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EFFECT OF ADVANCE ORGANIZERS ON STUDENTS' ACHIEVEMENT IN GENERAL SCIENCE: AN EXPERIMENTAL STUDY

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ABSTRACT

This study examines how elementary school students' achievement in general science is impacted by advance organizers. Young students benefit much from science education in terms of developing critical thinking and conceptual comprehension, yet conventional teaching approaches sometimes fall short in offering the cognitive frameworks required for engaging learning. Advance organizers are teaching aids created to close the knowledge gap between old and new information, improving students' factual and conceptual understanding of scientific ideas. Elementary school pupils participated in the study's experimental design. Multiple-choice questions measuring factual and conceptual knowledge were used in pre-tests and post-tests to gather data.The research tool for evaluating achievement was the General Science achievement Test (GSAT), which was created and approved by professionals. Descriptive statistics, paired sample t-tests, one-way ANOVA, and effect size computations (Cohen's d and eta squared) were used to gather and evaluate pre-test and post-test results using SPSS (version 26). Throughout the investigation, confidentiality and informed consent were upheld as ethical principles. The results showed that using advance organizers greatly raised students' academic performance in general science at all levelshigh, average, and low. Pupils showed a deeper comprehension of conceptual information and an improved comprehension of factual knowledge. According to the study's findings, advance organizers are a useful teaching tool for improving elementary school science instruction.The study has important ramifications for Pakistani curriculum development, teacher preparation, and teaching methods since it encourages student-centered learning and early scientific literacy development.

INTRODUCTION

One important factor influencing elementary school pupils' future success in science-related fields is how well they perform academically in general science. Since the basis of scientific knowledge is established early on, it is crucial to make sure that students successfully understand basic ideas. The cognitive framework required for effective learning is frequently lacking in traditional teaching methods, which results in academic performance, low retention rates, and a decline in student interest in the subject. In order to produce a generation of scientifically literate

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people who can contribute to and succeed in science-related fields, it is imperative that this issue be addressed.By offering a conceptual framework prior to the learning activity, advance organizersa cognitive strategy first proposed by David Ausubel in 1960serve to improve learning. Advance organizers help people comprehend and remember information better by connecting new information to what they already know. Advance organizersdescribe teaching resources intended to close the knowledge gap between students and the new material they need to learn. As cognitive scaffolds, advanced organizers help students integrate new information into their preexisting cognitive frameworks by providing a broad framework that facilitates understanding and retention.

The effect of advance organizers on students' performance in science classes has been the subject of more and more research in recent years. Effective teaching techniques are essential for promoting comprehension and retention because elementary students frequently struggle with abstract scientific concepts. According to recent research, advance organizerswhether they are concept maps, graphic organizers, or narrative summariescan greatly improve students' learning processes (Mayer, 2021; Topping et al., 2021). For example, by helping with information visualization and structuring, graphic organizers have been demonstrated to enhance understanding of scientific texts (Gonzalez et al., 2022).Additionally, research emphasizes how advance organizers help differentiate instruction and accommodate a range of learning styles in inclusive classrooms. Teachers can better assist students with different levels of prior knowledge and cognitive abilities by offering a clear framework (Hattie & Donoghue, 2021). The need for customized pedagogical approaches is highlighted by the current educational environment, especially as classroom diversity increases

The teaching-learning abilities and attitudes that students acquire in educational institutions are essential to modern life. Teachers in schools have a significant impact on students by fostering curiosity, nurturing talent, and imparting practical factual, conceptual, procedural, and metacognitive knowledge about the outside world (Arends, 2004).Prior research has independently shown that advance organizers are effective (Oyeniyi&Owolabi, 2020; UzZaman et al., 2015; Karthikeyan & Denisia, 2021). Positive results regarding the use of advance organizers as teaching aids have been consistently reported in these studies. According to Oyeniyi and Owolabi (2020), advance organizers greatly increased students' interest in and comprehension of the subject matter, which in turn improved comprehension and knowledge retention. Furthermore, by demonstrating enhanced student encouragement and enthusiasm for learning when they were used, the study by Karthikeyan and Denisia (2021) demonstrated the positive effects of advance organizers on the learning process.

