Time in young Adults: A Pilot Study

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ABSTRACT

Background: Stress and Anxiety are very common in everyday life. Also stress and anxiety affects reaction time. This can result in detrimental consequences on quality of life of an individual. Virtual reality games have been used in physiotherapy rehabilitation for different conditions but Virtual Reality Gaming use in young adult and its effect on stress and anxiety in young adults is unclear. The purpose of the study is to find out the effect of Virtual Reality Games in Stress, anxiety and Reaction time in young adults.
Method: 10 young adults with Perceived Stress scale score ≥13 and Self Rating Anxiety Scale score ≥17 were selected, each participant underwent virtual reality game intervention for 4weeks 3days/week.
Results: Pre and Post measures were taken using Inquisit Software for auditory and visual reaction time and perceived stress scale for stress and self-rating anxiety scale for anxiety. Wilcoxon's test was used to check the statistical significance with p value <0.05.
Conclusion: the study concludes that virtual reality games are beneficial in reducing stress, anxiety and improving auditory and visual reaction time.

Keywords: Virtual Reality, Stress, Anxiety.

INTRODUCTION

College life is one of the scintillating and memorable experiences in a students' life. Due to fast physical changes and mental development at this stage, students may experience the incompatibility of their mental development with their physical changes or with a social environment. Students are very likely to experience some or many stressors which may test their ability to cope: adapting to a new environment, balancing a heavy workload, making new friends, becoming more independent, and dealing with myriads of other issues.

The whole idea of an existing and vibrant college life is unveiled by these challenges which in turn contribute to stress and if not dealt with can only escalate and hamper their academic performance, emotional and social wellbeing. [1]

Anxiety is another most common mental health concern in college students. A large portion of college students reported feeling overwhelmed, exhausted, and hopeless. It is particularly problematic because anxiety is related to attrition. Some degree of anxiety can be helpful for high academic achievement. However, too much anxiety may hinder academic performance. [2]

According to professionals, reaction time is the time interval that occurs between the presence of some type of stimulus and the muscular based response to the said stimulus. Each stimulus presented results in

their own response. Therefore, if only one stimulus presents itself, the reaction time will be relatively short; whereas if multiple stimuli are present, the reaction time will occur over a longer period of time. The brain and the nerves allow us to react to stimuli in both a physical and a cognitive manner. As we age, reaction times naturally slow. Our reaction time starts with a nervous system. It includes both the peripheral nervous system, as well as the central nervous system. A stimulus results in a signal. This signal is dependent upon our senses. It could be a visual signal, auditory signal, tactile signal, taste signal, or a signal that stimulates our senses of smell. An individual must have a good motor-based agility to have a good reaction time. Individual's ability to respond quickly to a stimulus depends on his/ her ability to perceive. Studies have shown that an increase in stress increases reaction time. Continuing exposure to stress, work performance efficiency begins to fall. [3] Studies have shown that demanding tasks increase state anxiety which slows reaction time. The accepted figures of mean simple reaction time for college-age students have been about 190ms for light stimuli and 160ms for sound stimuli. [4]

Visual reality (VR) gaming is the application of a 3-dimensional artificial environment to computer games. VR environment is created with VR software and presented to the user in a way that supersedes the real-world environment. It can be used as a therapy tool to address different objectives like balance, increase standing time, muscle strength and endurance, postural control, bilateral coordination and improve walking, upper extremity ROM and endurance, fall prevention. VR technology has shown efficacy in reducing anxiety and stress in school-based anxiety, post-traumatic stress disorder, panic disorder, and other mental disorders. When used in cerebral palsy population reaction time was improved using visual reality intervention. [5] Visual reality intervention for eye-hand coordination, gait improvement, and reflexes for sports was used. [6] Virtual reality game-based training is better in improving balance and functional performance in individuals with paraplegic than real-world task-specific balance training. [7]

Purpose of study:

Unwarranted levels of stress and anxiety results in detrimental consequences on the quality of life for an individual. These negative effects are expressed in physical health, learning ability, retention, interpersonal relationships and behaviour. Some studies have concluded that anxiety increases activation, but leads to behavioural inhibition. Other studies show that anxiety facilitates performance in easy task and blocks performance in complex, difficult tasks. Also, an increase in the anxiety levels lead to the increase of the nervous activation, as well as to the rise of avoidance motivation. Therefore, the results of studies are contradicting. Reaction time in response to a situation can significantly influence our lives due to its practical implications. Fast reaction time can produce rewards whereas slow reaction time can produce grave consequences. [4] Very few studies have been done in India in the youth population. [8]

Aim and objectives:

Aim: To find the effect of virtual reality games on stress, anxiety and reaction time in college going students

Objectives:1. To find the effect of virtual reality games on stress using perceived stress scale in college-going students.

