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Effect of Game Based Teaching Practices and Visual Arts on Achievement in Mathematics Among Vii Grade Students

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Abstract

Mathematics is very interesting and one of the most important subject for students that deals with numbers, shapes, logic, quantity, data, arguments, etc. Mathematics develops the reasoning ability and logical thinking among the students. A significant contribution to achieving educational goals is made by the subject of mathematics, which has excellent educational values. The goal of math education is to cultivate strength, appropriate skills, appreciations, and attitudes. The study was experimental in nature. The current study falls under the umbrella of experimental research and multigroup pretest- posttest design will be adopted. The technique of sampling was random and representation. The sample consisting of 200 students of VII class, CBSE school students, from five schools of Amritsar City was selected. The purpose of the study was to examine the impact of visual arts and game-based teaching strategies on students in the seventh grade's mathematics achievement. In order to follow randomization of sampling, the investigator visited the schools and intelligence test by Dr.G.C Ahuja (2005), achievement test (pre test) were administrated on the students in the school. The obtained data was analyzed by using Mean standard deviation, 't' ratio and ANOVA test. The results of the study indicated that there exists strong and positiverelationship between the variables under study i.e., game based teaching practices and visual arts and significant effect exists of game based teaching practices and visual arts and their interaction on achievement in mathematics. The present study also bears implications for teachers, students and parents.

Introduction

Nearly everyone's life involves mathematics in some way. Mathematics has always been a vibrant and expanding intellectualendeavor.It has itsrootsinroutine operationsand servesas thefundamentalframework for extremelycutting-edgetechnologybreakthroughs. Theabilityto use mathematics has become incredibly important in practically everyone's life. All human behaviors, fromconceptionto death, are governed bymathematics. Our daily lives now involve mathematics to the point where we cannot function without it. The instruction of mathematics promotes the growth of abilities, sensibilities, and attitudes, as well as utilitarian or practical values. Values include:"intellectualvalues,""socialvalues,""moralvalues,""moralprinciples," "disciplinary values," "cultural values," "international values," "aesthetic values," "vocational values," and "psychological values." If mathematics is to play the expected role in today's scienceandtechnology, thenthewaythatthissubject istaught needstobechanged. Despiteour experts', mathematicians', psychologists', and teachers' best efforts, the students are unable to grasp the fundamental idea of it. Due

to a lack of understanding, lack of motivation, lack of interest, lackofconfidenceandcompetence, lackoftextbooks, lackofoutside-of-class learning, and poor study habits, students grasp specific methods, statements, theories, etc. rather than the spirit of mathematics. A varietyoftechniques should be employed for instructing mathematics. In the present study, it emphasizes on the integration of modern and traditional teachingmethods for better and effective teaching– learning process in the classroom and both the methods have their own 'pros' and 'cons'. In educational institutions, it will be very essential, interactive, beneficial, effective to combine the advantages of both traditional and modern methods of teaching in the classrooms to improve the interest, motivation, achievement, intelligence, learning ability skills among the students. In this method, teacher can use blackboard for writing purpose like complex mathematical equations while theoretical part can be taught on a LCD projector with the help of slides, animations, videos, some specific games etc, for better understanding among the students. Now a days, integration with game-based teaching practice and visual arts is considered an effective educational tool for improving education in classrooms of the future.

As per NEP 2020, Mathematics and computational thinking will be given more importance throughout the school years, beginning with the foundational level, using a range of creative ways such as the regular use of puzzles and games that make mathematical thinking more interesting and engaging. Digital games encourages teamwork, motivation, and better problem solving. increases engagement, motivates, and improves retention**.** In present scenario, The application of ICT technology to teaching processes such as game-based teaching practice isseen as one ofthe mediums of learning that can engage students in mastering Mathematics. This approach can also help to build on the concept of learning that is easier to understand **(Steinmaureretal.,2020**).**Tokac, Novak,andThompson(2019)** conductedameta-analysisto examine the impact of educational video games on students' math skills. When compared to conventionalteaching methods, math video games showed greater learning gains, according to a significant overall effect. Additionally, research shows that using video games to teach mathfromkindergarten(K) throughclass twelve is a marginallyeffective instructionalstrategy. **Noah (2019)** studied how students'performance and interest inalgebra atthe primaryeducationallevel were affected by a game-based instructional technique. The outcome demonstrated that the useof game-based instructional techniques in teaching has an impact on students' achievement and interest in algebra.

