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EFFECTIVENESS OF AUGMENTED REALITY TO ENHANCE LATERAL THINKING OF HIGH SCHOOL STUDENTS

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ABSTRACT- This paper explores the effectiveness of augmented reality to enhance lateral thinking of high school students. The researcher adopted the experimental method.Sample108 was taken for the research. Tools Used Augmented reality marker-based content, lateral thinking scale developed and standardized by the researcher. While taken pre-test of the experimental group had been used conventional teaching method so there are no changes of the control group and experiment group in lateral thinking and after the researcher has been used Marker-Based Augmented Reality content to the experimental group. Augmented Reality can also inspire empathy in an individual. It offers three-dimensional methods of presenting information versus the traditional one- dimension. The result of the research concludes that there is a significant effect of augmented reality to enhance lateral thinking of high school students.

Keywords: Augmented Reality, Educational Technology, Lateral thinking.

I. INTRODUCTION

Today, we are subject to innovation for all that we do. Technology has revolutionized the way we perform our day-to-day activities and works in the modern world. Educational technology has improved the efficiency and effectiveness of most all formal systems in human experience. It provides an appropriately designed situation for learning and teaching. Educational technology can be conceived as a science of techniques and methods by which educational goals can be realized. The use of educational technology in acquiring knowledge and skill has become an essential element in education and training. These educational technology elements in the educational process have magical efforts. A nation's intellectual strength depends on educational technology support. The use of computing and communicating technology, to enhance the efficacy of transaction and productivity,is the driving force in this new era of social and economic transformation in the new society. General instruction programs worried about the investigation of innovation, the utilization of specialized methods and cycles to tackle issues, and the effect of innovation on people and society (Note: Since the mid-1980s, "Technology Education" has become the preferred name for "Industrial Arts" programs) Thinking Skills Interrelated, generally "higher-order" cognitive skills that enable human beings to comprehend experiences and information, apply knowledge, express complex concepts, make decisions, criticize and revise unsuitable constructs, and solve problems used frequently for a cognitive approach to learning that views explicit "thinking skills" at the teachable level.

NATURE OF VARIABLE

AUGMENTED REALITY

Increased Reality is the innovation that grows our actual world, adding a layer of advanced data onto it. A view of the physical real-world environment with superimposed computer-generated information like images, thus changing the perception of reality, is the Augmented Reality. It is an interactive experience of the areal world environment where the objects that reside in the world are enhanced by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, hepatic, somatosensory, and olfactory.

LATERAL THINKING

According to Edward de Bono lateral thinking is solving problems through an indirect and creative approach, using reasoning that is not obvious and involves ideas that may not be obtainable using only traditional step-by-step logic. Lateral thinking deliberately distances itself from standard perception creativity as either "Vertical" logic or "Horizontal" imagination. Lateral thinking is the process of using the

information to bring about creativity and insight restriction. It can be learned, practiced, and used.It is conceivable to secure expertise in it similarly as it is conceivable to procure ability in science. It essentially means being able to think creatively or "outside the box" to solve a problem.

LATERAL THINKING AND TECHNOLOGY EDUCATION.

Waks, Shlomo Journal of Science Education and Technology, presents an analysis of technology education and its relevance to lateral thinking. Discusses prospects for utilizing technology education as a platform and a contextual domain for nurturing lateral thinking. Argues that technology education is an appropriate environment for developing complementary incorporation of vertical and lateral thinking. Usually, logical thinking is used to solve problems in a direct, straightforward way (also known as vertical thinking). Lateral thinking, however, looks at things from a sideways perspective (also known as horizontal thinking), to find answers that aren't immediately apparent. The term was first coined by psychologist Edward de Bono. These skills are often required in creative careers. If you study graphic or art and design at school, there's a good chance that you will have developed some of these skills already, which can be useful in your future career. Augmented Reality's relative seamlessness of digital objects within the "real world" encourages interactivity and engagement.

