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VISUAL MAPPING PROGRAM FOR INTEREST ENHANCEMENT

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Abstract

Interest is an important factor that motivates and energizes the learning of students. The present study investigated the enhancement of mathematical interest through visual mapping programming of 9th-standard students. Here the 50 experimental samples were drawn from Bengali medium in West Bengal Board of Secondary Education School of Howrah District West Bengal State. One group of pre and post-test experimental designs were adopted. A standardized mathematical interest scale by Dr. Uma Tandon and Ashok Pal was used for pre and post-test to measure the mathematical interest of 9th-standard students. Visual mapping programs were developed by the researchers. The hypothecation was tested by using z-score analysis and objectives were answered by using mean SD and feedback sheet of students. The finding was a significant difference in the enhancement of interest in the mathematics of students. Thus, it can be concluded that the visual mapping program enhanced students' interest in mathematics.

Keywords: *Visual mapping, concept mapping, mind mapping, thinking maps, mathematical interest.*

Introduction

Interest is an internal factor contributing to student learning success. Interest is known as a situation which related to the desires or needs of each person. It can also be described as a favorite in the human soul and happiness. Interest does not come automatically; however, it emerges from sharing, experience, and familiarity while studying or working. Because interest is always related to desires or needs, it is essential to make a specific situation for students who are always in demand and want to learn. When it comes to learning mathematics, interest is a thing it is essential. A person with great interest, too, will have great motivation. Higher education interests will create a positive attitude for students in mathematics.

Students' interest in mathematics is still low. The learning interests of elementary and middle school students decrease year by year, especially in mathematics and other sciences [15]. Some students in high school fancy taking up a course in mathematics at the University, and less than 9% of these students enjoyed lessons in mathematics [14]. Mathematics learning interest is just visible to a student with high ability in mathematics [8]. Students are not interested in math because students assume that mathematics only contains numbers, formulas, and abstract theorems that are very difficult to understand. Another reason is frustration as you feel hard to understand correctly. Students get frustration in learning when the teacher shows the problems in abstract only [1]. Students with continuously low performance in mathematics may eventually lose interest and refuse to learn further (Schraw et al. 2001).

David Ausubel, an educational psychologist, saw the educator's primary responsibility as the presentation of learning materials in a meaningful form, not as a list of facts. He indicated that educators must find procedures allowing the learners to tie new knowledge into their prior cognitive structure. He proposed visual mapping as a tool to promote meaningful learning [2]. Héctor C. Santiago, in his research, says that Visual Mapping Enhance Learning and Critical Thinking Skills [9].

Visual mapping is taking an idea or idea and turning it into a visual aid for better understanding. A series of key concepts that include direct, visual maps allow you to see complex information in front of you for a more comprehensive understanding. Visual mapping is an organization with images and the presentation of information. It includes concept maps, mind maps, and thinking maps. Visual mapping can be done using low-tech paper and pens or high-tech using real-time digital tools. Visual mapping is grounded in constructivism, which states that we create meaning through interaction between our experiences and ideas. The following list of strategies was gleaned from the literature. It gives a sense of the many ways people use visual mapping.

•Assess prior knowledge – students create a visual representation of what they know.

•Show how experts organize knowledge – build a map that tells students how you think.

•Summarize reading – ideas in an article, main points of a chapter, or the theme of a novel

•Plan a task – visualize a project or lab assignment to get a handle on what is involved

•Conduct an assessment – following a unit or course, students map what they have learned.

Mathematical interest is the students' liking to learn mathematics content and participate in mathematical activities, which is indicated by solving examples, studying, and getting involved in mathematics activity as a leisure-time pursuit. So, one of the ways to enhance interest in mathematics is the visual mapping program.

Need and importance of the study

Mathematics is an exciting subject based on calculation, formulas, and understanding. To visualize this subject with meaningful knowledge and explicit concepts and to increase or enhance interest in it, we use the visual mapping program, which provides students with a visual road map of their learning. In mathematics teaching, a teacher uses so many techniques, strategies, and methods to increase students' interest scale. But they are failures more times to motivate students in the subject. Visual mapping program combined with concept mapping, mind mapping, and thinking mapping is a creative process to enhance the interest of mathematics subject of students by engaging them in the mapping creation of own. The researcher is therefore needed to develop this program to create and enhance students' interest in mathematics.

