Impact of Foldable Graphic Organizer on Cognitive and Affective Learning in Grade 9 Science

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ABSTRACT

The present study focused on the impact of foldable graphic organizers on cognitive and affective learning among Grade 9 science learners in Western Bicutan National High School in the Division of Taguig City and Pateros. The objectives of this study included identifying learning gaps in cognitive and affective learning in science, determining the role of foldable graphic organizers in solving the identified learning gaps as perceived by science teachers, designing the foldable graphic organizers, assessing their acceptability by science teachers and science experts, and determining the impact on cognitive and affective learning among Grade 9 Science learners.

The study employed a descriptive quantitative research design. Data were collected through validated survey questionnaires, pre-test and post-test, and an acceptability checklist. Descriptive statistics, mean comparison, and t-tests were used for data analysis.

The developed instructional materials were found to be highly acceptable by both science teachers and science experts across eight evaluation domains: objectives, content, activities, usefulness, language and style, organization, presentation, and evaluation.

Based on the findings of this study, the use of Foldable Graphic Organizers had a significant positive impact on learners' cognitive learning and also strengthened their affective learning. The learners' cognitive performance improved from Low to Closely Approximating Mastery, while their affective responses showed Strong Agreement in commitment, positive attitude, confidence, interest and motivation, engagement, and participation in Science learning.

Keywords: foldable graphic organizer, learning gaps, cognitive learning, affective learning, impact.

INTRODUCTION

Education is a major factor in determining what learners will know, what skills they will develop, and how their character will be shaped. At present, teachers are being pushed by society and schools not to rely on a single method for teaching a topic but to employ varied teaching methods to deliver the same lesson in different ways. This emphasizes the significance of having an effective Science teacher, since Science not only contains many challenging topics but also requires deep understanding and strong interest in the subject. Nevertheless, many Grade 9 learners still find science very difficult, especially when teachers employ traditional and teacher-centered methods such as lectures and note-taking**.** This situation emphasizes the need for innovation in teaching strategies that can improve learning, making it not only more effective and accessible but also a more engaging and enjoyable learning experience for learners.

The reasons why teaching strategies need to be improved are that the Enhanced Basic Education Act of 2013 (Republic Act No. 10533) highlights the shift to learner-centered and learner-active teaching. Besides this, developing critical thinking and positive attitudes toward learning are some of the skills that this law aims to impart to learners. Therefore, consistent with this, the Department of Education is motivating educators to adopt innovative and impactful teaching methods. Also, DepEd Order No. 42, s. 2017, or National Adoption and

Implementation of the Philippine Professional Standards for Teachers (PPST), emphasizes teachers employing creative teaching approaches in addressing diverse learning needs.

In response to these challenges, educators are increasingly exploring innovative, learner-centered approaches that foster active learning and conceptual understanding. Employing foldable graphic organizers is one of the ways that can help in meeting these targets because such tools facilitate learners to become active, creative, and engaging learners. A foldable graphic organizer is one that a learner can fold and unfold while they are working with it. It is more than just listening, and it indeed turns learners into active learners. These foldables integrate visual, kinesthetic, and spatial learning elements, making them well-suited for simplifying complex science content.

Foldable graphic organizers are also one of the powerful methods to enhance learners' cognitive learning as well as affective learning, which are deemed the two critical aspects of learning. The focus of cognitive learning is the human brain's inner workings or processing, i.e., thinking, learning, understanding, and memory. Examples of cognition after comprehension are the ability to analyze, the ability to structure, and the capability to apply knowledge. Affective learning, however, is the opposite aspect of cognition and is concerned with the emotional side of things or people's feelings, moods, and so on, in this case, learners' feelings, moods, attitudes towards, and interest in learning. It involves classroom motivation, engagement, and willingness to participate. Both aspects are so interlinked that it makes it impossible for learners not to understand lessons when they are interested and motivated to learn and vice versa.

Generally, this study is a step toward achieving better Science education through an interactive, meaningful, and enjoyable learning experience for Grade 9 learners.

