Effect of Virtual Reality on Self-Esteem and Presence of Adolescents : A Pre-Post Study

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The definition of 'virtual' is near and reality is what we experience as human beings. So the term 'virtual reality' basically means 'near reality'. This study tried to understand the difference in Self Esteem of Adolescents who is completing a Successful Task in Real Life Environment and in Immersive Virtual Reality experimentally. The investigator may randomly select 60 adolescents within the age group of 13 to 19 years old. These subjects may be regard as the representatives of the population. In this experiment, the experimenter wishes to have two values or conditions (real life and virtual reality). Accordingly, 80 adolescents will be divided into two groups (40 as experimental group and 40 as controlled group). The samples are matched with respect to age and sex. The samples who fail successfully in completing the task will be excluded from the study. Two randomized group design in between-group design will be carried out to assess whether two different groups can differentiate self-esteem between real and virtual experiences. Rosenberg Self-Esteem Scale (1965) and Slater-Usoh-Steed Questionnaire (SUS) were used for the study. Descriptive statistics, paired t-test and ANOVA were employed for the data analysis. The result revealed a significant increase in self-esteem of adolescents after completing the task both in an Immersive virtual reality environment and a real environment than before doing the task. Thus it can be interpreted that tasks which can give positive affirmations can be used in interventions of adolescents with low self esteem. There is no significant gender differences in self-esteem of adolescents who are completing a successful task in immersive virtual reality but in the real environment, the females showed higher self esteem than the males who are completing a successful task. There is no significant difference in presence and self esteem of adolescents completing a successful task in the real life environment against those completing the task in virtual reality. However, there is slight increase of mean difference of Self Esteem among students successfully completing a task in virtual reality than those completing the task in real environment.

Key words: Adolescents, Virtual reality, real life environment, Self esteem, presence of mind.

Introduction

The term adolescence comes from the Latin word *adolescere*, meaning "to grow" or "to grow to maturity". As it is used today, the term adolescence has a broader meaning. It includes mental, emotional and social maturity as well as physical maturity. This point of view has been expressed by Piaget (1977) when he said, psychologically, adolescence is the age when the individual becomes integrated into the society of adults, the age when the child no longer feels that he is below the level of his elders, but equal, at least in rights.

Stereotypical depictions of adolescents are not new. Many are found in English literature from Chaucer to Dickens. Although media portrayals as well as the general popular notion of teenagers are often negative (as rebellious, alienated, spoiled and lazy) many studies contradict these generalized conceptions. In this context, Alfred Bandura (1964) has suggested that sometimes a self-fulfilling prophecy plays a role in adolescent behavior. If a society believes that adolescents are rebellious and out of control and if this image reinforced in the media, some young people will identify with these qualities or at least accept them. Hall (1904) used the German phrase '*Strum* and *Drang'* (Storm & stress) to characterize the passionate, moody and rebellious nature of the adolescent personality. Modern research does not support Hall's idea that adolescence is inherently stressful.

Adolescents are different from other age groups physically, cognitively, socially and emotionally. They deserve special appreciation and understanding. Parents, teachers, trainers, counselors, social workers and others who work with young people can do a better job when they have good information about the young people they serve. After decades of relative neglect there has been a rebirth of scientific interest in adolescent psychology. Hoffman (1976) suggests that the recent rebirth of interest in adolescent development partly reflects the belief that they are responsible for or victims of a disproportionate share of today's social problems-crime, violence, substance abuse, sexual abuse, eating disorders, depression and suicide.

As children approach adolescence, they encounter an increasing number of stressful life events. Compas (1987) has suggested that multiple stressful events in adolescent's lives often foretell emotional and behavioral problems later in life. Normative stressors (difficult life experiences that most teenagers experience) include schoolwork and tests; strained relationships; pressure for achievement; over concern about one's appearance and physical development; finances; changing schools and losing friends; concern about death and global issues; concern about future etc. (Boldero & Fallon, 1995; Murray, 1996).

Large number of today's adolescents has serious life problems such as suffering through their parent's separation and divorce or living in a society where ethnic and/or political violence is a common occurrence. Similarly, adolescence in many cultures feels imperiled by political and economic events that threaten their

sense of security. Further, many young people participate in high-risk activities that jeopardize their health and survival, such as alcohol and drugs.

Adolescence generally has a problem of getting along poorly with their families. They may face with problems of adjustment where there is a difference of opinions, ideas and attitudes with their parents. When the child enters the adolescence, his social roles and responsibility also will change. Change of role requires adjustment to new situations in a different ways by changing the old habits of childhood in home, school, and society.

According to Burns, 1982, self Esteem is the beliefs and evaluations people hold about themselves determine who they are, what they can do and what they can become. These powerful, inner influences provide an internal guiding mechanism, steering and nurturing individuals through life, and governing their behavior. People's concepts and feelings about themselves are generally labeled as their self-concept and self-esteem. These, together with their ability to deal with life's challenges and to control what happens to them, are widely documented in literature (Seligman, 1975; Bandura, 1977; Bowlby, 1980; Rutter, 1992; Harter, 1999).

According to Marcia (1994), the self is the 'deepest' structure in personality than identity. The function of self-include lending meaning and organization to one's experiences and motivating action by providing standards, strategies, incentives and scripts for behavior. The concept of self is used synonymously with the concept of personality, which includes all observable personal traits and behaviors that distinguish one from others. Although theorists originally thought of self-concept as a single entity, it is more helpful to view it as multidimensional.

Positive self-esteem is not only seen as a basic feature of mental health, but also as a protective factor that contributes to better health and positive social behavior through its role as a buffer against the impact of negative influences. It is seen to actively promote healthy functioning as reflected in life aspects such as achievements, success, satisfaction, and the ability to cope with diseases like cancer and heart disease.