Statement of the problem

To develop a visual mapping program to enhance students' interest in mathematics subject of class 9th std. of west Bengal board of secondary education in Bengali medium high school students of Howrah district in West Bengal.

Operational definition

Visual mapping

Conceptual

Visual mapping' is the tools & techniques used for displaying complex information visually. (David.M)

Operational

Visual presentation of knowledge of the whole to enhance students learning by providing meaningful understanding with a wide range of representations of previous knowledge to new knowledge.

Interest

Conceptual

According to Crow and Crow (1973),) interest means the motivating pressure that impels us to attend to someone, a thing or an activity, or it may be the affective experience that

the movement itself has stimulated. Alternatively, interest can be the cause of action and the result of participation in that activity.

Operational

Here the term interest is defined as the individual interest in the subject of the school curriculum.

Objectives

1. To develop a visual mapping program (concept maps, mind maps, thinking maps) for mathematics students.
2. To study the enhancement of interest in mathematics subjects of high school students for the visual mapping program.
3. To analyze the feedback sheet of students regarding the visual mapping program.

Hypothesis

1. There will be no significant difference in the enhancement of interest in mathematics subjects of high school students for the visual mapping program.

Variables

Independent: Visual mapping program

Dependent: Interest

Extraneous: School environment, attitude, age, sex of students, topics, time duration of the test.

Research at a Glance

Method	Experimental
Design	One group pre-tests post-test experimental design
Nature of the school	West Bengal Board of Secondary Education (WBBSE) in Bengali medium high school students of Howrah district in West Bengal.
Grade level	High school students of class 9^{th} std.
Subject	Mathematics
Population	All students are studying in class 9th std. of West Bengal Board of Secondary Education of Howrah district.
Sample	50 students are studying in class 9th std. of islampur Adarsha School of Howrah district in West Bengal.
Research tools	1. Visual mapping program (developed by the researcher) 2. Standardized Mathematical interest scale by Dr. Uma Tandon, Ashok Pal.
Statistical tools	Mean, S.D., Z scores, percentage.

Review of Related Literature

Héctor C. Santiago, O.D., Ph.D., FAAO(2011) in their study focusing on 'Visual Mapping to enhance Learning and Critical Thinking Skills' found that visual mapping allows the reader to visualize, analyze, compile and share ideas. . This paper reviews mapping tools that are useful for discussing and photographing a thought process (mind map), exploring knowledge structure (concept map), developing environments, arguments, conclusions about

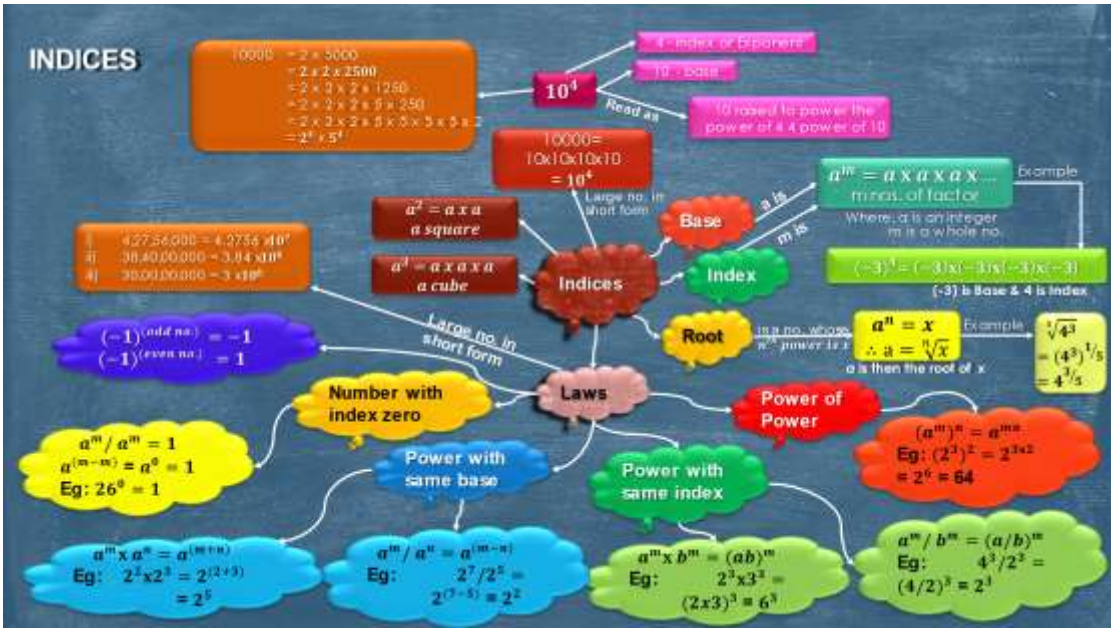
conflict (argument maps), and assessing student thinking. process (®Thinking Maps), seeks the relationship between dynamics (general systems thinking) and the development of simulation models (system dynamic). This paper also provides evidence of the effectiveness of these tools in promoting memory, comprehension, and critical thinking skills in general.