II. LITERATURE REVIEW

Romy Faisal Mustafa and Yeni RatnaHidayah (2019) conducted a study on explores the effect of problem-based learning on students' lateral thinking skills in biology subjects, the concept of environmental change. This quantitative research uses a quasi-experimental model with a pre-test post-test control group design. The sample used was 2 classes consisting of 64 students taken using the cluster random sampling technique. The lateral thinking skills test includes four lateral thinking factors, namely recognizing the dominant ideas of the problem, looking for different ways of looking at things, loosening rigid ways of thinking, and using random ideas to generate new ideas. The result of the research concludes that there is a significant influence of the PBL model on students' lateral thinking ability.

Karagöz and Beytullah (2019) conducted a study on the purpose of this study is to investigate the pre-service Turkish teachers' lateral thinking dispositions concerning different variables. The research is a descriptive study that was structured according to the correlational survey model. The sample of the study consists of a total of 197 pre-service teachers studying in the Faculty of Education in TokatGaziosmanpaşa University in the 2018-2019 academic year. The Lateral Thinking Disposition scale (LATD) developed by Smirch (2016) was used in the study. The data obtained were analyzed via SPSS 22 Windows software. Considering the results of the study, it was concluded that the total scores of the pre-service teachers from the LATD scale were in favor of the male students considering gender and the students graduating from the foreign language high schools in terms of the school from being graduated.

Lawrence, A. S. Arul; Xavier, S. Amaladoss (2013) conducted a study on the lateral thinking of prospective teachers with certain demographic variables. The investigator used a stratified random sampling technique there were significant differences between male and female prospective teachers in their lateral thinking and its dimensions description, humor, insight, and problem-solving.

David R. Squires (2020) conducted a study on Instructional Designs and Educational Technologies within Augmented Reality Transmedia Storytelling. This study investigates whether AR systems provide a uniquely beneficial learning context due to AR's native function to overlay information onto physical spaces at an art museum and the impact on participant perceived self-efficacy and overall engagement within the Augmented Reality enhanced environment. Participants also took part in an open-ended survey within the application. The quantitative data collected suggest that participants were highly engaged and utilized the application at the art museum extensively (N = 143); the qualitative results indicated that AR participants were exceedingly motivated and perceived an enhanced sense of engagement with the exhibit sites.

Javier Alejandro Jiménez Toledo et.al (2018) conducted a study on Collaborative Strategy with Augmented Reality for the Development of Algorithmic Thinking. The research was developed with students of the first course of computer programming under a quasi-experimental design with the application of post-tests, whose data obtained were analyzed with the Student's T-distribution. The results of the research obtained by combining collaborative processes with augmented reality tools as a didactic strategy for the development of algorithmic thinking in fundamental programming teaching.

Yufang Cheng et.al (2017) conducted a study on "Using augmented reality technology improves critical thinking for low achievement students" There are 45 participants (18 - 20 years old) from the first year in university to involve in experiments include pretest, intervention, and post-test, to explore the impact and learning performance by using the ARLS - SE with critical thinking for low - achievement students. The results found that the participants enjoyed the o operation of ARLS - SE and performed great learning effects on saponification reaction, and significant progress on the cultivation of critical thinking skills

NEED OF THE STUDY

The development of one country is dependent upon the student's mental health growth. The student's knowledge should be improved ata high level. Special attention should be given to that. So the use of technology is essential in education. It develops a mentality of interaction and collaboration. It can help the student adapt to their work quickly and more efficiently. The present educational scenario is a vast curriculumin front of the teacher and studentto achieve, are a few problems among them. Complicated and challenging particularly science student's multi-faced problems like understand the processes, complex structure, function, and practicals. So lateral thinking is vital for problems faced learners because it is the key to finding new ideas and better ways to do things.Development is a need for the upper hand and endurance. Sidelong reasoning is a device for imagination that prompts advancement. The conventional method of teaching is not enough for skill development they want more than that.Improving this skill can be challenging as lateral thinking comes more naturally to some people than others. A search of the internet reveals a variety of web-based Augmented Reality tools and apps are promoted 21st-century skills such as creativity, problem-solving, critical thinking, coding analysis, and testing. This study is an attempt to find out the effectiveness of augmented reality to enhance lateral thinking. Moreover, such a study on 9th standard students is an untouched area particularly Tamilnadu in the sivagangai district. Hence the study was undertaken by the researcher.