There is still a lack of specific research on advance organizers' efficacy in teaching elementary science, despite the encouraging literature on the subject. The majority of earlier research has mostly concentrated on different topics or higher education levels. This study intends to examine the direct effects of different kinds of advance organizers on elementary school students' performance in general science, given the crucial role that understanding fundamental scientific concepts plays in early education. By concentrating on this area, the study aims to offer empirical data that may guide teaching strategies and improve students' scientific learning experiences and results.

Objectives of the study

The following objectives were achieved in this research

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1. to find out the effect of advance organizers in enhancing factual knowledge of high, average and low achievers in the subject of general science
2. to examine the effect of advance organizers in enhancing conceptual knowledge of high, average and low achievers in the subject of general science

REVIEW OF LITERATURE

Advance organizers are frequently cited in research as useful teaching tools in science classes, especially for elementary and junior high school students. Over time, advance organizers assist students in integrating new information, activating existing knowledge, and remembering scientific concepts., Tajika and Kawakami's (1988) study showed that students When fifth-grade students were taught the structure of flowers,who were exposed to advance organizers fared considerably better on tests of immediate and delayed retention. This offered preliminary proof of the value of advance organizers in science classes at the elementary school level. These advantages are still supported by more recent studies also. Iskandar et al. (2023) discovered that when abstract concepts were taught using multimedia advance organizers connected to real-world activities then grade 4 students' scientific proficiency increased significantly. These results highlight how organizers can be tailored to contemporary, activity-based learning environments.Elfeky, Masadeh, and Elbyaly (2020) and Elfeky (2024) also investigated advance organizers in flipped classrooms and e-learning. Both studies showed gains in performance and science process skills, but they were not restricted to elementary students, indicating that the method works well for a variety of teaching modalities.The effectiveness of advance organizers is further supported by research done in African contexts. Working with junior secondary students in Nigeria, Atomatofa (2013) discovered that students exposed to advanced organizers performed better than their peers in terms of comprehending and remembering gravity concepts. This is consistent with the findings of Reed et al. (2019), who used electronic Frayer-model organizers in Grade 4 life science and saw increases in engagement and achievement.These individual findings are reinforced by meta-analytic evidence. After reviewing 55 studies from Grades 3–12, Anastasiou, Wirngo, and Bagos (2024) came to the conclusion that concept maps, a type of advance organizer, had a moderately positive impact ($g = 0.78$) on science learning outcomes. Similarly, İzci (2023) discovered that concept maps had a significant impact on academic achievement across 78 studies, with especially good results in junior and secondary schools ($d = 1.08$).When combined, these studies show that advance organizers: Boost general science achievement;Boost retention of knowledge;Encourage motivation and engagement; and work well in a variety of cultural and educational contexts. Strong empirical support for examining the impact of advance organizers on elementary students' general science performance can be found in this extensive body of literature.

Numerous studies have confirmed that advance organizers play a significant role in science education, especially at the elementary level, in terms of both cognitive processes and pedagogical practices (Ausubel, 1968; Mayer, 2002; Nesbit &Adesope, 2006).The decrease in cognitive load is another important advantage. The cognitive load theory (Sweller, 2010) stated that students' working memory capacity is constrained in early classes. By providing the fundamental structure of a subject before in-depth instruction starts, advance organizers reduce this load and free up mental energy for critical thinking and problem-solving. By fortifying the

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encoding process, advance organizers also improve knowledge retention over the long term. Retrieval becomes simpler and more effective when students comprehend how new information fits into preexisting frameworks.In a similar vein, Marzano and Kendall (2007) noted that elementary students' recall of science concepts was considerably enhanced by narrative and comparative organizers. Because of this, they are especially useful in disciplines like science, where mastery requires cumulative understanding.Learners are encouraged by advance organizers to move beyond memorization and toward conceptual understanding. By emphasizing connections between concepts, they develop the capacity to evaluate, contrast, and combine ideas.For instance, using a Venn diagram to compare plants and animals as advance organizers fosters understanding of common biological traits in addition to helping students memorize differences. Higher-order thinking and the development of scientific reasoning abilities have been demonstrated to be supported by comparative and graphic organizers in particular (Dahar&Faize, 2011; Tuncer&Sahin, 2018). In nutshell advance organizers aid in meaningful learning, lower cognitive load, improve recall and retention, foster conceptual understanding, accommodate a variety of learning styles, and boost motivation.

