

Original Article

## IMPACT OF VISUAL ORGANIZER ASSISTED SCIENCE INSTRUCTION ON STUDENTS' ACADEMIC ACHIEVEMENT: A COMPARATIVE INVESTIGATION

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### ABSTRACT

Profound educational transformation emerges when instructional strategies move beyond traditional delivery and engage learners through structured, concept-oriented approaches. The present investigation explores the educational impact of visual organizer-assisted science instruction on secondary students' academic achievement. Grounded in constructivist theory, the approach emphasizes conceptual clarity, meaningful association of prior and new knowledge, and active participation in the learning process. Specially designed visual organizers, aligned with the prescribed curriculum, were systematically implemented in an experimental group, while a control group received conventional teaching. A pre-test-post-test control group design was employed, and a standardized achievement test assessed comprehension, retention, application, and overall performance. The findings revealed remarkable improvement in students' post-test achievement scores, demonstrating that instruction supported with visual organizers significantly strengthens learning outcomes. Comparative analysis indicated positive academic gains among both boys and girls, affirming its universal applicability and effectiveness. Beyond quantitative enhancement, the method also contributed to improved engagement, cognitive organization, and sustained interest in science learning. The study ultimately asserts that visual organizer-based instruction holds substantial pedagogical promise, offering a scientifically validated, meaningful, and enriching pathway to academic success and improved classroom experience for secondary school learners.

**Keywords:** Visual Organizer, Academic Achievement, Science Achievement Test

### INTRODUCTION

In the present psychological era of education, the focus of teaching is not merely on the content to be delivered but on the learner who receives it. Modern education emphasizes that instructional strategies should correspond to the mental level, needs, interests, and learning abilities of the children. Education is meaningful only when learners are actively engaged in understanding concepts, establishing relationships, solving problems, and applying knowledge to real-life situations. Therefore, it becomes essential to adopt such methods which not only transmit knowledge but also encourage creativity, critical thinking, and independent learning among students.

As Vygotsky stated, "Learning is a socially mediated activity where knowledge is constructed through active participation."

Traditional methods of teaching, especially lecture-based approaches, often remain limited to the passive reception of knowledge. Although they transmit information, they fail to ensure meaningful understanding, retention, and application of

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Received: 09 January 2026; Accepted: 05 February 2026; Published 05 March 2026

DOI: [10.29121/granthaalayah.v14.i2.2026.6635](https://doi.org/10.29121/granthaalayah.v14.i2.2026.6635)

Page Number: 43-48

Journal Title: International Journal of Research -GRANTHAALAYAH

Journal Abbreviation: Int. J. Res. Granthaalayah

Online ISSN: 2350-0530, Print ISSN: 2394-3629

Publisher: Granthaalayah Publications and Printers, India

Conflict of Interests: The authors declare that they have no competing interests.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contributions: Each author made an equal contribution to the conception and design of the study. All authors have reviewed and approved the final version of the manuscript for publication.

Transparency: The authors affirm that this manuscript presents an honest, accurate, and transparent account of the study. All essential aspects have been included, and any deviations from the original study plan have been clearly explained. The writing process strictly adhered to established ethical standards.

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knowledge in new contexts. In contrast, constructivist approaches emphasize that knowledge is not delivered but constructed by learners through active involvement. Bruner rightly asserted that "The purpose of education is not to impart knowledge but to facilitate thinking." Hence, constructivist teaching encourages students to explore, discover, and relate new ideas with prior experiences.

In this context, the use of Visual Organizers has emerged as an effective pedagogical tool. Visual organizers provide a structured representation of concepts, enabling learners to visualize relationships among ideas, organize information meaningfully, and develop deeper conceptual understanding. They support meaningful learning by integrating newly acquired knowledge with previously learned concepts, thereby facilitating comprehension, retention, and transfer of learning. Novak (1993) emphasized that learning becomes more powerful when students can visualize and interrelate different elements of knowledge. Visual organizers also encourage active participation, collaborative learning, and reflective thinking, which are essential elements of modern education.

Thus, incorporating visual organizers into teaching science and other school subjects is not only pedagogically sound but also psychologically significant. They promote clarity of understanding, enhance memory, stimulate interest, and develop higher-order thinking skills. As Ausubel highlighted, "The most important factor influencing learning is what the learner already knows; teaching must connect with it." Visual organizers effectively bridge this connection and therefore hold great relevance in contemporary educational practice.

## DEFINITIONS OF KEY TERMS

### VISUAL ORGANIZER

#### 1) Novak and Gowin (1984)

"A visual organizer is a structured diagram that represents concepts and their relationships, helping learners arrange knowledge meaningfully and connect new information with prior understanding."