LITERATURE-BASED RESEARCH FRAMEWORK

Science education occupies a significant place in the Philippine educational system because of its role in developing scientifically literate and critical-minded citizens. Republic Act No. 10533 (2013) emphasizes the development of learners capable of critical thinking, lifelong learning, creativity, and problem-solving through a learner-centered, pedagogically sound curriculum. The law mandates the use of instructional approaches that address learners' cognitive needs and promote meaningful learning experiences. It further highlights the importance of developing essential competencies, skills, and values necessary for academic success and lifelong learning. These provisions support the use of innovative teaching strategies such as foldable graphic organizers, which can enhance learners' cognitive achievement and foster positive attitudes toward learning Science.

This research was anchored in the Socio-Cultural Theory of Learning by Lev Vygotsky and more specifically on the notion of the Zone of Proximal Development (ZPD). The theory states that learners can perform tasks and grasp concepts more deeply and efficiently when they are supported and assisted by others. The Zone of Proximal Development, in simple words, is the difference between what learners can do on their own and what they can do with the help of others. According to Tzuriel (2021), one of the main ideas of Vygotsky's theory is the great significance of communication, collaboration, and leading the learners through the learning stages to development not only cognitively but also socially. Sociocultural Learning Theory supports the use of foldable graphic organizers because it integrates social interaction, guided learning, and meaningful engagement, all of which contribute to improving cognitive understanding and positive affective development among Grade 9 learners.

Additionally, DepEd Teacher Resource on Higher-Order Thinking Skills in Science (2025) emphasizes the use of instructional strategies that promote critical thinking, analysis, and learner engagement in Science classrooms. It highlights the importance of teaching methods that encourage learners to actively process information rather than merely memorize facts. Foldable graphic organizers align with these principles because they require learners to organize, connect, and synthesize scientific concepts.

The present study differs from previous studies in several aspects. First, while most existing studies focused primarily on the cognitive domain, such as academic achievement, conceptual understanding, and retention,

the current study examines both cognitive and affective learning outcomes. Particularly, it seeks to determine how foldable graphic organizers influence not only learners' academic performance but also their attitudes, interest, motivation, and engagement toward science learning. Second, many previous studies investigated the effectiveness of conventional graphic organizers, mind maps, or digital visual learning tools across various subject areas, whereas this study specifically focuses on foldable graphic organizers as an interactive and manipulative learning material in Grade 9 Science. Third, the present study is conducted within the context of junior high school science education, providing localized evidence regarding the effectiveness of foldable graphic organizers among Grade 9 learners.

METHODOLOGY

Research Design

This study utilized a descriptive-developmental and quasi-experimental research design to determine the impact of using Foldable Graphic Organizers on the cognitive and affective learning of Grade 9 Science learners.

The descriptive design was used to determine the perceived learning gaps in the cognitive and affective learning of Grade 9 Science learners as evaluated by Science teachers. It was also employed to assess the perceived role of Foldable Graphic Organizers in addressing the identified learning gaps. This design was appropriate because descriptive research describes existing conditions, characteristics, perceptions, and trends among a specific group of respondents (Creswell & Creswell, 2018).

The developmental phase involved the preparation, refinement, and validation of the Foldable Graphic Organizers. The developed instructional materials were evaluated by Science teachers and Science experts in terms of objectives, content, activities, usefulness, language and style, organization, presentation, and evaluation. This phase was suitable because design and development research focuses on the systematic design, development, and evaluation of instructional products, tools, and processes (Richey & Klein, 2007).

The quasi-experimental approach, specifically the one-group pre-test–post-test design, was used to determine the impact of the Foldable Graphic Organizers on learners' cognitive learning performance. The learners were assessed before and after the use of the instructional materials to determine whether a significant improvement occurred. This design was appropriate in an educational setting where the researcher implemented an intervention but could not fully randomize individual learners due to existing classroom arrangements and practical school conditions (Campbell & Stanley, 1963; Fraenkel et al., 2012).

Overall, the use of a descriptive-developmental and quasi-experimental research design was appropriate for the study because it enabled the researcher to identify learning gaps, develop and validate instructional materials, and determine the impact of the Foldable Graphic Organizers on Grade 9 Science learners.

Research Locale and Participants

The study involved three primary participant groups: Science experts, Science teachers, and Grade 9 learners from public secondary schools in the Division of Taguig City and Pateros. These three groups utilized the developed foldable graphic organizers. The first and second groups from the five (5) secondary schools were chosen following certain criteria, which are: first, they were categorized as Science experts and Science teachers; second, their number of years in teaching the Science subject; and lastly, their educational attainment. Moreover, the third group was Grade 9 learners of Western Bicutan National High School, where the researcher teaches.