As per NEP 2020, The art-integrated approach will strengthen the links between education and culture." The benefits ofart-integrated classrooms include "deeper understanding and longer retention," "authentic and personally meaningful learning," "building cooperation, collaboration, andconfidence,""creatingself-awareness,"and"creatingasenseofownership."Inmypresent study, Visualarts plays a veryimportant role indifferent learning areas to encourage and engage student to participate, which will develop the confidence, interest, clarity of concept among the student aswellasenhanceteaching learningprocess. **Punzalan(2018)**investigatedthe impact of visual arts on student academic performance. The study's findings indicated a substantial difference in posttest performance between the experimental and control groups; in other words, the group that studied art appreciation through visual arts fared much better than those who employed the typical lecture-discussion technique. **Eveline, Paul and Evelyn (2020)** the study assesses the effects of the Mathematics, Arts, and Creativity in Education (MACE) programme on students' ability in geometry and visual arts in the upper grades of elementary school. The results showed that students who received the MACE lesson series improved more than students who received regular geometrylessons onlyingeometricalaspects perceived ina visualartwork. **Rationale of the Study**

At the present time, we observe that the students of different schools, boards anduniversities they do not

show satisfactory results in the subject of Mathematics. Sometimes results in Mathematics are unsatisfactory, which create hindrance among the students to learn about Mathematics. And in some cases, students are not so much interested in teaching Mathematics. Inthe primaryclasses, sometimes teachers fail to adequatelyexplain mathematical concepts, which results in students losing interest. However, sometimes students fail to understand fundamental concepts, which leads to conflicts between students. In the time of modern technology, Mathematics subject should not teach by lecture method. We should teach the subject of Mathematics by innovative techniques like Mind Mapping, Games, Flipped Classroometc, are so many innovative techniques which should be used by teachers for making their teaching effective and efficient. These create an interest among the students towards Mathematics and they properly clarify the concept and to solve the problems in a proper way.But inthe classrooms lecture method is used bythe teacher and students do not take anyinterest in Mathematics. Mathematics develops the reasoning ability and logical thinking among the students. But the objectives of Mathematics are at different stages are different of school education. Its main aim is to enable the students to understand the mathematical concepts, principles and processes, to develop the problemsolving technique. So, the students may be able to expresstheir thoughtsclearlyandaccurately. Buttheseobjectivesofteaching mathematicsare not achieved due to so many reasons like traditional approach of mathematics which has been used by the teachers in the classrooms. The teachers should assume that students do not know anything. Even the teachers teach the Mathematics subject through teacher- centered approach, but the reality is that the subject should be taught through child- centered approach. It is compulsory and necessary for the teachers that how the new knowledge is added into the previous knowledge of the students. But presently in the schools, no focus is to be given by the teachers at particular stage. This type of teaching do not develop mathematical attitude amongthe students. Usually in classrooms, teaching of Mathematics takes place through conventional methods without hands- on- experience. The investigator solicited the opinions of mathematics students. Mathematics should be taught in three domains in schools. i.e. cognitive, affective and psycho- motor domains catch in the mind. According to the National Education Policy (2020), digital games encourage teamwork, motivation, and better problem solving, increaseengagement, motivates, and improves retention, and art integrated learning will strengthen the links between education and culture, resulting in deeper understanding, longer retention, and the development of cooperation, collaboration, and confidence. The present study has been undertakenwithanobjective to studythe effect ofgame- based teaching practices and visualarts on achievement in mathematics among VII grade students.