THEORETICAL FRAMEWORK:

Constructivist learning principles and cognitive theory serve as the foundation for this study's theoretical framework. One popular teaching method that helps students integrate new information and preconditions their understanding is the use of advance organizers in classrooms. This framework investigates the theories underlying the efficacy of advance organizers in raising student achievement, especially in the context of elementary school general science instruction.

Piaget's theory of cognitive development sheds light on how kids learn. Children go through phases of cognitive development and build knowledge through interactions with their surroundings, according to Piaget. This theory highlights the necessity for teachers to present material in a way that corresponds with elementary students' cognitive capacities, taking into account that they are usually in the concrete operational stage.According to constructivist theorists like Vygotsky and Brunner, students construct their understanding from past experiences and knowledge. Vygotsky's Zone of Proximal Development (ZPD) theory lends credence to the notion that scaffolding improves student performance. By effectively connecting new science concepts to existing knowledge, advance organizers serve as a type of scaffolding that helps students build new understanding.

According to research, by encouraging meaningful learning, advance organizers improve students' learning. Students show better understanding, retention, and transfer of knowledge when they connect new information to preexisting cognitive structures. For subjects like general science, which frequently involve abstract concepts and processes, this relationship between advance organizers and academic performance is essential.The effectiveness of advance organizers in diverse educational contexts has been the subject of recent studies. Duman and Köz (2022), for instance, discovered that students who were exposed to advanced organizers in science classes performed noticeably better on tests than their counterparts. According to Akar and Cokadar's (2021) research, elementary students who had advance organizers were more engaged and had a deeper comprehension of science subjects.

Now move to thefundamental facts and information about a subject is referred to as factual knowledge. This includes knowledge of scientific concepts, definitions, and terminology in

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general science (Anderson &Krathwohl, 2001). Deeper understanding is based on factual knowledge. Jonassen (2003) asserts that before students can develop a more sophisticated understanding of science, they must first acquire factual knowledge. Students with strong factual knowledge typically do better on tests that call for the recall and recognition of scientific terms. The lowest but most fundamental level of cognitive learning is factual knowledge, according to Anderson and Krathwohl's (2001) revision of Bloom's taxonomy. Factual knowledge in elementary school general science refers to the vocabulary, particulars, symbols, and definitions that form the foundation for higher-order thinking and problem-solving. Knowing the names of the planets in the solar system, the components of a plant, or the definition of photosynthesis are a few examples.

The comprehension of ideas, theories, models, and principles in a field is known as conceptual knowledge. It entails understanding the connections between scientific facts and the broad concepts that direct scientific investigation in general science (Mayer, 2002). Students who possess conceptual knowledge are better able to integrate facts and solve problems. According to Bransford et al. (2000), students who possess strong conceptual knowledge are better able to apply what they have learned to novel circumstances. According to recent studies, including one by Ji et al. (2022), students who use inquiry-based learning strategies perform better on science tests because they have a deeper comprehension of scientific concepts than students who primarily concentrate on factual recall. Understanding the relationships between fundamental components within a larger structure that allow them to work together is known as conceptual knowledge (Anderson &Krathwohl, 2001). Conceptual knowledge entails understanding the theories, models, generalizations, and principles that explain how and why scientific phenomena occur, in contrast to factual knowledge, which is mainly focused on memorizing terms and details. Understanding scientific laws (like Newton's laws of motion), models (like atomic structure), and systems (like the interdependence of plants and animals in ecosystems) are all included in general science. According to Bransford et al. (2000), conceptual knowledgethat is, the capacity to apply what has been learned in one context to novel or unfamiliar circumstancesis essential for learning transfer. Pupils who possess strong conceptual frameworks are better equipped to identify trends, anticipate outcomes, and modify their understanding to address issues in unfamiliar contexts. All things considered, conceptual knowledge serves as a link between higher-order thinking and factual recall. It is an essential objective of science education at the elementary level since it gives students the tools they need to synthesize, transfer, and apply scientific knowledge to new problems.