2. To find the effect of virtual reality games on anxiety using the Anxiety Self Rating Scale in college-going students.

3. To find the effect of virtual reality games on reaction time using Inquist 5.0v software in college-going students.

MATERIALS AND METHODOLOGY

The study design was experimental and was carried out in virtual reality game zone. The sampling method was purposive

and sample size was 10. The target population was 18-24 years old individuals.

Inclusion criteria: 1. Participants aged 18-24 years of age.2. Both males and females. 3. College going students. 4. Score of ≥13 on perceived stress scale.5. Score of on ≥17 on self-rating anxiety scale

Exclusion criteria: 1. Participants on any exercise program or going to gym.

2. Participants having addiction of alcohol consumption and smoking. 3. Participants diagnosed with any mental disorder. 4. Participants not willing to participate

Materials used:

Perceived stress scale 2. Self-Rating Anxiety Scale 3. Inquisit 5.0v software 4. Pen 5. Consent form

PROCEDURE:

50 Participants were screened using Perceived stress scale, anxiety self-rating scale. For visual and auditory reaction time Inquisit 5.0v software was used on a laptop. Participants fulfilling the inclusion criteria were selected. Pre and post readings were taken using above mentioned scales and software. Informed consent was taken from the participants. Participants underwent virtual reality intervention for 4 weeks, 3 days/week for 20min per session. Spaem software was used for the virtual reality games. It had 5 games namely tennis, basketball, archery, skiing, and boxing. The individual selected 1 game that he/she knows and played for 20min. The data was collected and put in an excel spreadsheet. Appropriate statistical test was applied, and results were analysed

RESULTS

As the sample size was small, we have considered it not normally distributed so the data was analysed using non-parametric test. Wilcoxon test was done to compare pre and post readings within group of perceived stress scale, anxiety self-rating scale, Auditory and Visual reaction time.

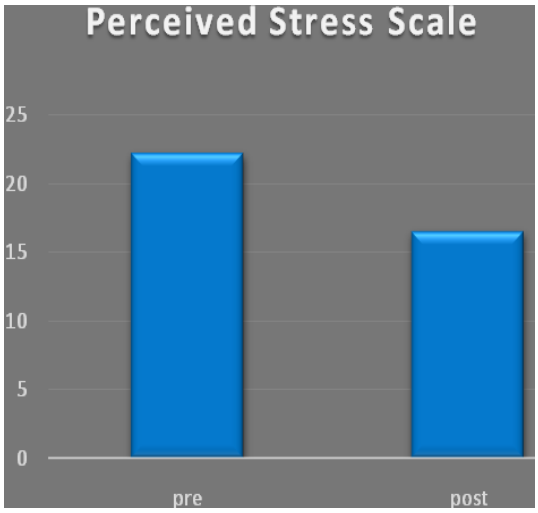
Ten participants with score of ≥13 on perceived stress scale and score of ≥ self-rating anxiety scale were included in the study. The data was entered into the excel spreadsheet, tabulated and subjected into statistical analysis.

Statistical measures such as mean, Standard deviation (SD). Test od significance such as Wilcoxon test was used to analyze the data. Results were concluded to be statistically significant with p value <0.05.

Perceived stress scale, auditory reaction time, visual reaction time and anxiety self-rating scale were the outcome measures.