Conversely, an unstable self-concept and poor self-esteem can play a critical role in the development of an array of mental disorders and social problems, such as depression, anorexia nervosa, bulimia, anxiety, violence, substance abuse and high-risk behaviors. These conditions not only result in a high degree of personal suffering, but also impose a considerable burden on society. As will be shown, prospective studies have highlighted low self-esteem as a risk factor and positive self-esteem as a protective factor. To summarize, self-esteem is considered as an influential factor both in physical and mental health, and therefore should be an important focus in health promotion; in particular, mental health promotion.

Self-esteem continues to be one of the most commonly research concept s in social psychology (Baumeister, 1993; Wells & Marwell, 1976; Wylie, 1979). Teachers, administrators and parents are commonly concerned about student's self-esteem. Its significance is often exaggerated to the extent that low self-esteem is viewed as the cause of all evil and high self-esteem as the cause of all good. Self-esteem is associated with depression, anxiety, motivation and general satisfaction with one's life. Given these associations, children and adolescents who lack self-esteem may be more dependent on their parents and have lower academic and vocational goals. Moreover the belief is widespread that raising an individual's self-esteem (especially that of a child or adolescent) would be beneficial for both the individual and society as a whole.

Compared to members of other age groups adolescents are overly sensitive about their appearance and behavior. They give a lot of thought to who they want to be and how others judge them. Egocentric thinking leads adolescents to place themselves at the centre of other people's attention. Not only does this increase their sense of importance and uniqueness. It also heightens their self-awareness and occasionally their discomfort.

Erikson (1960) coined the term 'identity crisis' to refer to adolescent's serious questioning of their essential personal characteristics, their view of themselves, their concern about how others view them and their doubts about the meaning and purpose of their existence. Resolution of the identity crisis is most likely when the three

dimensions of identity, ego, personal and social-merge i.e., when a young person's capabilities and interests match the opportunities for expression available in his environment.

The adolescent who like himself as a person will invariably be quite cheerful, whereas the adolescent with low self-esteem will be depressed. Adolescents with low self-esteem are insecure in their relationships and feel anxious about futures. Low self-esteem during adolescence is also associated with drug use, delinquency, depression and suicidal thoughts. The, feelings of unworthiness and share are associated with psychological maladjustment (Bolognini et.al. 1996; Harter, 1986; Baumeister, 1993; Reimer, 1996; Schweister et.al., 1992). There is a connection between self-esteem, achievement and adjustment. Feelings of self-worth often accompany accomplishment of some kind. During the high school years, most adolescents develop increasingly positive views of themselves. Further, many students have difficulty adjusting to the transition to secondary school. The So –called 'top-dog' phenomenon suggests that the status senior secondary student in a new school environment is a blow to self- esteem.

The definition of virtual reality comes, naturally from the definitions for both 'virtual' and 'reality'. The definition of 'virtual' is near, and reality is what we experience as human beings. So the term 'virtual reality' basically means 'near reality'. This could, of course, mean anything but it usually refers to a specific type of reality emulation. The world through our senses and perception systems have five senses: taste, touch, smell, sight and hearing. These are however only our most obvious sense organs. The truth is that humans have many more senses than this, such as a sense of balance (Kinesthetic sense) for example. The sensory inputs from theses senses goes for processing of sensory information by our brains and it, ensures that we have a rich flow of information from the environment to our minds.

In other words, our entire experience of reality is simply a combination of sensory information and our brain's sense-making mechanisms for that information. It stands to reason then, that if we can present your senses with made-up information, the perception of reality would also change in response to it. Then, one would be presented with a version of reality that isn't really there, but from our perspective it would be perceived as real. Something referred as a virtual reality.

So, in summary, virtual reality entails presenting our senses with a computer generated virtual environment that we can explore in some fashion. Virtual Reality (VR) can be used to give participants an egocentric view of a co-located virtual body, using a Head-Mounted Display (HMD). They can move this body through real-time motion tracking thus providing synchronous visuo-motor stimulation.

There are many different types of virtual reality systems but they all share the same characteristics such as the ability to allow the person to view three-dimensional images. These images appear life-sized to the person. Plus they change as the person moves around their environment which corresponds with the change in their field of vision. The aim is for a seamless join between the person's head and eye movements and the appropriate response, e.g. change in perception. This ensures that the virtual environment is both realistic and enjoyable. If an implementation of virtual reality manages to get the combination of hardware, software and sensory synchronicity just right it achieves something known as a *sense of presence.* Where the subject really feels like they are present in that environment.

Immersive virtual reality or simply stated, virtual reality (VR) is a future technology that exists today as finding use in art projects, games, journalism and movies for the most part. Wherever it is too dangerous, expensive or impractical to do something in reality, virtual reality is the answer. From trainee fighter pilots to medical applications trainee surgeons, virtual reality allows us to take virtual risks in order to gain real world experience. As the cost of virtual reality goes down and it becomes more mainstream you can expect more serious uses, such as education or productivity applications, to come to the fore.

Virtual Reality and Adolescents

Several studies have shown that it is possible to substitute a person's body by a virtual one giving rise to illusions of presence and ownership with respect to the virtual body. The effects and traces of such body substitution can be measured using subjective reporting, behavioural and objective physiological measures. However, a study whether an adolescent's self esteem increases after completing a task in virtual reality environment has not yet been conducted. Similarly the effect of virtual reality on the psychological variable mindfulness and its effects have also not been studied so far. The effect of completing a task in the virtual environment versus a real environment with reference to presence is also studied here.

Today, adolescents grow up in two worlds of the Real and the Virtual. And because adolescents must develop skills for competently operating in each if they are to achieve a functional independence, parents must embrace this new complexity in preparation they provide. Although, of course the two worlds overlap, consider a rough contrast between experiencing the two. There are just a few of possible differences adolescents might experience between living in the Real and the Virtual world. Because most parents of adolescents primarily grew up in a Real world setting, even though they themselves have become acculturated to the Virtual world as adults, they have no historical frame of reference for being parented in the Two Adolescent Worlds of today.