METHOD AND PROCEDURE

To investigate the impact of advance organizers on elementary school students' performance in general science, the current study used a true experimental research design, more precisely the pre-test, post-test control group design. Due to their ability to control extraneous variables through random assignment, true experimental designs are regarded as the most rigorous approach in educational research (Creswell & Creswell, 2018). This allows for strong causal inferences. All 30 fifth-grade students at the Islamabad Model School for Boys (I–V), Shah Allah Ditta, Islamabad, made up the study's population. The entire population of 30 Grade 5 students was chosen as the study's sample. All students were included to guarantee maximum coverage and prevent sampling bias because the population size was small and manageable,

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negating the need for an additional sampling frame. An experimental group and a control group, each consisting of 15 participants, were randomly selected from the sample size of 30 students. Students were divided into groups using a simple random sampling technique, guaranteeing that each person had an equal chance of being assigned to either condition.Tests in the form of multiple-choice questions were developed. The pre-test and post-test were identical and were based on the five general science chapters of the fifth-grade textbook created by the National Book Foundation in Islamabad while taking Bloom's Taxonomy into consideration. There were 45 multiple-choice questions (each with one number) on the pre-test and post-test. Three of the questions assessed factual, conceptual from each chapter.

DATA COLLECTION PROCEDURE

Participants in this study were randomized to either the experimental or control groups. While the control group was instructed using conventional lecture-based techniques, the experimental group was instructed using Ausubelian advance organizers. Before the intervention, a pre-test was given to both groups to determine baseline equivalency in factualand conceptual knowledge. With permission from the institution's head, data was gathered through the pre-test and post-test.

DATA ANALYSIS

ANOVA, t-test, mean, and standard deviation were used to analyze the data. The t-test, which shows how frequently there is a difference between the mean scores of the experimental and control groups for a given sample size, is a practical method of determining the significant difference between the two mean scores at a chosen probability level.

RESULTS

Table 1: Paired Samples Statistics Overall Difference of Pre-test and Post test

Tests	M	N	SD	T	df	Sig	Cohen d
Post Test	29.23	30	4.19	11.837	29	.000	2.16
Pre Test	21.87	30	1.85				

All students' total pre-test and post-test scores were compared using the paired samples t-test. From the pre-test ($M = 21.87$, $SD = 1.85$) to the post-test ($M = 29.23$, $SD = 4.19$), the results showed a statistically significant improvement ($t(29) = 11.84$, $p <.001$). The intervention had a significant impact on overall student performance, as evidenced by the effect size of Cohen's d = 2.16, which shows a very large effect.This shows that students' post-test scores were, on average, over 7 points higher than their pre-test scores. The difference shows that the instructional intervention was quite successful in improving students' factual knowledge, and it is both statistically significant and educationally valuable.There was an average increase of 7.37 points.

Table 2: Paired Samples Statistics Difference of Factual Knowledge

Tests	M	N	SD	t	df	Sig	Cohen d
Post Test Factual Knowledge	10.03	30	1.496	7.760	29	.000	1.42
Pre Test Factual Knowledge	7.70	30	.749				

A paired-samples *t*-test was conducted to compare factual knowledge scores before and after the intervention. Results indicated that post-test scores (M = 10.03, SD = 1.50) were significantly higher than pre-test scores (M = 7.70, SD = 0.75), $t(29) = 7.76$, $p < .001$. The mean increase of 2.33 points represented a large effect, Cohen's $d = 1.42$. These findings suggest that the intervention had a substantial positive impact on students' factual knowledge.
The findings show that students' factual knowledge improved statistically significantly between the pre- and post-tests. The intervention's considerable positive impact on student learning outcomes is confirmed by the large effect size (Cohen's d = 1.42), which shows that it was very effective in improving factual knowledge.