OBJECTIVES OF THE STUDY

1. To find out the effectiveness of Augmented Reality to enhance lateral thinking of high school students.
2. To find out whether there is any significant difference between the control group and the Experimental group of lateral thinking of high school students.
3. To find out whether there is any significant difference between pre-test and post-test of the control group and experimental group with regards to lateral thinking of high school students.
4. To find out there is any significant difference between male and female, rural and urban high school students in their lateral thinking with regards.

III. METHODS USED

The researcher adopted an equivalent group of pre-test-post-test experimental designs in which tools were employed for the pre-test assessment on lateral thinking of selected students in the first stage. In the second stage, there were experimental groups and control groups. The experimental group was used teaching with Augmented Reality content, and the control group was used the traditional method of teaching. In the third stage, the post-test assessment was taken.

Population

The population of the study consists of high school students in the sivagangai district of southern Tamilnadu in India

Sample and sampling technique

The investigator selected 108 high school students studying in the sivagangai district of southern Tamilnadu in India. The investigator used the stratified random sampling technique.

Tools Used

The researcher used the following tools for data collection.

1. Augmented realityAnatomy 4D app
2. Lateral thinking scale developed and standardized by the researcher.

Statistical Techniques Used

Descriptive statistics namely mean, standard deviation, t-test was computed for the variable in the study.

Apparatus

The researcher used fifty-four tablets given while classroom teaching. Shows Augmented Reality content of high school students. The researcher was used for the study. Different Augmented Reality apps and tools were used to measure the effects of Augmented Reality on lateral thinking.

Experimentation

Thecontrol group and experimental group were carried out to move the objectives of the study. Both experiments consist of three phases, (i) pretreatment phase, (ii) treatment phase, and (iii) posttreatment phase. The procedure is given below.

(i) Pretreatment Phase

Researcher after selecting the samples to be used in the study. Selected students were given appropriate and detailed instruction about the study, and mentioned the purpose of the study. There were one hundred eight participants who have been selected for the study.

The participants selected were divided into two groups. One group is called the Experimental group another one is the Control group. Each group contains 54 students. The researcher has taken the pretest from these two groups given certain specified in lateral thinking of high school students.

(ii) Treatment Phase

The treatment phase is the second phase, after getting pre-test results the researcher has decidedto treat with Augmented Reality content through the Anatomy 4D app for the experimental groupBy scanning printed targets, its shows 3D models of a human body and allows to interact with it. A researcher has used 54 Android tablets as an apparatus for this study and a conventional method is given to the control group.

(iii) Posttreatment phase.

It is the third phase of experiments, after the completion of 21 days, lateral thinking scale provides by the researcher in the present study. The post-test was taken from two groups for assessment of lateral thinking.

IV. ANALYSIS

Null hypothesis 1

Table 1

The first hypothesis framed is that there is no significant difference between the Control group and the Experimental group of high school studentsconcerning their lateral thinking.

Table 1 Comparing mean scores post-test of lateral thinking between Experimental group and control group

Lateral thinking	N	Mean	SD	T value	Remarks at 5% level
Control	54	47.1	14.8	7.6	S
Experimental	54	67.0	13.0		

(At 5% level of Significance of the table value of „t" is 1.96)

It is inferred from the above table that there is a significant difference in the mean scores between the control group and the Experimental group concerning the Lateral thinking of high school students. Therefore the null hypothesis is rejected.

Null hypothesis2

The Second hypothesis framed is that there is no significant difference between pre-test and post-test of an experimental group of high school students with regards to their lateral thinking.

Table 2, Comparing mean scores of pre-test and post-test of an experimental group of high school students with regards to lateral thinking

Experimental	N	Mean	SD	T value	Remarks at 5% level
pre-test	54	27.6	8.0	22.2	S
post-test	54	68.1	11.0		

(At 5% level of Significance of the table value of „t" is 1.96)

It is inferred from the above table that there is a significant difference in the mean scores between pre-test and post-test of the experimental group concerning the Lateral thinking of high school students. Therefore the null hypothesis is rejected.

Null hypothesis 3

The third hypothesis framed is that there is no significant difference between pre-test and post-test of the control group of high school students with regards to their lateral thinking.

Table 3 Comparing mean scores of pre-test and post-test of a control group of high school students with regards to lateral thinking.