#### 2) Academic Achievement

The measurable learning outcomes of students, reflected through test scores and performance indicators, demonstrating their comprehension, retention, and application of academic content.

#### 3) Science Achievement Test

A Science Achievement Test is a standardized and scientifically constructed assessment tool designed to measure students' comprehension, retention, application, and overall mastery of science concepts, thereby providing a reliable indicator of academic performance and learning effectiveness in science.

## REVIEW OF RELATED LITERATURE

An examination of earlier and contemporary studies reveals a sustained scholarly emphasis on the role of visual and physical organizers in enhancing learning outcomes in science education. Ausubel (1978) provided the theoretical basis by asserting that advance organizers facilitate meaningful learning through the integration of new information with prior knowledge. Adcock (2000) later emphasized that visual structuring of content reduces cognitive load and improves learners' processing efficiency. Empirical investigations by Chang et al. (2002) demonstrated that concept mapping enhances comprehension and summarization skills, a finding further supported by classroom-based studies in science education Asan (2007). Chen (2007) reported that the use of advance organizers in web-based environments improves learning and retention, while Akinbobola (2008) highlighted their positive influence on students' attitudes and achievement in science. At the secondary level, studies by Adesola and Salako (2013) and Cheema and Mirza (2013) confirmed the effectiveness of visual organization strategies in improving academic performance. With the integration of technology, Aljaser (2017) and Amar (2019) emphasized the growing effectiveness of electronic and graphic visual organizers.

Recent research conducted between 2020 and 2024 further supports that digital and interactive visual organizers enhance conceptual understanding, student engagement, and long-term retention Hwang and Kim (2020), Wu and Chen (2022), Kim (2023). In conclusion, the collective evidence clearly establishes that visual organizers play a central role in structuring knowledge, simplifying complex scientific concepts, and promoting meaningful and lasting learning, thereby making them an indispensable instructional tool in contemporary science.

## NEED AND SIGNIFICANCE OF THIS RESEARCH PAPER

The experiences of traditional science classrooms reveal that conventional methods largely emphasize the mechanical acquisition of facts rather than meaningful understanding and practical application. Consequently, students often fail to transfer their scientific knowledge to real-life situations, and misconceptions frequently emerge due to incorrect interpretation of scientific experiences. In recent times, students' interest in studying science and their academic achievement has shown a declining trend, indicating the urgent need for innovative, learner-centered, and cognitively stimulating instructional strategies.

Therefore, it becomes essential to question whether traditional approaches are truly producing desirable educational outcomes or whether more effective and dynamic methodologies are required for science teaching. In this context, the use of Visual Organizers appears to be a powerful pedagogical innovation, as they help learners visualize relationships among concepts, construct knowledge meaningfully, and actively participate in the learning process. Albert Einstein's view is highly relevant here: "Education is not the learning of facts, but the training of the mind to think." Similarly, David Paul Ausubel emphasized that meaningful learning occurs when new ideas are clearly related to previously acquired knowledge. Hence, the present study seeks to investigate the comparative influence of teaching science through Visual Organizers on students' academic achievement, with the aim of determining whether this approach can make science learning more effective, engaging, and applicable to real life.

### RESEARCH OBJECTIVES

- 1) To examine the effectiveness of Visual Organizers on the Science achievement of Class IX female students by analyzing the difference between their pre-test and post-test achievement scores.
- 2) To examine the effectiveness of Visual Organizers on the Science achievement of Class IX male students by analyzing the difference between their pre-test and post-test achievement scores.
- 3) To examine the effectiveness of Visual Organizers on the Science achievement of Class IX students by analyzing the difference between their pre-test and post-test achievement scores.
- 4) To examine the effectiveness of Traditional Method on the Science achievement of Class IX students by analyzing the difference between their pre-test and post-test achievement scores.

### HYPOTHESIS OF THE STUDY

#### H0-1

There is no significant difference between the pre-test and post-test achievement scores of class IX science students after being taught through Traditional Method.

#### H0-2

There is no significant difference between the pre-test and post-test achievement scores of class IX science Female students after being taught through visual organizers.