Table 3: Paired Samples Difference of Conceptual Knowledge Pre Test and Post Test

Tests	M	N	SD	t	df	Sig	Cohen d
Post Test Conceptual Knowledge	9.13	30	1.479	7.999	29	.000	1.46
Pre Test Conceptual Knowledge	6.87	30	.819				

A paired-samples *t*-test was conducted to compare conceptual knowledge scores before and after the intervention. Post-test scores (M = 9.13, SD = 1.48) were significantly higher than pre-test scores (M = 6.87, SD = 0.82), $t(29) = 7.999$, $p < .001$. The mean increase of 2.26 points represented a large effect, Cohen's $d = 1.46$. These results indicate that the intervention substantially improved students' conceptual knowledge.
The results indicate that students' conceptual understanding improved statistically significantly between the pre- and post-tests. The intervention was very successful in improving students' conceptual comprehension, as seen by the significant effect size (Cohen's d = 1.46), which also confirms the intervention's considerable positive contribution to learning outcomes.

Table 4: Descriptive Statisticsand ANOVA Post Test

Achievement	N	M	SD	df	F	Sig.	η²	Cohen's f
High Achievers	11	33.18	2.86	2	23.64	.000	0.636	1.32
Average Achievers	7	29.14	2.67	27				
Low Achievers	12	25.67	2.35					
Total	30	29.23	4.19	29				

According to the descriptive statistics, the post-test mean score was highest for high achievers (M = 33.18, SD = 2.86), followed by average achievers (M = 29.14, SD = 2.67), and lowest for low achievers (M = 25.67, SD = 2.35). All pupils combined received an average score of 29.23 (SD = 4.19).
The one-way ANOVA revealed a statistically significant difference among the three achievement groups, $F(2, 27) = 23.64$, $p < .001$. The effect size was very large, $\eta^2 = .636$, indicating that 63.6% of the variance in post-test scores was explained by group membership. Cohen's *f* was 1.32, which also represents a very large effect size due treatment.
These findings demonstrate that the advance organizers effect the students' level of achievement (high, average, low) had a substantial impact on their overall post-test performance. Specifically,

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high achievers significantly outperformed average and low achievers, while low achievers scored the lowest

Conclusion: According to the analysis, students' overall performance on the post-test was significantly impacted by their achievement levels. Low achievers received the lowest scores, while high achievers performed the best. Average achievers came in second. It is confirmed by the very substantial effect size (η^2 =.636; Cohen's f = 1.32) that students' learning outcomes were significantly influenced by their success level. These results imply that in order to help average and low achievers raise their performance to the level of high achievers, specialized support and instructional tactics could be required.

Table 5: Descriptive Statistics and ANOVA Post Test Factual Knowledge

Achievement	N	M	SD	df	F	Sig.	η²	Cohen's f
High Achievers	11	11.36	.81	2	13.930	.000	.508	1.02
Average Achievers	7	9.71	.95	27				
Low Achievers	12	9.00	1.35					
Total	30	10.03	1.50	29				

Descriptive statistics revealed that high achievers obtained the highest mean score (M = 11.36, SD = 0.81), followed by average achievers (M = 9.71, SD = 0.95), while low achievers had the lowest mean score (M = 9.00, SD = 1.35).

A one-way ANOVA was conducted to compare post-test factual knowledge scores among high, average, and low achievers. The results indicated a statistically significant difference among the groups, $F(2, 27) = 13.93$, $p < .001$. The effect size was large, $\eta^2 = .51$, suggesting that 51% of the variance in factual knowledge scores was explained by achievement level. Correspondingly, Cohen's $f = 1.02$, which also represents a very large effect.

Table 6: Descriptive Statistics and ANOVA Post Test Conceptual Knowledge

Achievement	N	M	SD	df	F	Sig.	η²	Cohen's f
High Achievers	11	10.36	1.12	2	16.157	.000	.545	1.10
Average Achievers	7	9.29	.95	27				
Low Achievers	12	7.92	.99	29				
Total	30	9.13	1.48					

Descriptive statistics showed that high achievers obtained the highest conceptual knowledge mean score (M = 10.36, SD = 1.12), followed by average achievers (M = 9.29, SD = 0.95), while low achievers scored the lowest (M = 7.92, SD = 1.00).