Table 1: Comparison of mean of pre and post readings of Perceived stress scale

Perceived stress scale	mean	SD	p value	Interpretation
Pre	22.2	3.55	0.007	Significant
Post	16.5	5.48		

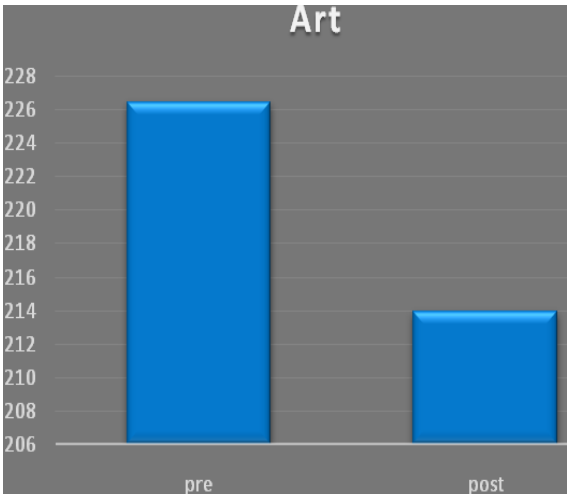


Graph 1: Comparison of mean of pre and post readings of Perceived stress scale

Interpretation: Table1 shows a comparison of pre and post readings of Perceived stress scale within the group, Wilcoxon test was applied where P value was less than 0.5, which is considered to be significant, which suggest that stress was reduced post-intervention.

Table 2: Comparison of mean of pre and post readings of Auditory Reaction Time

Auditory Reaction time	Mean	SD	p value	Interpretation
Pre	226.4	17.67	0.047	Significant
Post	213.9	22.72		

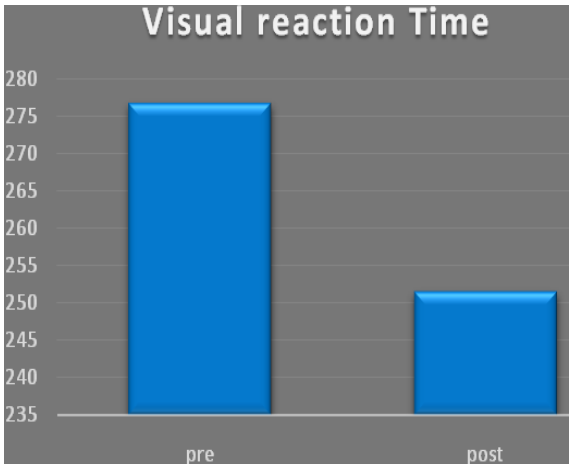


Graph 2: Comparison of mean of pre and post readings of Auditory Reaction Time

Interpretation: Table 2 shows a comparison of pre and post readings of Auditory reaction within the group, Wilcoxon test was applied where P value came less than 0.5, which is considered to be significant, which suggest that Auditory reaction time reduced post-intervention.

Table 3: Comparison of mean of pre and post readings of Visual Reaction Time

Visual reaction Time	Mean	SD	p value	Interpretation
Pre	276.6	32.23	0.028	Significant
Post	251.4	32.24		

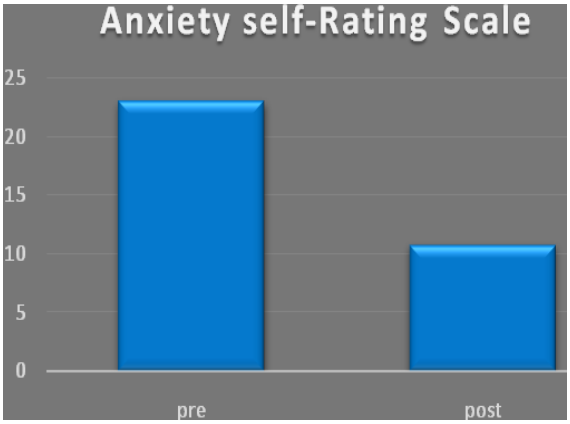


Graph 3: Comparison of mean of pre and post readings of Visual Reaction Time

Table 3 shows a comparison of pre and post readings of Visual reaction within the group, Wilcoxon test was applied where P value came less than 0.5, which is considered to be significant, which suggest that Visual reaction time reduced post-intervention.

Table 4: Comparison of mean of pre and post readings of Anxiety Self-Rating Scale

Anxiety Self Rating Scale	Mean	SD	p value	Interpretation
Pre	22.9	3.38	0.005	Significant
Post	10.7	4.8		



Graph 4: Comparison of mean of pre and post readings of Anxiety Self-Rating Scale

Interpretation: Table 4 shows a comparison of pre and post readings of Anxiety self-rating scale within the group, Wilcoxon test was applied where P value came less than 0.5, which is considered to be significant, which suggest that anxiety reduced post-intervention.