Adolescents, are the one who choose more to live in a virtual world than any other groups. For instance in a world of computers and televisions, losing touch with the real world and its problems. Undoubtedly that the benefits of computers in everyday life cannot be questioned, absolutely in every field of science or life the computer has become a good and indispensable friend due to its specific effectiveness. But things do not stop here because we know that anything, no matter how good it is, used excessively, especially during childhood and adolescence, may lead to seizure, to addiction and even disease.

Because of many shortcomings in the society, that adolescents confront during this period, cause them to spend more time in another world, unreal, "virtual", which is more easily accessible and manageable than the real world in which we live. "Virtual" world helps a teenager to access almost anything, very quickly, without money or with less money. This world does not humiliate him and also it creates a satisfaction and a safety feeling. The safety feeling that adolescent feels in this "virtual" world , is also due to lack of attention of his parents which are too busy with so many other things in which he feels excluded, causing him to spend more time on the internet where he does not feel alone anymore.

Need and Significance of the Study

The purpose of the present study was to assess the effect of virtual reality on the self-esteem among adolescents in the age group of 13 to 19 years. This study is intended to validate whether a virtual body can be effectively recognized as a feasible substitute to the self-body at the unconscious level as far as self esteem and mindfulness is concerned. A mental activation equivalent to what would be expected in a real scenario is to be

found after exposing participants to immersive virtual environment. This particular result provides a measure of response-as-if-real indicating that participants tended to accept their given virtual bodies as their own.

The main objectives of the study is to draw attention to the fact that there is a difference in self esteem of adolescents who are completing a successful task in real life and in immersive virtual reality .

The Rosenberg Self Esteem questionnaire was administered to the group of students. This was the pre test survey. After a 2 week, the students were divided into a control group and test group. Both the groups were given a task. They were demonstrated the process of withdrawing money from a bank. They were asked to reproduce the order of the proceedings in money withdrawal from a bank, in the correct order. By doing this, they were told that they will be becoming a part of nation building, by helping the illiterate people be a part of digitization of the economy. This could inflict a sense of achievement and self - esteem in the students. The difference in testing both the groups was that, the test group was put in a VR environment to complete the task and the control group was given a direct demonstration. After the completion of the test, successful candidates were again given the Rosenberg Self Esteem questionnaire. This was the post test survey. This time the candidates in VR were also tested with the *Slater-Usoh-Steed Questionnaire (SUS)* to understand the variable presence.

The adolescents in this age group face many kinds of pressures at home and also outside. It is globally accepted fact that during adolescence a child goes through a lot of changes physically, emotionally and socially. These changes have a great impact on them; they can either make or break an individual. The family nurtures the individual and prepares him for his role and function in society. Consciously, or unconsciously the home environment and one's own body moulds the behavior, personality, and attitude, level of aspiration, aptitude of the child. The modern era of globalization and liberalization has not only changed the economy of our nation but also embarked a great revolution in the society and culture as a whole. These ongoing changes in the society have not only affected the thinking of people but has also changed the perceptions of people, their lifestyles, even the dimensions of anxiety have changed, now even the small children are facing different kinds of pressures, so adolescence which is considered an age of storm and strife is bound to have more pressures which affect their emotional maturity.

There are a lot of cultural differences in the upbringing of children as well as in family dynamics between India and western countries. While in the western cultural context, adolescence is considered as a period of emancipation from parents. In India, the dependence of adolescents on his family continues. In the Indian family setting, families are highly cohesive and bound by close kinship ties. We live a shared life and subordinate individual autonomy to family cohesiveness. Moreover, the economic scenario and the employment opportunities make our adolescents more dependent upon the family/parents than in the west. Hence a task performed in the real world and a task performed in a virtual world could give different self esteem outcomes for an individual.

Any Pre- Post study on self - esteem among adolescents paves light into what drives the factors affecting self esteem at this particular age, which makes or breaks an individual. But, how Virtual Reality tools becomes handy is because of the immersive effect it in providing a completely different environment to test the subject. Recent proliferation of available virtual reality (VR) tools has seen increased use in psychological research. This is due to a number of advantages afforded over traditional experimental apparatus such as tighter control of the environment and the possibility of creating more ecologically valid stimulus presentation and response protocols.

A number of sexual and substance abuse prevention interventions have been successful at improving knowledge and behavioral skills. During adolescence,youth engagement in risk behaviors increases, placing many adolescents at risk for pregnancy and other unwanted health outcomes. Youth Risk Behavior Surveillance (YRBS) data indicate that among adolescents in high school, 71% have tried alcohol and 40% have tried marijuana (CDC, 2012). Therefore, making innovative, adolescent-friendly tools in virtual reality may enhance the capacity of risk prevention interventions among adolescents.

Researches found that virtual reality therapy may be used as treatment techniques in psychological disorders, like agoraphobia, Post traumatic stress disorder etc. It allows patients to achieve victory over virtual height situations they could not confront in real life, and that gradually increasing the height and danger in a virtual environment produced increasing victories and greater self-confidence in the patient that they could actually confront the situation in real life. Virtual therapy interventions empower people. The simulation technology of

virtual reality lends itself to mastery oriented treatment . Rather than coping with threats, phobics manage progressively more threatening aspects in a computer generated environment. The range of applications can be extended by enhancing the realness and interactivity so that actions elicit reactions from the environments in which individuals immerse themselves.

The effectiveness of virtual reality therapy is also found in treating military combat personnel who were already diagnosed with chronic PTSD (post-traumatic stress disorder), the treatment consists of which consisted of multiple sessions of virtual reality exposure and virtual reality exposure therapy and they found decrease of symptoms of PTSD. VR is very helpful in these areas as it is impossible for military combat personnels to return to the war zone, it can be recreated in virtual reality. Many, World Trade Centre attack victims of 9/11 were subjected to VR therapy and found useful in PTSD.