A one-way ANOVA was conducted to examine differences in post-test conceptual knowledge among high, average, and low achievers. The results indicated a statistically significant difference among the groups, $F(2, 27) = 16.16$, $p < .001$. The effect size was very large, $\eta^2 = .55$, showing that 55% of the variance in conceptual knowledge scores was explained by achievement level. Similarly, Cohen's $f = 1.10$, which also represents a very large effect according to Cohen's benchmarks.

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DISCUSSION

The results from every table show that using advance organizers significantly and favorably improved primary school pupils' general science learning outcomes.
First, the effectiveness of advance organizers as a teaching aid is demonstrated by the overall improvement from the pre-test to the post-test (Table 1), which has a very large effect size (Cohen's d = 2.16). These findings are consistent with Ausubel's (1968) theory of meaningful learning, which holds that by relating new information to what has already been learned, advance organizers offer cognitive scaffolding. Comparing advance organizers to traditional techniques, prior research has shown similar benefits in comprehension and memory (Akinsola&Animasahun, 2007; Akar&Cokadar, 2021).

Second, the improvements in both conceptual and factual knowledge imply that the intervention was successful in fostering higher-order comprehension as well as rote memory. Mayer (2002) asserted that well-structured instructional procedures foster both surface-level and deep learning, and this dual improvement confirms his findings. In line with Novak's (2010) work on concept mapping, the notable improvement in conceptual understanding specifically implies that advance organizers aid students in integrating concepts.

Third, accomplishment levels (high, average, and low) had a substantial impact on post-test results, according to the ANOVA results (Tables 4-6). In terms of total performance, factual knowledge, and conceptual understanding, high achievers routinely surpassed other groups. These results are consistent with those of Omoifo (2012), who discovered that students' ability to benefit from structured instructional interventions is frequently influenced by their prior accomplishment levels. The absence of comparable improvements for average and poor achievers, however, indicates that although advance organizers are helpful, performance gaps may need to be filled with differentiated instructional support.

Lastly, the intervention's high educational value is confirmed by the extremely significant effect sizes observed in all comparisons. This is consistent with the findings of Abdulla (2010), who found that textual and graphic organizers greatly improved learning results for a variety of student groups. All things considered, these results imply that including advance organizers into scientific instruction can result in significant gains in conceptual understanding and information recall, even though lower-achieving students might need more scaffolding.

Recommendations

1. Teachers should be encouraged to regularly incorporate advance organizers into science lectures as the study showed that they considerably enhanced both factual and conceptual understanding. To introduce instructors to various forms of advance organizers (such as idea maps, flow charts, and outlines) for efficient classroom use, training workshops may be held.
2. To become proficient in creating and utilizing advance organizers, educators must pursue continual professional development. Regular training sessions that show how advance organizers can be modified for various science topics and student achievement levels should be scheduled by school authorities.

3. Instead of only serving as teaching aids, advance organizers ought to actively engage their students. To improve understanding and recall, for instance, students can be assisted in making their own concept maps either before or after class.
4. Remedial programs utilizing advanced organizers suited to their level should be created because low achievers shown the least improvement. Simplified illustrations, organized summaries, or step-by-step learning tools to progressively expand their knowledge base are a few examples.

REFERENCES

Abdulla, M. A. (2010). The effectiveness of advance graphic organizers-based remedial teaching on improving the ability level of social problem-solving in primary school students with learning disabilities in social studies. *Scandinavian Journal of Human Sciences, 4*(1), 1–25.

Akar, H., &Cokadar, H. (2021). The impact of advance organizers on student engagement and understanding in science classrooms. *Journal of Education and Practice, 12*(3), 45–56.

Akinsola, M. K., &Animasahun, I. A. (2007). The effect of advance organizers on students' achievement and retention in mathematics. *Educational Research and Reviews, 2*(5), 109–113.

Anderson, L. W., &Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives.* Longman.

Anastasiou, S., Wirngo, E. C., &Bagos, P. G. (2024). The effects of concept mapping on science learning: A meta-analysis. *Educational Psychology Review, 36*(1), 77–99.

Arends, R. I. (2004). *Learning to teach* (6th ed.). McGraw-Hill.

Ausubel, D. P. (1968). *Educational psychology: A cognitive view.* Holt, Rinehart & Winston.