Nwaocha Vivian Ogochukwu(2010) in his paper entitled 'Enhancing student's interest in mathematics via multimedia presentation', examined high school students learning mathematics. Researchers indicate that multimedia presentations can improve students' understanding, enthusiasm, class attendance, and satisfaction.

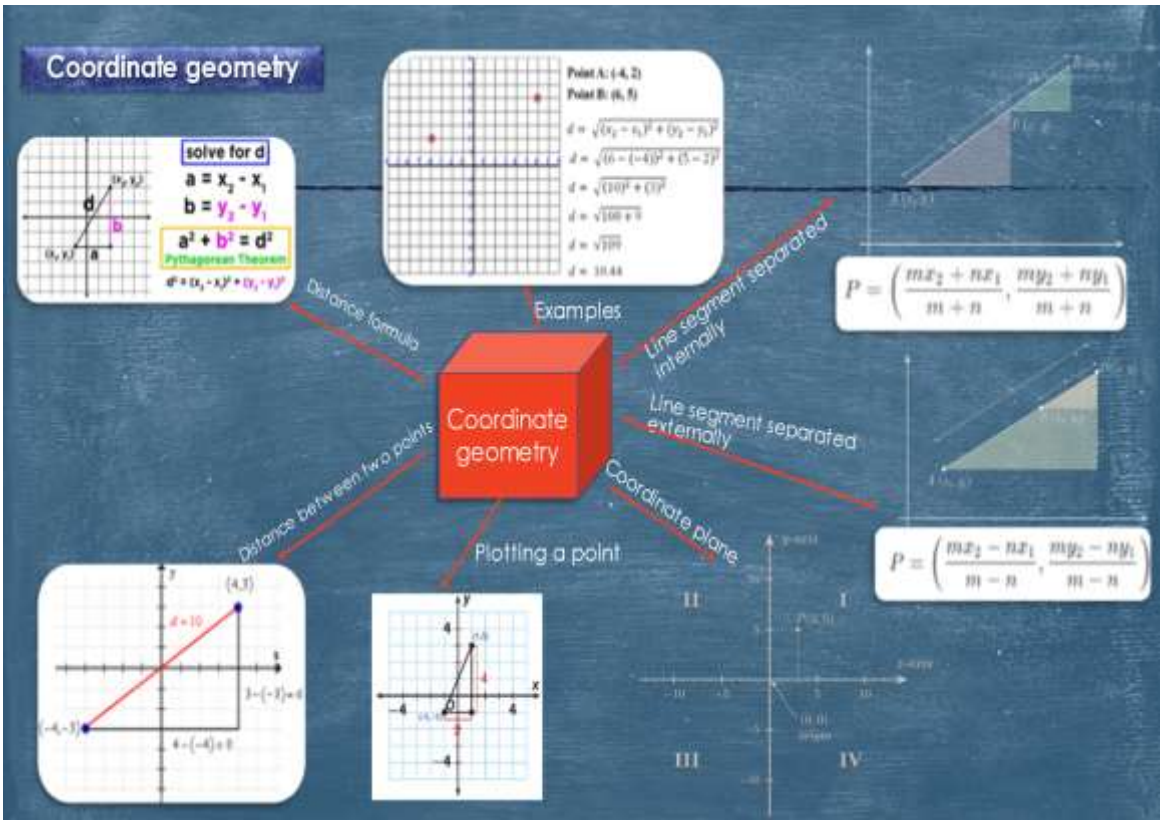
Charles Y. C. Yeh, Hercy N. H. Cheng, Zhi-Hong Chen, Calvin C. Y. Liao and Tak-Wai Chan(2019), through their work focusing on 'Enhancing achievement and interest in mathematics learning through Math-Island' found out that the conventional teacher-led instruction remains dominant in most elementary mathematics classrooms in Taiwan. But the Math-Island enhanced students' mathematics achievement, especially in calculation and word problems, and a high level of interest in mathematics.