Control	N	Mean	SD	T value	Remarks at 5% level
pre-test	54	69.40	11.26	0.65	NS
post-test	54	68.00	9.79		

(At 5% level of Significance of the table value of „t" is 1.96)

It is inferred from the above table that there is no significant difference in the mean scores between pre-test and post-test of the control group concerning the Lateral thinking of high school students. Therefore the null hypothesis is accepted.

Null hypothesis 4

The fourth hypothesis framed is that there is no significant difference between male and female high school students with regards to their lateral thinking.

Table 4 Comparing mean score of male and female high school students with regards to lateral thinking

Lateral thinking	N	Mean	SD	T value	Remarks at 5% level
Male	29	70.2	10.1	2.07	S
Female	25	64.41	10.47		

(At 5% level of Significance of the table value of „t" is 1.96)

It is inferred from the above table that there is a significant difference in the mean scores between male and female high school students with regards to Lateral thinking. Therefore the null hypothesis is rejected.

Null hypothesis 5

The fifth hypothesis framed is that there is no significant difference between rural and urban high school students concerning their lateral thinking.

Table 5 Comparing mean score of rural and urban high school students with regards to lateral thinking.

Lateral thinking	N	Mean	SD	T value	Remarks at 5% level
Rural	23	69.03	11.26	0.65	NS
Urban	31	67.13	9.79		

(At 5% level of Significance of the table value of „t" is 1.96)

It is inferred from the above table that there is no significant difference in the mean scores between rural and urban high school students with regards to Lateral thinking. Therefore the null hypothesis is accepted.

V. FINDINGS

1. There is a significant difference between the control group and the Experimental group of high school students concerning their lateral thinking.
2. There is a significant difference between the pre-test and post-test of the Experimental group of high school students concerning their lateral thinking.
3. There is no significant difference between pre-test and post-test of a control group of high school studentsconcerning their lateral thinking.
4. There is a significantdifference between male and female high school students concerning their lateral thinking.
5. There no significantdifference between rural and urban high school students with regards to their lateral thinking.

VI. DISCUSSION

The table result showed it is significant between the control group and the experimental group of high school students with regards to their lateral thinking. This means that experimental group treated with Augmented reality (Marker-based content) through Anatomy 4D app is used in classroom teaching(Anatomy 4D from the skeletal system to the muscular and digestive systems. By scanning printed targets, the application shows 3D models of a human body and allows to interact withandroid tablet),Marker-based Augmented Reality was preferred in the majority of educational Augmented Reality studies (86%) followed by location-based Augmented Reality (11%) and hybrid (3%) in a limited number of studies. Marker-based Augmented Reality is a relatively easy technology use (Thornton et al., 2012).

According to Yufang Cheng et.al (2017) "Using augmented reality technology improves critical thinking for low achievement students"explore this study Augmented Reality gives a tremendous improvement of critical thinking. According to Javier Alejandro Jiménez Toledo et.al (2018) Collaborative Strategy with Augmented Reality for the Development of Algorithmic Thinking.So that lateral thinking will be developed any one of technic or strategy should be used. So the researcher has been used augmented reality for enhancing lateral thinking.

At the same time Control group is treated with the conventional method of teaching due to the significance of the control group and the experimental group in lateral thinking of high school students. Augmented Reality can also inspire empathy in an individual. It offers two- three-dimensional methods of presenting information versus the traditional one-dimension.Using fostering images, 3D animations. This combination of interactivity and engagement with emotion, in turn, could enhance the ability of students to remember what they've learned– and lead to faster acquisition of information and skills. Hence Augmented Reality enhances lateral thinking in high school students.

VII. CONCLUSION

This paper proposes a marker-based augmented reality application using a teaching process that will help to combine virtual objects with the real environment facilitating.Marker-based augmented reality experiences require a static image also referred to as a trigger photo that a person can scan using their mobile device via an augmented reality app. The tablet scan will trigger the additional content (video, animation, 3D or other) prepared in advance to appear on top of the marker. Augmented Reality enables sensory activities (including visual, auditory, hepatic, and somatosensory, and olfactory.) in skill development. Augmented Reality provides less distraction of attention and using fostering images,3D animations, that induced sensory activities and able to develop lateral thinking skills.

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