Virtual Reality (VR) Therapy is one of the emerging and most effective applications of VR technology, where patients are exposed to stimuli in fully controllable environments. Whether it is immersive, such as a HMD, or non-immersive, such as desktop-like displays, the idea is to recreate a believable artificial environment that stimulates physical responses similar to those of a real environment that can be individually controlled, replicated, and tailored to the patient's experiences. The patient is presented only with environmental features that he or she can control, such as difficulty level, complexity, and amount of stimuli. This enables a highly scalable and controllable environment. Researchers have also developed VR programs that are intended to distract patients and work as a virtual pain relief, e.g. for back pain and for children who are undergoing treatment for cancer. Slow, mild and controlled exposure for patients suffering from acrophobia, aquaphobia and arachnophobia has been proven helpful.

The current study, focusing on the influence of virtual reality on the self-esteem of adolescents is expected to contribute to the existing knowledge which may enrich the people working with the adolescents particularly the parents, teachers and counselors. This empirical study is expected to unveil the factors in the family environment that are of vital importance in the formation of self-esteem as well as in the adjustment status of the adolescents. It is hoped that the findings may suggest means to have better home environments to enhance to self-concept of adolescents and guide them become well-adjusted individuals along with emotional maturity.

During the period of adolescence, self- esteem is particularly vulnerable and is easily influenced by feedback from the environment. However, the most important and factors that influence students' self-esteem is the environment they are in, which is both the real environment(home, school etc) and the virtual environment(social media, gaming).

Review of Literature

In order to reproduce experiments that are ethically impossible in a real scenario with humans and where the intrinsic limitations of manipulating the bodily signals make impossible the alteration of spatiotemporal coherences of multisensory stimulations turn to Virtual Reality (VR). Immersive Virtual Environments (IVE) can be used to systematically test particular stimuli in humans without compromising their integrity.

Several studies have shown that it is possible to substitute a person's body by a virtual one and measure the effects and traces of such embodiment via experiments using subjective reporting, behavioural and/or objective physiological measures (Llobera et al. 2013; Maselli and Slater 2013; Kokkinara and Slater 2014).

A study conducted by Luciana (2010) on one minute more: Adolescent addiction for virtual world viweed that more and more children and adolescents choose to live in a virtual world, a world of computers and televisions, loosing touch with the real world and its problems. The results found that both the degree of computer use by teenagers as extracurricular activities and also the factors that push them to use excessively the computer in their spare time. The main objectives draw attention to the fact that adolescents who spend too much time in front of the computer quickly become to have different problems in various areas of life; to identify the extent of computer use by adolescents, as a extracurricular activities; to explore the factors favoring that it causes adolescents to excessively use computer during their spare time; to present the consequences and the effects of computer dependency into the lives of Romanian adolescence.

According to Barlow (1999), In the near future, as far as adolescence and teen agers concerned, virtual reality will be so cheap as to become universal. When that happens, previously disenfranchised individuals and communities will gain what has been denied them for so long; the pedagoggy of the oppressed can be made in

the real virtual world. For adolescents, this positive vision might include increased self-esteem and a sense of voice of marginalized youth and communities, a strong sense of global culture etc.

Etengoff (2011) conducted a study on Playing with Pixels: Youth, Identity, and Virtual Play Spaces. The study focused upon the impact that virtual play spaces. It was reported that virtual environments such as Teen Second Life are cultural tools that enable contemporary youth to mediate their processes of identity construction, social relations, and cognitive development through their co-engagement in symbolic activities such as storytelling and avatar design. In addition a wide range of scholarsconcerns regarding vulnerable virtual players (for example, those with low self-esteem) as well as the larger social implications of virtual environments themselves. For these reasons, those who work with adolescence should focus upon inviting them to critically reflect upon their choices concerning their participation in and use of virtual environments

Cabiria (2008) found that after adult lesbian and gay Second Life users engaged in online virtual world activities they reported an increased sense of belongingness, connectedness, improved well being, higher self-esteem, and optimism.

Cabiria (2008) hypothesized that these positive outcomes resulted from an increased sense of authenticity related to the lived virtual experience. That is to say, the authentic self was able to safely emerge within the virtual spacedesigned by youth for youth have on the development of today"s adolescents.

In an article, (Young, 1998 and 2009) reported the fear that adolescents with low self-confidence and limited social skills may be particularly vulnerable to the danger of substituting their virtual life and identity for physical world social interactions

This substitution technology provides a reliable platform to study how adolescents represent their bodies and which are the responses to body changes, motor actions, and body perception in general. In fact, VR allows us to alter the virtual body in ways that would not be achievable in the real world, for example changing body sizes [Banakou et al., 2013; Normand et al., 2011], modifying limbs [Kilteni et al., 2012], altering the race [Peck et al. 2013] or gender and age [Slater et al. 2010] of experiment participants.]

Taking into account more recent discussions of presence, Bystrom, Barfield & Hendrix (1999) introduce the Immersion, Presence and Performance model of interaction in IVEs. It is implicit in their approach to presence that this would be optimal for people in the real world as compared to a virtual world. This approach to presence is concerned with action rather than the appearance of how things look and sound. In other words 'being there' is the ability to act there. It is clear that in this approach also, the greatest potential for people to carry out successful action is in the real world. (Whether or not they can actually carry out these actions because of questions of personal ability or power relationships is another matter).

A thorough review of the literature on presence can be found in Draper, Kabur & Usher (1998). If presence is optimal for real-world experiences then methods that attempt to elicit or measure presence should be able to discriminate between experiences that take place in a physical environment and virtual environment.