Objectivesof theStudy

1. Todevelop Achievementtest(pre-test and post-test) forselected chaptersofmathematics.
2. To prepare instructional material on conventional,game based teaching practices and visual arts for teaching selected chapters of mathematics of VII grade students.
3. Tostudythedifferenceinmeangainscoresofthestudentsinmathematicstaughtthrough game-based teaching practices and conventional method of teaching.
4. Tostudythedifferenceinmeangainscoresofthestudentsinmathematicstaughtthrough visual arts and Conventional method of teaching.
5. To study the difference in mean gain scores of boys and girls in mathematics taught throughGame-Based teaching practices.
6. Tostudythedifference inmeangainscoresofboysandgirls inmathematicstaughtthrough visual arts.

7. Tostudy theeffectof gamebasedteachingpractices andvisual arts andtheirinteraction on achievement in mathematics.

HypothesesoftheStudy

1. There isno significant difference inmeangainscoresofthestudentsinmathematicstaught through Game-based teaching practices and conventional method of teaching.
2. Thereisnosignificantdifferencein mean gain scores of the students inmathematics taught through visual arts and conventional method of teaching.
3. There is no significant difference in mean gain scoresofboys and girls in mathematics taught through Game-Based teaching practices.
4. Thereisnosignificant differenceinmeangainscoresofboysandgirlsinmathematics taught through visual arts
5. Thereissignificanteffectofgamebasedteachingpracticesandvisualartsandtheir interaction on achievement in mathematics.

Measures

Toanalysethedata,theinvestigatorusedanappropriatestatisticalapproach:

- Meanstandarddeviation;skewness;kurtosiswasusedtoanalyzethedata.
- 't'ratiowascalculatedtotestthesignificancedifferencebetweenthemeanscore.
- ANOVA was utilised to examine the impact of game-based teaching practises and visual arts, as well as their interaction, on mathematics achievement.

ResearchMethodology

It is necessary to adopt a systematic approach for collecting the data, for testing hypothesis of undertaken study.

SampleandSamplingTechnique

Thetechnique ofsampling wasrandomand representation. The sample was consistsof200 students drawn from affiliated to C.B.S.E. In this sample, there were 100 boys and 100 girls of VII grade school students of Amritsar district.

ResearchDesign

The present investigation falls under the domain of experimental research and multigroup pretest-posttest design will be adopted.

AnalysisandInterpretation ofData

The collected data was analysed by employing inferential statistical techniques i.e., Mean Standard Deviation, T-Test and One WayANOVAtest. The analysis ofdata is discussed below: ***Significance of difference in mean gain scores of the students in mathematics taught through game-based teaching practices and conventional method of teaching.***

The t - value was calculated to see if there was a significant difference between the mean achievement scores of the game-based teaching practices (experimental group 1) and the conventional method (controlled group). Table 4.1 displays the results**.**

Table4.1:t–ratioofmeangainscoresofthe experimentalgroup1(game-basedteaching practices) and

controlled group (conventional method) in mathematics.

Group	N	Mean	S.D.	Mean Difference	df	t- ratio	Inference
A1 (Experimental)	70	4.51	1.92	1.01	128	2.73	ignificant at0.05as las0.01 level
A3 (Controlled)	60	3.5	2.26				

Table 4.1 showsthat meangainscoresofexperimentalgroupand controlled groupare4.51 and3.5respectivelyandmeandifferenceis1.01.Thecalculatedvalueoft–ratioisgreaterthan 1.98 and 2.62. It demonstrates that there is statistically significant difference in the mean achievement scores ofgame-based teaching practices (experimentalgroup) and the conventional method(controlledgroup)inmathematics.Asaresult,ourhypothesis, "No significant difference in meangainscoresofthe students inmathematics taughtthroughgame-basedteachingpractices and conventional method of teaching" is not accepted.

Significanceof differenceinmeangainscoresof thestudentsinmathematicstaughtthrough visual arts and conventional method of teaching.

In order to find out the significance of the difference between the mean achievementscores of the visual arts (experimental group 2) and the conventional method (controlled group). The t-ratio was discovered to be calculated using the means and standard deviation of both groups. The results are presented in table 4.2 below.