DISCUSSION

The purpose of the study was to find out the effect of Virtual Reality games on stress, anxiety and reaction time. Four weeks of intervention was given. Analysis of outcomes indicated a significant difference of pre and post readings within-group (Wilcoxon test) for all variables including PSS ($P<0.05$), ART ($P<0.05$), VRT ($P<0.05$), ASRS ($P<0.05$).

Table 1 shows that perceived stress is reduced post-intervention, the study supporting my result was done by Silvia Francesca Mari Pizzoli et al in the year 2018 titled "User-Centered Virtual Reality for Promoting Relaxation: An Innovative Approach." which stated that Virtual Reality is used to promote relaxation, reduce stress, and induce control over once own body and physiological response. Virtual reality

features contents that are generically associated with pleasant, peaceful, nonarousing sceneries such as islands, parks, gardens and other open space, generic nature-based environments. Indeed, as often used imagery techniques too. These environments have proved to be a valuable means to reduce stress. Regarding sound features specifically nature-based VR Scenarios filled with natural sounds resulted in being more effective for stress reduction, compared with natural scenarios without them. These RVR interventions usually present users with multimodal stimuli involving visual, auditory and haptic modalities to try lowering physiological activation gaining control over body reactions. Thus, not only visual natural elements display some intrinsic relaxing properties. Apart from natural sounds, RVR scenarios present auditory stimuli that may include warm and calm voices giving instructions to relax muscles, relieve stress and negative thoughts. [9]

Tables 2 and 3 show that auditory and visual reaction time is reduced post-intervention, the study supporting my result was conducted in the year 2017 by Paramita Bhattachariyya et al titled "Exposure to Video Games Shortens Simple Visual Reaction Time: A Study in Indian School Children." The study concluded that playing action video games by virtue of their very nature enhances visual processing and thinking strategy playing results in training of CNS in improving the ability to ignore or inhibit extraneous distracting stimuli. It could be also a result of training-induced enhancement of performance which abounds in the field of perceptual learning. It not only ensures better sensory-motor performance but also significantly improve the cognitive fields of these individuals. Therefore, they exhibit faster reaction time. These faster leads to better concentration, alertness, muscular coordination and improve performance in speed and accuracy task. [10]

Table 4 shows that anxiety is reduced post-intervention, the study supporting my result was conducted by Nan Zeng in year December 2017 titled "Virtual Reality Exercise for Anxiety and Depression: A Preliminary Review of Current Research in an Emerging Field." Ten electronic databases were searched for studies on this topic from January 2000 to October 2007. Studies were eligible if the article: (1) was peer-reviewed; (2) was published in English; and (3) was quantitative measure in assessing anxiety- and depression-related outcomes.

VR is a technology-based interface that allows user to experience computer-generated virtual environments. Over the past decade, VR technology has experienced increasing application in the treatment of individuals with mental disorders. As previously stated, most available VR literature focused on effects of VRET on mental disorders. VRET is based upon emotion-processing theory, which postulates that fear memories are structures and contain information regarding fear stimuli, responses, and meaning. As such, VRET has been widely used in clinical research to trigger and adjust those fear structures by presenting novel incompatible information and advancing emotional processing (e.g., creating a virtual environment containing the trigger(s) of an individual's anxiety and/or depression). Within these clinical research studies, a growing body of literature has demonstrated that VRET is related to large declines in symptoms of both anxiety and depression, and is similar in efficacy to traditional exposure therapy. [11]

CONCLUSION

The study concludes that virtual reality games are beneficial in reducing stress, anxiety and improving auditory and visual reaction time.

Limitations of study: 1. Small sample size. 2. Comparison between males and females was not done.3. Stress duration was not taken into consideration.

Future scope of study: 1. The study can be carried out in large sample size and different

population. 2. Other outcome measures can be taken. 3. Virtual Reality Intervention should be one of a part of rehabilitation program.

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How to cite this article: Tharani SA, Shah MR, Kothari PH et.al. Effect of virtual reality games on stress, anxiety and reaction time in young adults: a pilot study. Int J Health Sci Res. 2020; 10(4):156-161.

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