Methodology

The purpose of any research design in to provide a maximum amount of information relevant to the problem under investigation at a minimum cost. A with-in group design is followed in the study. Here the same sets of adolescents are tested differently at different times (after a two weeks time) and we compare their score as result of different treatments. Thus in the research design, one group pretest-posttest design will be followed.

Pretest-Posttest Design

For many true experimental designs, pretest-posttest designs are the preferred method to compare participant groups and measure the degree of change occurring as a result of treatments or interventions.

Pretest-posttest designs grew from the simpler posttest only designs, and address some of the issues arising with assignment bias and the allocation of participants to groups. The only stipulation is that the subjects must be randomly assigned to groups, in a true experimental design, to properly isolate and nullify any nuisance or confounding variables.This design allows researchers to compare the final posttest results between the two groups, giving them an idea of the overall effectiveness of the intervention or treatment. (C) The researcher can see how both groups changed from pretest to posttest, whether one, both or neither improved over time. If the control group also showed a significant improvement, then the researcher must attempt to uncover the reasons

behind this. (A and A1). The researchers can compare the scores in the two pretest groups, to ensure that the randomization process was effective. (B)   These checks evaluate the efficiency of the randomization process and also determine whether the group given the treatment showed a significant difference. In the present study Survey Research method is also used to collect data of self esteem of adolescents.

Sample

   In this study, the investigator randomly selected 60 adolescents within the age group of 13 to 19 years old. They were selected from different schools of Kottayam and Ernakulam district. These subjects are regarded as the representatives of the population. Out of which 30 of them are males and 30 of them are females. The samples are matched with respect to age and sex. The control group contained 15 males and 15 females, while the experimental group contained 15 males and 15 females. The samples who failed to successfully completing the task were excluded from the study. The schools included different areas of a each district, one from urban area, one from a suburban area and one from a rural community. The student sample included 100, 60, 50, and 30 percent of the rural, suburban, working-class, and inner-city schools, respectively; selection was made from among the classes of social studies teachers who were interested in cooperating with the research project. All the classes were untracked and heterogeneous in their particular schools. The students, by virtue of being at least marginally successful in public schools, were thus not representative of the full range of alienation in adolescents.

Tools/ Instruments in Pre Test

   The following tools were used for collecting the data for the study, in the pre test:

Personal Information schedule

    Personal data schedule was prepared by the investigator in order to collect information regarding the socio demographic characteristics of participants like age, gender, number of siblings, birth order, socio-economic status, place of residence, academic standing and previous VR experience. The two groups took 3 minutes in completing this section.

Rosenberg Self-Esteem Scale

The Rosenberg Self-Esteem Scale (1965) developed by sociologist Rosenberg, is a self-esteem measure widely used in social science research. The RSES is designed similar to social survey questionnaires. It is a ten-item Likert type scale with items answered on a four-point scale from strongly agree to strongly disagree. Five of the items have positively worded statements and five have negatively worded ones. The scale measures state self-esteem by asking the respondents to reflect on their current feelings. The Rosenberg self-esteem scale is considered a reliable and valid quantitative tool for self-esteem assessment. The two groups were given no time limit. The last person completed the questionnaire after 4 minutes.(Appendix 4.1)

Reliability and Validity

The Rosenberg self-esteem scale presented high ratings in reliability areas; internal consistency was 0.77, minimum coefficient of Reproducibility was at least 0.90 (Rosenberg, 1965). A varied selection of independent studies each using such samples as parents, men over 60, high school students, and civil servants showed alpha coefficients ranging from 0.72 to 0.87 (all fairly high) Test-retest reliability for the 2 week interval was calculated at 0.85, the 7 month interval was calculated at 0.63 (Silber and Tippett, 1965, Shorkey and Whiteman 1978). The RSE is closely connected with the Coopersmith Self-Esteem Inventory.

Tools/ Instruments in Post Test

The following tools were used for collecting the data for the study after 2 week interval:

Real environment and Immersive virtual reality environment

Real environment is a class room or room in which the students are explained the different steps of withdrawal of money from a bank. Immersive virtual reality environment is an exact replica of the real environment created using animation software and 360 degree filming.

The filming was previously done using a Freedom 360 Gopro Rig and stitched seamlessly for a VR 360 degree viewing using Autopano Video software.

The scenarios were implemented on an Oculus Rift HMD with the following features.

Headset with the following specifics :

Resolution: 960 x 1080 per eye.

Field of View: 100° Field of View (nominal)

Display Type: AMOLED.

Display Size: 5.7″

Video Input: DVI/HDMI.

Weight: 440 grams (without cable)

Head Tracking: Available.

- Touch Controllers
- Two Sensors
- Remote
- Xbox One Wireless Controller

The self esteem questionnaire and MAAS questionnaire were administered twice on the same adolescents group within a reasonable time gap of two weeks. Figure 1. A. indicates the real environment in which the group observe the banking process to complete the task. B. Indicates the immersive virtual environment in which the group observe the banking process to complete the task

After a gap of 2 week, the students were divided into a control group and experimental group. Both the groups were given a task. They were demonstrated the process of withdrawing money from a bank. They were asked to reproduce the order of the proceedings in a bank withdrawal in the correct order. The task was created to test the attention and reproduction ability of the order of the bank process. The subjects were told that by reproducing the process, they will be later helping out illiterate people to do this process in a bank.By doing this, they were told that they will be becoming a part of nation building, by helping the illiterate people be a part of digitization of the economy. This could inflict a sense of achievement and self - esteem in the students. The difference in testing both the groups was that, the test group was put in a VR environment to complete the

task and the control group was given a direct demonstration. After the completion of the test, successful candidates were again given the Rosenberg Self Esteem questionnaire and the MAAS(Mindfulness Awareness Attention Scale) questionnaire. This was the post test survey. This time the candidates in VR were also tested with the **Slater-Usoh-Steed** Questionnaire (**SUS**) to understand the effect of the variable, presence.