Atomatofa, R. (2013). Effect of advance organizers on Nigerian junior secondary students' achievement in basic science. *International Journal of Science Education, 35*(12), 2003–2024.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school.* National Academy Press.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage.

Dahar, M. A., &Faize, F. A. (2011). Effect of the use of concept maps on students' learning achievements in Pakistan. *International Journal of Academic Research, 3*(2), 85–91.

Duman, B., &Köz, E. (2022). The effect of using advance organizers on students' academic achievement in science courses. *Journal of Educational Research and Practice, 12*(4), 22–35.

Elfeky, A. I. M. (2024). The effect of using flipped classrooms with advance organizers on students' science achievement. *International Journal of Emerging Technologies in Learning, 19*(2), 45–59.

Elfeky, A. I. M., Masadeh, T. S., &Elbyaly, M. Y. H. (2020). Advance organizers in flipped classrooms: Effects on achievement and science process skills. *Journal of Education and Learning*, *9*(3), 124–135.

Gonzalez, C., Ramirez, A., & Perez, J. (2022). Graphic organizers as tools to enhance elementary students' comprehension of science texts. *International Journal of Science Education*, *44*(5), 721–740.

Hattie, J., & Donoghue, G. (2021). Learning strategies: A synthesis and conceptual model. *npj Science of Learning*, *6*(1), 1–13.

Iskandar, S. M., Rahayu, W., &Mulyani, S. (2023). The use of multimedia advance organizers in teaching abstract science concepts to elementary students. *Journal of Science Learning*, *6*(1), 15–28.

İzci, K. (2023). The effect of concept maps on students' academic achievement: A meta-analysis. *Journal of Educational Technology & Online Learning*, *6*(1), 58–75.

Ji, X., Liu, H., & Wang, Y. (2022). Inquiry-based learning and students' conceptual understanding in science education. *International Journal of Science and Mathematics Education*, *20*(7), 1453–1475.

Jonassen, D. H. (2003). *Learning to solve problems: An instructional design guide.* Pfeiffer.

Karthikeyan, J., &Denisia, R. (2021). The effectiveness of advance organizers in enhancing students' learning outcomes. *International Journal of Instruction*, *14*(2), 455–468.

Marzano, R. J., & Kendall, J. S. (2007). *The new taxonomy of educational objectives.* Corwin Press.

Mayer, R. E. (2002). Rote versus meaningful learning. *Theory into Practice*, *41*(4), 226–232.

Mayer, R. E. (2021). *Multimedia learning* (3rd ed.). Cambridge University Press.

Nesbit, J. C., &Adesope, O. O. (2006). Learning with concept and knowledge maps: A meta-analysis. *Review of Educational Research*, *76*(3), 413–448.

Novak, J. D. (2010). Learning, creating, and using knowledge: Concept maps as facilitative tools in schools and corporations (2nd ed.). Routledge.

Omoifo, C. N. (2012). Dance of survival: Science, technology and mathematics education in the global village. *Inaugural Lecture Series 124, University of Benin Press.*

Oyeniyi, A. A., &Owolabi, T. (2020). Effect of advance organizers on students' academic achievement and interest in biology. *Journal of Education and e-Learning Research*, *7*(3), 288–294.

Reed, D. K., Petscher, Y., &Foorman, B. R. (2019). The effects of electronic graphic organizers on fourth-grade students' science learning. *Elementary School Journal*, *119*(4), 635–658.

Sweller, J. (2010). Cognitive load theory: Recent theoretical advances. *Cognitive Load Theory*, *1*(1), 29–47.

Tajika, H., & Kawakami, M. (1988). The effects of advance organizers on learning and retention in elementary school science. *Japanese Journal of Educational Psychology*, *36*(3), 213–220.

Topping, K. J., Buchs, C., Duran, D., & Van Keer, H. (2021). *Effective peer learning: From principles to practical implementation.*Routledge.

Tuncer, M., &Sahin, E. (2018). The effect of concept maps and advance organizers on students' academic achievement. *Journal of Education and Training Studies, 6*(9), 41–49.

UzZaman, S., Akhter, N., &Hussain, S. (2015). Effectiveness of advance organizers in teaching science concepts at elementary level. *Journal of Elementary Education, 25*(2), 69–84.