A Azmidar*, D Darhim and J A Dahlan (2017), through their work focusing on 'Enhancing Students' Interest through Mathematics Learning '. In this article Concrete-Pictorial-Abstract approach theoretically improves students' mathematics interest. This literature study concludes that the Concrete-Pictorial-Abstract approach can be used as an alternative to enhance students' mathematics interests.

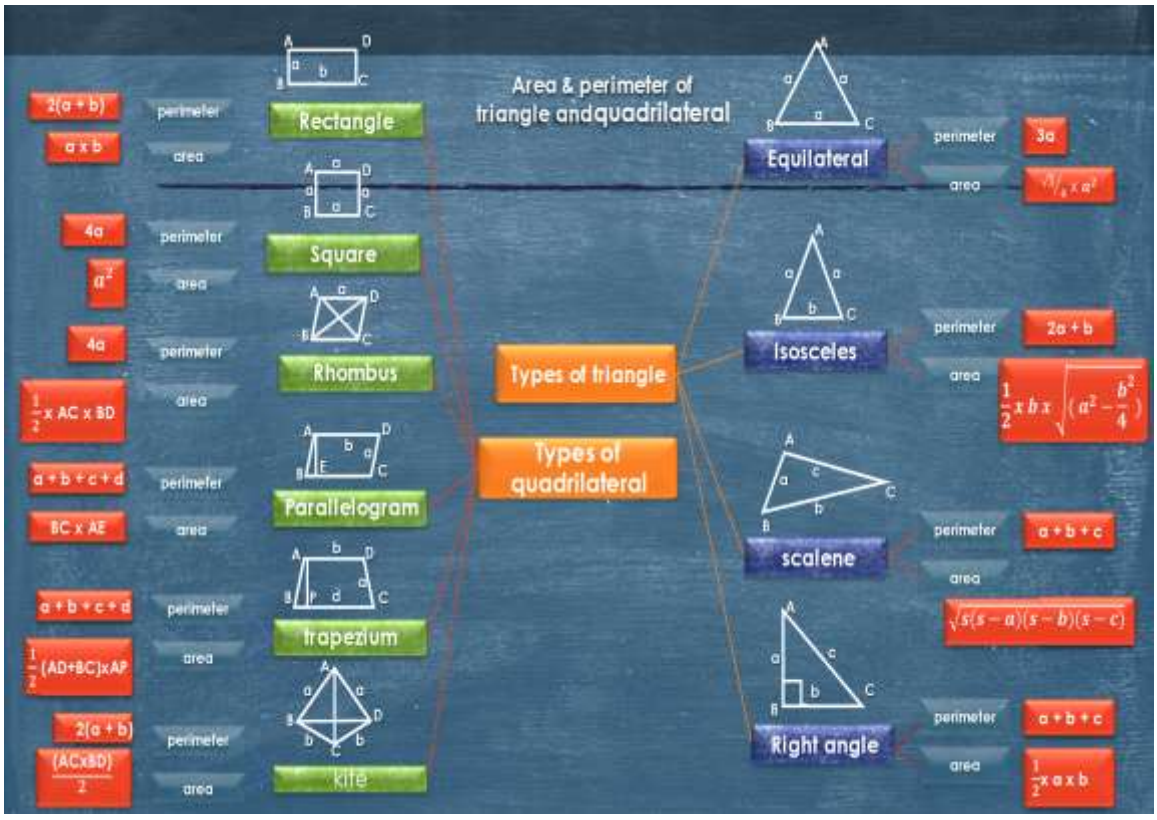
Visual mapping program development



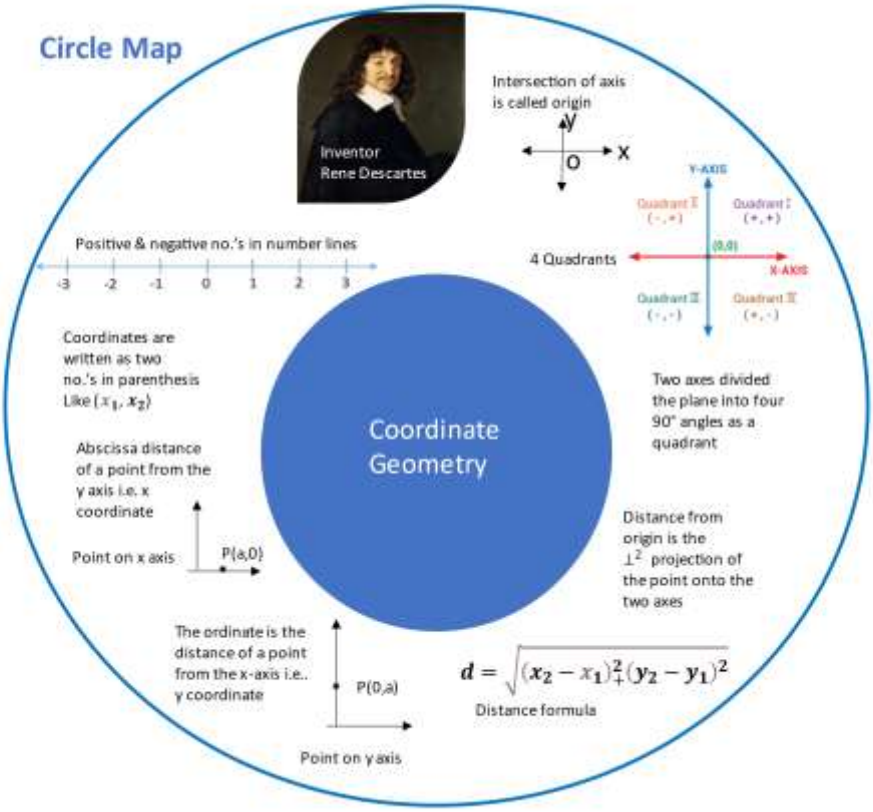
Picture 1: Mind maps on indices



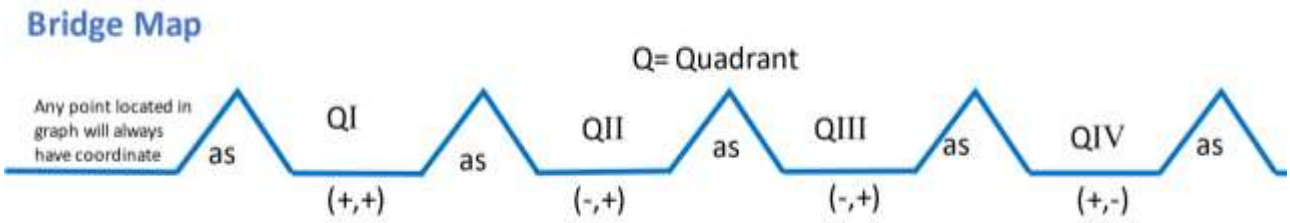
Picture 2: Concept maps on coordinate geometry



Picture 3: Concept maps on area and perimeter of triangle and quadrilateral



Picture 4: Thinking maps (Circle Map) on coordinate geometry



Picture 5: Thinking maps (Bridge Map) on coordinate geometry

Implementation

After the 2nd semester, a 1-week teaching-learning program was conducted to familiarize the students with the mapping program. At the beginning of this program, a mathematics interest scale was shown as a pre-test in the experimental group. After that, all experimental group students learned mathematics through the visual mapping program. The investigator developed visual maps (concept maps, mind maps, thinking maps) in 3 chapters of mathematics like laws of indices, co-ordinate geometry, area and perimeter of triangle and quadrilateral for class 9th std. Students. Although the teachers in this school adopted mathematics class lectures using visual mapping techniques. At the same time, the students explore the visual maps at their own pace. At the end of the 1-week program, same mathematics

interest scale was administered as a post-test to evaluate students' interest enhancement in mathematics. A feedback sheet was given to them to understand the students' responses to how they felt about the visual mapping program.