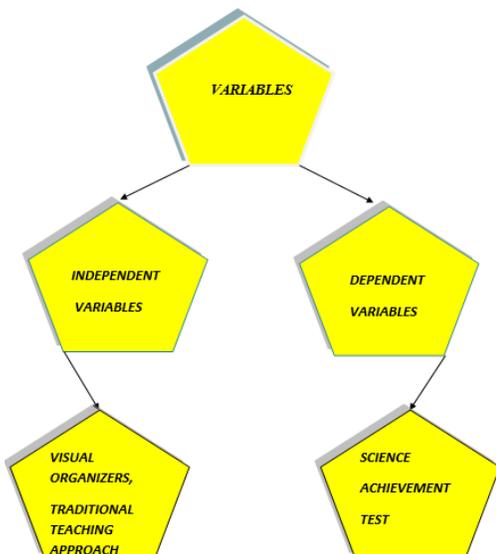
#### H0-3

There is no significant difference between the pre-test and post-test achievement scores of class IX science Male students after being taught through visual organizers.

#### H0-4

There is no significant difference between the pre-test and post-test achievement scores of class IX science students after being taught through visual organizers.

### VARIABLES OF THE STUDY



## SAMPLE OF THE STUDY

A sample refers to a specific group of participants selected from the target population for conducting research. In the present study, the sample consisted of Class IX Science students selected from Aadharshila the School Chandpur, Bijnor. The students were chosen using a purposive sampling technique, ensuring relevance and suitability to the research purpose.

## TOOLS OF THE STUDY

In the present study, two major categories of tools have been employed, namely structural and measuring tools. The structural tool comprises the use of visual organizers, which have been systematically developed and implemented as an instructional strategy to promote clarity of concepts, organization of knowledge, and meaningful learning among students. In this research, the visual organizers have been specifically designed on the basis of the Class IX NCERT Science curriculum, and these structured tools were consistently used during instructional sessions. The measuring tool of the study is science achievement, assessed through a standardized Science Achievement Test prepared to evaluate students' comprehension, retention, application, and overall academic performance in science. Thus, from the researcher's perspective, the study aims to determine the effectiveness of visual organizers developed from NCERT Class IX Science content in enhancing students' science achievement, by scientifically examining the relationship between the instructional intervention and learners' achievement outcomes.

## VALIDITY AND RELIABILITY OF THE TEST INSTRUMENT

**Validity:** To ensure the academic rigor and authenticity of the present study, special emphasis was placed on establishing the validity of the research tool. A test is considered valid when it accurately measures the attribute or capability for which it has been constructed. In this study, the validity of the Science Achievement Test was assured through content validity, wherein subject experts critically evaluated whether the test items truly represented the prescribed content and instructional objectives. Their expert judgment confirmed that the tool appropriately covered essential areas of the curriculum, ensuring that the test genuinely measures students' science achievement.

**Reliability:** Along with validity, equal importance was accorded to ensuring the reliability of the test, so that the obtained results remain consistent and dependable. Reliability refers to the stability and consistency of scores when a test is administered under similar conditions. In the present research, reliability was established using the Split-Half Method, wherein the test was divided into two equivalent halves and the correlation between their scores was calculated. The obtained reliability coefficient of 0.85 reflects a high degree of internal consistency, indicating that the test is trustworthy, dependable, and scientifically sound for measuring students' performance.

**Study Description:** In the present research an experimental approach was employed to examine the effect of Visual Organization strategies in comparison with the conventional teaching method on the academic achievement of Class IX science students. The study aimed to produce strong empirical evidence supporting innovative instructional practices for improving student learning outcomes.

## STUDY DESIGN

The study adopted a pre-test-post-test control group experimental design. One group was taught through visual organizers, whereas the control group received traditional instruction. Pre-tests and post-tests were administered to both groups to compare achievement levels, thereby ensuring reliability, objectivity, and a scientifically controlled evaluation of instructional effectiveness.

## RESULTS AND INTERPRETATION

**H0-1** There is no significant difference the pre-test and post-test achievement scores of class IX science students after being taught through Traditional Method.

GROUP	NUMBER (N)	MEAN (M)	STANDARD DEVIATION (S.D)	't' VALUE	SIGNIFICANCE LEVEL	Column1
SUDENTS PRE-TEST CONTROL GROUP	40	20.25	6.62	2.42	0.05 Rejected	0.01 Accepted
STUDENTS POST-TEST CONTROL GROUP	40	23.925	6.99		Significant Difference	Not significant Difference

The table presents a comparison of the pre-test and post-test achievement scores of Class IX science students taught through the traditional method. The post-test mean score ( $M = 23.925$ ) shows an improvement over the pre-test mean score ( $M = 20.25$ ), indicating a learning gain after instruction. With 78 degrees of freedom, the calculated t-value (2.42) is higher than the critical value at the 0.05 level (1.99), showing a significant difference at this level. However, the calculated t-value is lower than the critical value at the 0.01 level (2.64), indicating that the difference is not significant at the 0.01 level. This suggests that teaching through the traditional method leads to some improvement in students' post-test achievement, but the effectiveness is not strong at a higher level of significance. In comparison, the improvement observed through visual organizer-based teaching appears to be more effective than the traditional method in enhancing students' academic achievement.