The SUS questionnaire as used in the above cited most recent studies was employed, the only change being that direct references to an experience within a VE were changed to refer to the 'bank'. Hence the same questionnaire could be used for both V and R groups. The 6 questions relating to presence were as follows:

1. Please rate your sense of being in the office space, on the following scale from 1 to 7, where 7 represents your *normal experience of being in a place*.

I had a sense of "being there" in the bank:

1. Not at all ... 7. Very much.

2. To what extent were there times during the experience when the bank was the reality for you?

There were times during the experience when the bank was the reality for me...

1. At no time ... 7. Almost all the time.

3. When you think back about your experience, do you think of the bank more as images that you saw, or more as somewhere that you visited?

The bank seems to me to be more like...

1. Images that I saw ... 7. Somewhere that I visited.

4. During the time of the experience, which was strongest on the whole, your sense of being in the bank, or of being elsewhere?

I had a stronger sense of...

1. Being elsewhere ... 7. Being in the bank.

5. Consider your memory of being in the bank. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today? By 'structure of the memory' consider things like the extent to which you have a visual memory of the bank, whether that memory is in colour, the extent to

which the memory seems vivid or realistic, its size, location in your imagination, the extent to which it is panoramic in your imagination, and other such structural elements.

I think of the bank as a place in a way similar to other places that I've been today... 1. Not at all ... 7. Very much so.

6. During the time of the experience, did you often think to yourself that you were actually in the bank?

During the experience I often thought that I was really standing in the bank...

1. Not very often ... 7. Very much so.

Slater-Usoh-Steed Questionnaire (SUS)

The Slater-Usoh-Steed (SUS) questionnaire has been developed over a number of years and a number of experiments at the University College of London. The questions are based on variations on one of three themes: sense of being in the VE, the extent to which the VE becomes the dominant reality, and the extent to which the VE is remembered as a place. Participants rate each of the six questions on a 1-to-7 scale and the number of 6 and 7 responses is counted to produce the score for the SUS. An example question is " During the time of the experience, did you often think to yourself that you were actually in the office space? 1(Not very often) - 7(Very much so)" .

Slater, Usoh, and Steed (1994) proposed that both external and internal factors contribute to presence. They identified external factors based on existing research. These factors were quality and resolution of displays, consistency of environment, interactivity, realistic self-representation, and simple connection between actors and effects. Internal factors were identified based on a Neuro Linguistic Programming model. These factors were primary presentation system (visual, auditory or kinesthetic) and perceptual position (egogenic or exogenic). An empirical model was constructed that related sense of presence to these factors. Partly based on Barfield & Weghorst, three presence indicators were identified:

1. Sense of being there

2. Extent to which the VE becomes more "real or present" than reality

3. Locality: the extent to which the VE is thought of as a place visited.

The original SUS questionnaire consisted of three items rated on a seven point rating scale. It has since been extended; the latest version contains six items. These items are listed in Appendix A. The overall score is calculated as the number of high (score six or seven) responses. This avoids the problem of averaging ordinal responses, and allows the use of logistic regression.

There are two principal ways used in the literature to calculate the level of presence based on the SUS presence questionnaire: the presence average, where the average score across all six questions is calculated for each participant and this average is used to rank and categorise the responses; and the presence count, where the number of times each participant selects a particular score is recorded and various classifications are determined from the groupings. Using the presence count method, and as proposed by Slater et al , where a participant scores 2 or more high (6 or 7) responses they are classified as high presence, a score of 1 is deemed to be medium presence and a score of 0 is deemed to be a low presence response. (Enclosed as Appendix 4.3)

Procedures

Permission to conduct the study was obtained from the concerned school principals. Out of the 15 classes (8th standard thru 10th Standard), the respondents were selected randomly. For this, the attendance register was made use of. Every alternate student from the register (1, 3, 5, 7 and so on…) was selected and was given the questionnaires bound together. To emphasize the assurance of confidentiality, the respondents were not required to reveal their names anywhere in the questionnaires or General Data Schedule. But to conduct a pre-post study some initials were required to trace back the questionnaires to each respondent.

(a) When initially agreeing to take part in the experiment, the subjects were briefed and a disclosure agreement [Appendix 5] was given, a time was booked for several days later. On the day of testing they were introduced to the Rosenberg Self Esteem questionnaire and MAAS questionnaire. They were asked to complete the questionnaire. There was no time limit. However the first person completed in 1 minute and the last person completed in 5 minutes.Time taken was also noted.

One subject did not complete this questionnaire, so that the part of the analysis requiring use of the representation systems variables, was based on 60 subjects.

(b) On arrival for the experimental session, the subjects were given a sheet to read, briefly outlining the various procedures, including a warning that some people experience a degree of nausea caused by virtual reality. The subjects were given the opportunity to withdraw at that point (though none did so).

(c) The experimental guide introduced the subject briefly to the HMD Oculus Rift. The subject donned the HMD for a short training period. This offered training in picking up objects, and moving through the environment. The training lasted for a maximum of five minutes.

(d) The HMD was removed and the subject given the disclosure to read, and any questions were answered at that point.

(e) The HMD was donned once again, and the main experiment completed.

(f) The HMD was removed, and the subject taken to another room to complete the post-experiment questionnaire.

The experimental process involved a class announcement by the lecturer in charge to invite participation. Participation was entirely voluntary and there was no grading associated with the exercise. The volunteers were then invited in groups to a separate lab location where independent HMD devices were installed on high-performance computers, each physically separate to the other.

The students were divided into a control group and test group. Both the groups were given a task. They were demonstrated the process of withdrawing money from a bank. They were asked to reproduce the order of the proceedings in money withdrawal from a bank, in the correct order. By doing this, they were told that they will be becoming a part of nation building, by helping the illiterate people be a part of digitization of the economy. This could inflict a sense of achievement and self - esteem in the students. The difference in testing both the groups was that, the test group was put in a VR environment to complete the task and the control group was given a direct demonstration.