Tools

The researcher used a Standardized mathematics Interest Scale by Dr. Uma Tandon & Ashok Pal for the age group 15-18 years students. The scale is effortless to admire. There are 5 options ranging from Strongly Agree to Strongly disagree. Students have to put a tick mark on any of the options which he feels are right for them. 20 min. time is sufficient to fill up the scale. The scale consists of both positive and negative statements. Positive statements are to be scored as 5,4,3,2,1 & negative statements are to be scored as 1,2,3,4,5 for strongly agree, agree, undecided, disagree, and strongly disagree. There are 24 items on the scale. The reliability coefficient of the scale is .88 by the test-retest method.

Data analysis and Interpretation

Table 1: Z score, Grade, and interpretation of experimental group

Respondent	Pre-test Z score	Post-test Z score	Pre-test Grade	Post-test Grade	Pre-test interpretation	post-test interpretation
1	-7.748344371	-1.048744461	G	E	Extremely low	Below average
2	-7.630085147	-0.310192024	E	D	Below Average	Average
3	-7.511825922	0.723781388	C	C	Above average	Above average
4	-7.393566698	-0.310192024	E	D	Below Average	Average
5	-7.275307474	0.576070901	C	C	Above average	Above average
6	-7.15704825	-0.310192024	E	D	Below Average	Average
7	-7.038789026	-1.344165436	E	F	Below Average	Low
8	-6.920529801	-1.639586411	E	F	Below Average	Low
9	-6.802270577	-0.310192024	D	D	Average	Average
10	-6.684011353	-0.310192024	D	D	Average	Average
11	-6.565752129	0.576070901	D	C	Average	Above average
12	-6.447492904	-0.310192024	D	D	Average	Average
13	-6.32923368	0.723781388	E	C	Below Average	Above average
14	-6.210974456	-0.310192024	D	D	Average	Average
15	-6.092715232	0.576070901	E	C	Below Average	Above average
16	-5.974456008	-1.787296898	E	F	Below Average	Low
Respondent	**Pre-test Z score**	**Post-test Z score**	**Pre-test Grade**	**Post-test Grade**	**Pre-test interpretation**	**post-test interpretation**
17	-5.856196783	-0.310192024	D	D	Average	Average
18	-5.737937559	-0.605612999	D	E	Average	Below average
19	-5.619678335	-0.310192024	D	D	Average	Average
20	-5.501419111	1.019202363	D	C	Average	Above average

21	-5.383159886	-0.162481536	E	D	Below Average	Average
22	-5.264900662	-0.014771049	F	D	Low	Average
23	-5.146641438	-1.491875923	D	F	Average	Low
24	-5.028382214	-0.457902511	D	D	Average	Average
25	-4.91012299	-0.310192024	F	D	Low	Average
26	-4.791863765	0.576070901	C	C	Above average	Above average
27	-4.673604541	-0.605612999	D	E	Average	Below average
28	-4.555345317	-0.310192024	E	D	Below Average	Average
29	-4.437086093	-0.605612999	E	E	Below Average	Below average
30	-4.318826868	1.314623338	C	B	Above average	High
31	-4.200567644	-1.196454948	D	E	Average	Below average
32	-4.08230842	0.723781388	C	C	Above average	Above average
33	-3.964049196	-0.457902511	F	D	Low	Average
34	-3.845789972	-1.639586411	E	F	Below Average	Low
35	-3.727530747	-0.605612999	D	E	Average	Above average
36	-3.609271523	-0.901033973	D	E	Average	Above average
37	-3.491012299	-0.753323486	D	E	Average	Above average
38	-3.372753075	-1.344165436	D	E	Average	Above average
39	-3.254493851	-0.605612999	D	E	Average	Above average
40	-3.136234626	-0.310192024	D	D	Average	Average
41	-3.017975402	1.314623338	C	B	Above average	High
42	-2.899716178	0.871491876	B	C	High	Above average
43	-2.781456954	1.314623338	B	B	High	High
44	-2.663197729	1.314623338	C	B	Above average	High
45	-2.544938505	0.871491876	C	C	Above average	Above average
46	-2.426679281	1.462333826	B	B	High	High
47	-2.308420057	1.314623338	B	B	High	High
48	-2.190160833	1.610044313	B	B	High	High
49	-2.071901608	2.053175775	A	A	Extremely High	Extremely high
50	-1.953642384	2.053175775	B	A	High	Extremely high