Table4.2:t–ratioofmeangainscoresofthe experimentalgroup2(visualarts)and controlled group (conventional method) in mathematics.

Group	N	Mean	S. D.	MeanDifference	df	t-ratio	Inference
A2 (Experimental)	70	4.57	2.16	1.07	128	2.74	Significant at0.05as las0.01 level
A3 (Controlled)	60	3.5	2.26				

Table 4.2 shows that the mean gain scores ofthe experimentaland controlgroups are 4.57 and 3.5, respectively, with a mean difference of1.07. The calculated t - ratio is greater than 1.98 and 2.62. It demonstrates that there is a difference in mean gain scores and standard deviation between the experimentaland controlgroups in mathematics. As a result of our hypothesis, "No significant difference in mean gain scores of the students in mathematics taught through game- based teaching practices and conventional method of teaching" is not acceped.

Significance of difference in mean gain scores of boys and girls in mathematics taught through game-based teaching practices.

The mean gain scores of boys and girls in the experimental group were calculated to determine the significance of the difference between their mean gain scores. The t-ratio was calculatedusingthemeansandstandarddeviationsofbothgroups.Table4.3displaystheresults.

Table4.3: t–ratioofmeangainscoresofboys andgirlsoftheexperimentalgroup 1(game based teaching practices)

Variable	N	Mean	S.D.	MeanDifference	df	t-ratio	Inference
Girls	35	5.34	1.89	2.48	68	5.39	Significant t0.05aswell as 0.01 level
Boys	35	2.86	1.93				

According to the above table, the mean gain scores for girls and boys are 5.34 and 2.86, respectively.Thecalculatedvalueoft-ratiois5.39,whichisgreaterthanthetablevaluesof
2.00 and 2.65. It is obvious that the calculated t - value is greater than the tabulated value. As a result, the mean achievement scores of boys and girls differ significantly. As a result, the third hypothesis, "No significant difference in mean gain scores of boys and girls in mathematics taught through game-based teaching practices," is not accepted.

Significanceofdifferenceinmeangainscoresofboysandgirlsinmathematicstaught throughvisual arts.

The mean gain scores of boys and girls in the experimental group2 were calculated to determine the significance of the difference between their mean gain scores. The t-ratio was calculatedusingthe meansandstandarddeviationsofbothgroups.Table4.4 displaystheresults.

Table4.4: t–ratioofmeangainscoresofboys andgirlsoftheexperimentalgroup 2(visual arts)

Variable	N	Mean	S.D.	Mean Difference	df	t-ratio	Inference
Girls	35	5.43	1.93	1.83	68	3.73	Significant at 0.05 as wellas0.01 level
Boys	35	3.6	2.16				

According to the above table, the mean gain scores for girls and boys are 5.43 and 3.6, respectively.Thecalculatedvalueoft -ratio is3.73,whichishigherthanthetable valuesof2.00 and 2.65. It is obvious thatthe calculated t - value is greater thanthetabulated value. As a result, the mean achievement scores of boys and girls differ significantly. As a result, the third hypothesis, "No significant difference in mean gain scores of boys and girls in mathematics taught through visual arts," is not accepted.

Significant effect of game based teaching practices and visual arts and their interaction on achievement in mathematics.

ANOVA was utilized to examine the impact ofgame-based teaching practices and visual arts, as well as their interaction, on mathematics achievement. An ANOVA table contains a summary of the findings.The outcomes of a real experiment are shown in Table 4.5.

AnalysisofVariance Results

F-statisticvalue=0.02731 P-value = 0.86898

DataSummary				
Groups	**N**	**Mean**	**Std.Dev.**	**Std.Error**
Group1 (gamebasedteachingpractices)	70	4.51	1.92	0.2291
Group 2 (visualarts)	70	4.57	2.16	0.2587

Table4.5Analysisofvariancecomparingeffectofgamebasedteachingpracticesandvisual arts and their interaction on achievement in mathematics.