The task was to remember the right sequential order in which a person has to do things in order to withdraw money from a simulated bank.Many students who participated could not complete the task successfully. They were discarded. Only 30 students who could successfully complete the task in the real environment and 30 students who could successfully complete the task in the virtual environment were selected for the next phase.

After the completion of the test, successful candidates in both the groups were again given the Rosenberg Self Esteem questionnaire and the MAAS(Mindfulness Awareness Attention Scale) questionnaire. This was the post test survey. This time the candidates in VR environment were also tested with the **Slater-Usoh-Steed** Questionnaire (**SUS**) to understand the effect of the variable, presence.

Result and Discussion

This section describes the major objectives of the study. This gives the comparison between pre and post study of self- esteem among participants doing a task in real environment and virtual environment. Thus this section gives the result of the test. Comparison is also made between presence of participants doing the task in real environment and virtual environment. Analysis of gender difference in self- esteem and mindfulness of participants in both environments are also studied.

Hypothesis 1:

There will be significant difference in self-esteem of adolescents before completing a successful task and after completing the task in a Immersive virtual reality

Table 1: Mean, SD and corresponding t - value of the VR group before and after. (Self Esteem before task and Self Esteem after task)

Variables	Self Esteem Before task		Self Esteem After task		t value
	Mean	SD	Mean	SD	
Virtual Environment	20.20	4.35	20.83	4.96	25.324**

*** Significant at the 0.01 level**

Table1 indicates the mean, SD and corresponding t- scores of the group who did the task in the immersive virtual reality. The corresponding scores on the variable self esteem before and after doing the task in the VR environment is given. From table it can be inferred that the mean scores of self esteem has a slight difference in values before and after the task. It has increased slightly after task. It reveals that the Mean Score of (20.83) self

esteem after task is higher when compared to Mean Score (20.20) of self esteem before task.n But in order to test the significance of difference between two states, t-test was employed. It was found that there is a significant differences between self esteem before doing the task and after successfully completing a task in VR environment. Thus there is significant difference in self esteem of students before and after doing a task in virtual reality at 0.01 levels. Self Esteem is slightly higher for adolescents who successfully completed a task in virtual reality environment than before doing the task.

This may be because the candidates after completing the task has a feeling of achievement and also they value themselves more because they have helped someone in need by fulfilling the task. Also they have performed something in a new medium, virtual reality, which makes them feel worthy of doing . The high expectation of finishing the task in a lesser explored medium like virtual reality and the positive outcome, increases the confidence. This is reflected in their self esteem. In consistent with the above findings Broker Joel (1979) conducted a Study of the effects of self-esteem, success–failure, and self-consciousness on task performance. It was proved that if low SEs were provided with success feedback from a previous task, then the nature of their self-consciousness would be altered on a subsequent task. Thus after a positive feedback and a false success assurance, those with low self esteem who failed the previous task , succeeded in a subsequent task, which shows also an increase in self esteem. Thus the first hypothesis is accepted with this finding.

Hypothesis 2: *There will be significant difference in self-esteem of adolescents before completing a successful task and after completing the task in the real life environment*

Table 2: Mean, SD and corresponding t - value of the real environment group before and after. (Self Esteem before task and Self Esteem after task)

Variables	Self Esteem Before task		Self Esteem After task		t value
	Mean	SD	Mean	SD	
Real	18.6667	4.13007	20.1667	3.86035	28.613**

Environment					

*** Significant at the 0.01 level*

Table 2 indicates the mean, SD and corresponding t- scores of the group who did the task in the real environment. The corresponding scores on the variable self esteem before and after doing the task in the real environment is given. From the table it can be inferred that the mean scores of self esteem has a difference in values before and after the task. It has increased slightly. It reveals that the Mean Score of (20.167) self esteem after task is higher when compared to Mean Score (18.67) of self esteem before task.But in order to test the significance of difference between two states, t-test was employed. It was found that there is a significant difference between self esteem before doing the task and after successfully completing a task in a real environment.

Thus there is significant difference in self esteem of students before and after doing a task in a real environment at 0.01 levels. Self Esteem is higher for adolescents who successfully completed a task in virtual reality environment than before doing the task.

This may be because the candidates after completing the task has a feeling of achievement and also they value themselves more because they have helped someone in need by fulfilling the task. Also they have performed something which makes them feel worthy of doing . The high expectation of finishing the task successfully and the positive outcome increases the confidence. This is reflected in their self esteem.

In consistent with the above findings Feather, Saville, Margaret (1967) conducted a Study of Effects of amount of prior success and failure on expectations of success and subsequent task performance.. Anxiety and Disappointment were tested before and after the performance of tasks. And it was found that they negatively correlated. Which also shows that while there was anxiety before doing a task, led to decrease in anxiety after the completion of the task. This could be also attributed as increase in self esteem, after successful completion. Thus the second hypothesis is accepted with this finding

Hypothesis 3:*There will be significant gender differences in self-esteem of adolescents who are completing a successful task in immersive virtual reality.*

Table 3 Means and S*tandard* deviation of gender differences in self-esteem of adolescents who are completing a successful task in immersive virtual reality and corresponding t-value.

Variables	Male (15)		Female (15)		t value
	Mean	SD	Mean	SD	
Self Esteem after task	21.4000	5.44846	20.2667	4.54292	.619

Table 3 shows the mean and Standard deviation in self esteem between male and female adolescents who are completing a successful task in immersive virtual reality. It reveals that the Mean Score of (*21.4000*) male is higher when compared to Mean Score (*20.2667*) of females. But in order to test the significance of difference between two groups, t-test was employed. It was found that there are no significant differences between two groups(male and female) in perceived self esteem.