Range of Z- scores	Grade	Interpretation
+2.01 and above	A	Extremely High
+ 1.26 to 2.00	B	High
+ 0.51 to + 1.25	C	Above Average
-0.50 to + 0.50	D	Average
-0.51 to -1.25	E	Below Average
-1.26 to -2.00	F	Low
-2.01 and below	G	Extremely Low

Z score formula:

$$z = \frac{x - M}{\sigma}$$

X= Raw score
M= Mean
σ = Standard deviation (S.D)

The result is shown in table 1 that there is a change in the z score result. Post-test of the mathematics interest scale z score is much better than the pre-test z score result. So, the grade of those students is also better than the previous. They increased their interest in mathematics by using a visual mapping program.

Table 2: Mean & S.D. and Z score of pre and post-test results of the experimental group

Type of test	Mean	S.D.	Z Score
Pre-test	66.52	8.5	16.71
Post-test	92.1	6.77	

Mean have to be compared in one direction thus, the test is a right-tailed two-sample z test. At α=0.05, the critical value is 1.645 from the z table which is less than 16.71. Thus, the null hypothesis can be rejected. The alternative hypothesis is accepted. It can be concluded that the visual mapping program enhanced the mathematics interest of students.

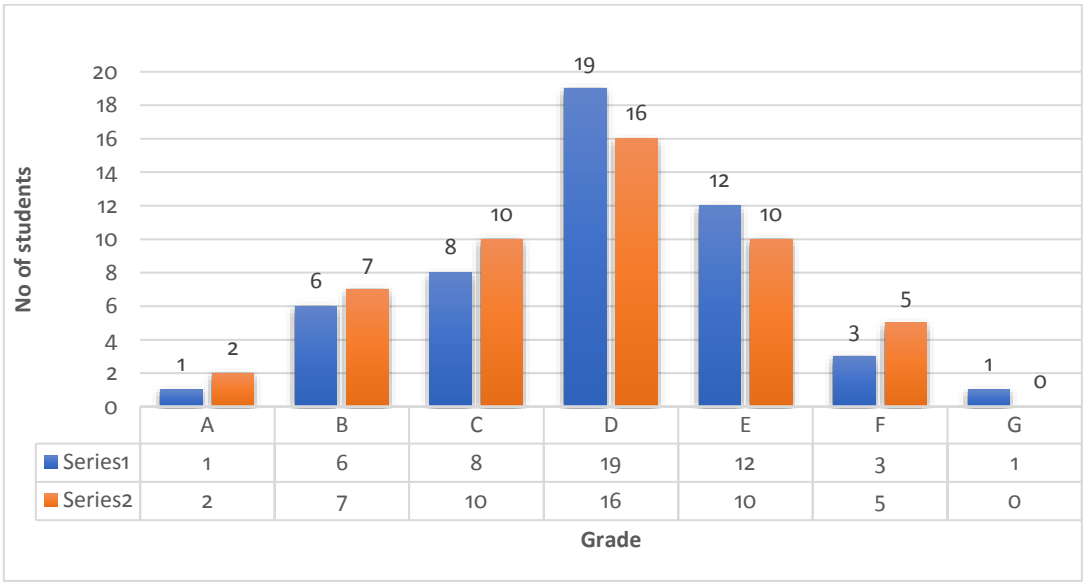


Chart 1: Graph showing variation in the grade of students

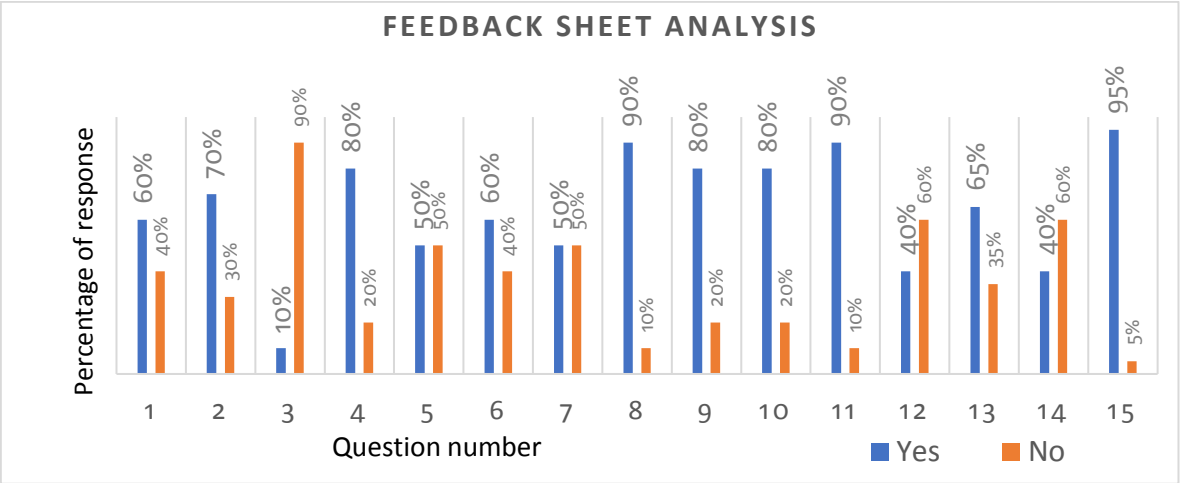
Table 4: Number of students in pre-test & post-test

Grade	Pre-test	Post-test
A	1	2
B	6	7
C	8	10
D	19	16
E	12	10
F	3	5
G	1	0

According to the pre-test & post-test z scores of students, it is shown that the interest level in mathematics is increased by using a visual mapping program. In the graph table, it is shown that the students of the Extremely high level of interest are changed from 1 to 2, high level of interest from 6 to 7, Above average level of interest from 8 to 10, but the change is decreasing in average, below average and extremely low from 19 to 16,12 to 10,1 to 0 respectively, and low level of interest is increased from 3 to 5 no of students.

Table3: Feedback sheet response of the students regarding the visual mapping program

Item no.	Item	Yes	No
1.	The visual mapping program is up-to-date.	60%	40%
2	It is arranged in a logical sequence.	70%	30%
3.	It summarized the lecture.	90%	10%
4.	This program is presented in colourful arrows, pictures & branches.	80%	20%
5.	It is according to the syllabus.	50%	50%
6.	Visual mapping programs fulfil the needs of students in mathematics.	60%	40%