**H0-2** There is no significant difference between the pre-test and post-test achievement scores of class IX science Female students after being taught through visual organizers.

GROUP	NUMBER (N)	MEAN (M)	STANDARD DEVIATION (S.D)	't' VALUE	SIGNIFICANCE LEVEL	Column1
					0.05	0.01
FEMALE PRE-TEST EXPERIMENTAL GROUP	20	21	6.91	5.9	Rejected	Rejected
FEMALE POST-TEST EXPERIMENTAL GROUP	20	31.65	4.17		Significant Difference	

The table demonstrates the academic growth of Class IX science students taught through the traditional method and the visual organizer approach. The pre-test results show a mean score of 21 with a standard deviation of 6.90, whereas the post-test results after instruction through visual organizers reveal a higher mean score of 31.65 and a reduced standard deviation of 4.17. With 38 degrees of freedom, the calculated t-value of 5.90 exceeds the critical values at both 0.05 (2.02) and 0.01 (2.71) levels. Hence, the null hypothesis is rejected, indicating a significant difference between pre-test and post-test mean scores. This confirms that the use of visual organizers significantly enhances the academic achievement of Class IX science Female students.

**H0-3** There is no significant difference between the pre-test and post-test achievement scores of class IX science Male students after being taught through visual organizers.

GROUP	NUMBER (N)	MEAN (M)	STANDARD DEVIATION (S.D)	't' VALUE	SIGNIFICANCE LEVEL	Column1
					0.05	0.01
MALE PRE-TEST EXPERIMENTAL GROUP	20	20	6	6.96	Rejected	Rejected
MALE POST-TEST EXPERIMENTAL GROUP	20	31.35	4.17		Significant Difference	

The table demonstrates the academic growth of Class IX science students taught through the traditional method and the visual organizer approach. The pre-test results show a mean score of 20 with a standard deviation of 6.00, whereas the post-test results after instruction through visual organizers reveal a higher mean score of 31.35 and a reduced standard deviation of 4.17. With 38 degrees of freedom, the calculated t-value of 6.96 exceeds the critical values at both 0.05 (2.02) and 0.01 (2.71) levels. Hence, the null hypothesis is rejected, indicating a significant difference between pre-test and post-test mean scores. This confirms that the use of visual organizers significantly enhances the academic achievement of Class IX science Male students.

**H0-4** There is no significant difference between the pre-test and post-test achievement scores of class IX science students after being taught through visual organizers.

GROUP	NUMBER (N)	MEAN (M)	STANDARD DEVIATION (S.D)	't' VALUE	SIGNIFICANCE LEVEL	Column1
					0.05	0.01
SUDENTS PRE-TEST EXPERIMENTAL GROUP	40	20.5	6.4	9.14	Rejected	Rejected
STUDENTS POST-TEST EXPERIMENTAL GROUP	40	31.5	4.12		Significant Difference	

The table demonstrates the academic growth of Class IX science students taught through the traditional method and the visual organizer approach. The pre-test results show a mean score of 20.50 with a standard deviation of 6.40, whereas the post-test results after instruction through visual organizers reveal a higher mean score of 31.50 and a reduced standard deviation of 4.12. With 78 degrees of freedom, the calculated t-value of 9.14 exceeds the critical values at both 0.05 (1.99) and 0.01 (2.64) levels. Hence, the null hypothesis is rejected, indicating a significant difference between pre-test and post-test mean scores. This confirms that the use of visual organizers significantly enhances the academic achievement of Class IX science students.

## CONCLUSION

The present study concludes that visual organizer–assisted science instruction constitutes a more meaningful and effective pedagogical approach than conventional teaching methods at the secondary school level. By fostering conceptual clarity, systematic organization of knowledge, and active learner engagement, visual organizers significantly enhance students' academic achievement in science. The comparative investigation indicates that while traditional instruction may lead to limited improvement, the integration of visual organizers creates richer learning experiences that support comprehension, retention, and application of scientific concepts. The effectiveness of this approach across diverse learner groups further highlights its universal pedagogical value. Overall, the findings affirm that visual organizer–based instruction holds substantial promise for improving science learning outcomes, strengthening classroom interaction, and promoting deeper cognitive processing, thereby contributing to more effective and learner-centered science education.

## ACKNOWLEDGMENTS

None.

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