ANOVA Summary						
Source	**Degreeof Freedom DF**	**fSquares SS**	**nSquare MS**	**F-Stat**	**P-value**	**Inference**
Between Groups	1	0.1141	0.1141	0.0273	0.869	ignificant at0.05as well as 0.01level
Within Groups	138	576.6377	4.1785			
Total	139	576.7518				

According to the above table, the calculated F- value is 0.02731, which is lower than the table values of 3.84 and 6.64. It is obvious that the calculated F - value is less than the tabulated value. Asaresult,theeffectofgamebasedteachingpracticesandvisualartsandtheir interaction on achievement in mathematics insignificantly. As a result, the fifth hypothesis, **"Significant effect of game based teaching practices and visual arts and their interaction onachievement in mathematics,"** is accepted. Figure 4.5 depicts a graphical representation of the preceding results.

Resultsand Discussion

The current study indicated that there is a favorable and substantial influence of game-based teaching approaches and visual arts on mathematics achievement among VII grade students. According to the foregoing interpretation of the data,

a) There is a significant difference in mean gainscores of the students in mathematics taught through game-based teaching practices and conventional method ofteaching. This confirm findings from other researchers such as Adeyemi and Ajibade (2011) and Olubola and Aladgana (2003) who found that using new techniques as experimental treatments led to better results. Consequently, students who were taught using a game- based method did better than those who weretaught using the traditional method.

b) There is a significant difference in mean gain scores of the students in mathematicstaught through visual arts and conventional method of teaching. This results supportthoseofEveline, Paul, and Evelyn, among other researchers.(2019)Results showed that students who took the MACE lesson series fared better than those who merely took standard geometry lectures when it came to understanding geometrical details in a piece of visual art.

c) There is a significant difference in mean gain scores of boys and girls in mathematics taught throughgame-based teaching practices. Khan, Ahmad, and Malik (2017) validates research on the influence of Digital Game-Based Learning (DGBL) and gamification on engagement, learning, and gender differences, as well as literature on applying DGBL models for instructional design.This suggests that when maths was taught using game- based methods, girls outperformed boys.

d) There is a significant difference in mean gain scores of boys and girls in mathematics taught through visual arts. Nutov (2021) verifies the findings indicate that: (1) incorporating art as a learning-teaching approach increases motivation, stimulatespositive feelings, and increases curiosity; (2) engaging in art is positively correlated with achievement in mathematical tasks; and (3) active

engagement in creating original artwork contributes to achievement even more than passive selection and analysis of existing artwork. This suggests that when maths was taught using visual arts techniques, girlsoutperformedboys.

e) There is a significant effect of game based teaching practices and visual arts and their interaction on achievement in mathematics. When the teaching strategies of game-based teaching practises and visual arts were combined, student success improved.Additionally, the students gained a growth mindset (Boaler, 2016), which created a good work ethic. Second, student pair work assisted them in developing problem-solving abilities. Third, the pupils were engaged by the games and arts.

EducationalImplicationsofthe Study

The present study's findings have implications for teachers, parents, and school administrators. Teachers should participate in a range of activities, try new teaching techniques, and organize seminars to assist students progress. Game-based teaching practices and visual arts play a vital part in teaching and boosting student success because theygive students with direct experiences. It promotes a thorough comprehension of topics. It is beneficial to both boys and girls, and increases pupils' cognitive behavior. It enables the instructor to provide more relevant learning opportunities for the students. Teachers should plan activities that allow all students to learn in the methodthat best suitsthem. Studentscanbenefit fromthe learning processand become more adaptable. This shift includes less reliance on instructors and more on peers, the development of abilities to study and learn from actual experiences, and the capacity to collaborate. By reinforcing course content and theory, game-based teaching methodologies and visual arts experiences help students prepare for their chosen vocations. In learner-centered rather than instructor-centered environments, students learn by doing, discovering, reflecting, and applying. Students strengthen their communication skills, build their self-confidence, and improve their decision-making abilities by reacting to and resolving real-world challenges and processes. Considering the advantages of combining game-based teaching techniques with visual arts, numerous topics that may be taught through this style of learning can be offered in schools.

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