7.	It is appropriate for the grade level of students.	50%	50%
8.	It is developed on the complete knowledge of the topic.	90%	10%
9.	This program is helpful in note-taking.	80%	20%
10	This program clears the basic idea of a topic.	80%	20%
11.	A visual mapping program is helpful in self-learning.	90%	10%
12.	This program encourages students to respond in the classroom.	40%	60%
13.	It can remove the fear and anxiety of students in mathematics.	65%	35%
14.	It helps in solving complex problems.	40%	60%
15.	A visual mapping program can connect the previous knowledge with new knowledge.	95%	5%



Observation: The feedback sheet analysis clearly indicates that more than and equal to 90% of students are very much satisfied with the visual mapping program which summarized the lecture, self-learning, note-taking, and complete knowledge of the topics, and also connects the previous knowledge with the new knowledge. (70-80) % of students agree with its presentation style. (60-65) % of students agree that this program is up to date, fulfills their needs, and removes the fear and anxiety of students in mathematics. 50% of students agree that it's according to the syllabus and appropriate for the grade level of students. 40% of students agree with its helpful nature to solve complex problems and encourage students to respond in the class.

Interpretation: So, the students gave positive feedback regarding lecture summarization, note-taking, self-learning, connection with previous to new knowledge, presentation style, and up-to-date.

Findings

Based on the above analysis findings are:

1. The experimental group of students enhanced their interest in mathematics by using the visual mapping program.
2. Post-test z score is better than pre-test z score results.
3. Students gave positive feedback regarding the visual mapping program.

Education Implication

1. Visual mapping program is more effective to increase and enhance the interest of students in mathematics subjects.
2. Using a visual mapping program in mathematics classes will help students to improve their self-learning and note-taking.
3. Students can construct their own study maps and connect their previous knowledge to new knowledge.

Conclusion

It can be concluded by current research that the visual mapping program enhanced students' interest in mathematics.

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