The increase of self esteem in males after completing a task in virtual reality, over female students may be because, the males are more interested to try out new technological gadgets. Male knowledge about the use of virtual reality in gaming and movies, could be higher than that of females of Kerala, who are lesser prone to play video games. Thus the excitement of experimenting virtual reality and successful completion of a task in VR would have increased the self esteem of male candidates more than females.

As a subjective evaluation, there is no need of disparity between self esteem between male and female adolescents in our society. In consistent with the above finding, the studies by Gentile, Brittany; Grabe, Shelly; Dolan-Pascoe, Brenda; Twenge, Jean M.; Wells, Brooke E.; Maitino, Alissa (2009) states there is no gender difference among the specific self esteem domains like, academic self esteem, social acceptance self esteem, family self esteem, and affect self-esteem between male and female adolescents. Thus the hypothesis is rejected.

Hypothesis 4: *There will be significant gender differences in self-esteem of adolescents who are completing a successful task in real life environment*

Table 4 -Means and Standard deviation of gender differences in self-esteem of adolescents who are completing a successful task in real environment and corresponding t-value.

Variables	Male (15)		Female (15)		t value
	Mean	SD	Mean	SD	
Self Esteem after task	18.5333	4.32380	21.8000	2.54109	2.523*

* Significant at the 0.05 level

Table 4 shows the mean and Standard deviation in self esteem between male and female adolescents who are completing a successful task in real environment. It reveals that the Mean Score of (*21.8000*) female is higher when compared to Mean Score (*18.5333*) of males. But in order to test the significance of difference between two groups, t-test was employed. It was found that there are significant differences between two groups in perceived self esteem and it was found significant at (0.05) level.

The increase of self esteem in females after completing a task in real environment, over male students may be because, the females are more interested to try out new tasks in real world than using technological gadgets. Male knowledge about the use of virtual reality in gaming and movies, could be higher than that of females of Kerala, who are lesser prone to play video games. But females are more interested in social work and doing service to others in real life. Thus the excitement of helping out someone doing a task and successful completion of that task i would have increased the self esteem of female candidates more than males.

Conclusion

One of the major findings of this study is that there is significant increase in self-esteem of adolescents after completing a successful task than before completing the task both in a Immersive virtual reality

environment and a real environment. This is a positive sign. This will help psychologists and programme developers develop tools and tasks in virtual reality to enhance self esteem of adolescents.

The presence test is that the questionnaire should be applied to individuals in a real environment, and should consistently result in higher 'presence' responses than for people in a virtual environment, other things being equal. This test was applied to two groups with SUS presence questionnaire. The SUS questionnaire showed no significant differences in measured presence between a group carrying out a search task in a virtual environment, and another group carrying out the task in a corresponding real environment.

The most important result is that if a scientist asks a lay person a question, for example, concerning their 'sense of being there' that person will come up with some interpretation that makes the question seem sensible, and then answer that question. If someone is asked for their sense of 'being there' on a 1 to 7 scale, it gives them permission to answer with a score of less than 7 even when they are really there. The questions are reinterpreted to make sense in the given context. In a VE presence is interpreted as the sense of being in the environment that is depicted by the computer generated displays, and the ability to act in that environment. In the real-world, since there is no doubt that the individual is present in the obvious sense, it becomes reinterpreted as the sense of involvement, the lack of isolation, perhaps the degree of comfort. The thought 'I am not comfortable to be here' might lead to a low 'presence' response.

The finding that there is no significant difference in presence, mindfulness and self esteem of adolescents completing a successful task in the real life environment against those completing the task in virtual reality shows that the virtual environment was simulated almost as real as the real world using 360 degree filming and the best HMD devices available. Thus a virtual environment can substitute reality almost as effective as the real environment.

The findings also showed that there is significant difference in mindfulness of adolescents after completing a successful task against before completing the task in a Immersive virtual reality and real environment. This is a positive sign. This will help psychologists and programme developers develop tools and tasks in virtual reality to enhance self esteem of adolescents.

It is also revealed that there is no significant gender differences in self esteem and mindfulness of adolescents who are completing a successful task both in virtual environment and real environment. Since self esteem and mindfulness are psychological variables why there should be disparity between male and female? In the modern world, it is against the developmental principles of a nation.

In spite of every effort to make the study, as precise and objective as possible, certain limitations has been found in this study. And the researcher was able to identify the following limitations The study is restricted to only certain schools in Kottayam and Ernakulam districts only. The study is confined to the adolescents between the age group of 15 – 18 years. Findings of the study are generalized, based on the student's response. The study utilises only three variables- Self Esteem, Mindfulness and Presence. More psychological variables could have been added. The samples size was only 60. The study did not include more children with previous VR exposure. Lack of experience of the investigator was a problem. As the study was time bound and had to be completed within a limited period of four months the sample size and the area had to be restricted .There is a need for further research in effect of Virtual Reality on Self Esteem at the individual level as well as societal level. Thus the future research on learning disability may incorporate the following suggestions.

1. Future research may be carried out on larger samples selected by using appropriate sampling procedures

2. Future researchers may include larger geographical areas

3. More variables could be included.

4. There should be provisions to give incentives to participants so that their participation will be more genuine.

5. The study can be conducted as a longitudinal study, provided there is adequate time limit.

To sum up, this present investigation is a humble attempt to unfold the problems of adolescents who have taken a task in virtual reality with respect to their self esteem, and presence. It is submitted hoping that it might stimulate and generate more research in this field.

In light of the fruitful experience, investigator feels that since assurances of successful completion of tasks shows increase in subsequent self esteem, such practices should be included in schools in the real environment. Such tasks if included in the virtual world would also be beneficial for adolescents.   Investigator suggests that we should include more of virtual reality environments in treatment of conditions for which an access in real world is not possible. (Post war trauma, Phobias etc)

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