Sampling Technique

The researcher used a purposive sampling technique. This means that a careful selection of respondents that would satisfy certain conditions necessary for this research took place. It is employed because only Grade 9 Science teachers and Science experts from five (5) secondary public schools in the Division of Taguig and Pateros were utilized to ensure an in-depth assessment of the effectiveness of the foldable graphic organizers in Grade 9 Science. Seventy-nine (79) Grade 9 learners participated in the study, along with thirty-one (31) Science

teachers and sixteen (16) Science experts. Additionally, the study was conducted at Western Bicutan National High School- the school where the researcher is currently teaching- where the pre-testing and post-testing took place before and after the use of Foldable Graphic Organizers as instructional materials.

Research Instrument

The following research instruments were employed in this study: a survey questionnaire about perceived learning gaps in cognitive and affective domains of learning and the perceived role of foldable graphic organizers to meet those needs, a survey questionnaire on acceptability of the instructional material, and a test for cognitive and affective learning. All these instruments were prepared based on reviewed literature, and their validity and reliability were checked through pilot testing. The description of each research tool used and the processes involved in preparing each instrument are described below in detail.

1. Survey Questionnaire on the Perceived Learning Gaps on Cognitive and Affective learning among Grade 9 science learners and the Perceived Role of Foldable Graphic Organizer in addressing learning gaps.

This survey aims to determine the perceived learning gaps in Science 9, focusing on cognitive and affective learning. The questionnaire consisted of four parts.

Part I gathered demographic information such as school affiliation, teaching experience, and highest educational attainment.

Part II focused on the perceived learning gaps among Grade 9 learners in cognitive and affective learning experienced by the Science teachers. It included ten items rated on a five-point Likert scale ranging from 1 (No Gap) to 5 (Very Great Significant Gap).

Part III determined how Science teachers perceived the role of foldable graphic organizers in addressing the learning gaps. It also included ten items, each rated on a five-point scale from 1 (Strongly Disagree) to 5 (Strongly Agree)

Part IV allowed Science teachers to provide open-ended suggestions and recommendations based on the identified cognitive and affective learning gaps in science.

The validity of the tool was verified by science expert validators with excellent academic background in science education, evaluation, and teaching methodology. The comments from the experts helped to fine-tune the items and ensure their relevance to classroom practices.

The instrument was administered among the chosen public secondary schools within the Division of Taguig City and Pateros. Distribution of surveys was conducted face-to-face during school visits and departmental meetings, while some were accomplished using online means to make sure the respondents were accessible. Detailed instructions were provided in each survey section.

The administration of the instrument strictly adhered to ethical research principles, and confidentiality of data was maintained.

Survey Questionnaire on the Acceptability of Proposed Foldable Graphic Organizers

The survey questionnaire was developed by the researcher to assess the quality and suitability of the instructional materials prepared in this research. The questionnaire was developed following the guidelines of the review to maintain its content validity. The questionnaire is made up of three parts:

Part I comprises demographic information such as affiliation with schools as well as types of respondents who can either be a science expert or a science teacher.

Part II comprises 40 items and is divided into eight different subscales corresponding to the following criteria for the level of acceptability: Objectives, Content, Activities, Usefulness, Language and Style, Organization, Presentation, and Evaluation. These eight subscales include five indicator statements to be assessed on a 5-point Likert Scale ranging from 1 (Not Acceptable) to 5 (Highly Acceptable), with clear descriptions provided for each scale point. The complete instrument is included in this manuscript as Appendix J.

Part III offers an open-ended section where respondents may give comments and recommendations.

It was validated among science experts to maintain its reliability. This questionnaire was administered to 47 respondents, 31 of whom are science teachers and 16 are science experts of the Division of Taguig City and Pateros. The data were collected by means of printed questionnaires, which were personally delivered to respondents during the visit to the schools. Instructions were provided in each section of the survey.

Cognitive Learning Test

This researcher-made test was designed to measure the cognitive learning of Grade 9 learners before and after the implementation of the developed foldable graphic organizer. The test consisted of 30 multiple-choice questions that aligned with the Most Essential Learning Competencies (MELCs) of the Fourth Quarter Science 9 curriculum. The test assessed cognitive learning.

For purposes of ensuring quality content and alignment, the initial test had fifty (50) items. These items were piloted using other sections of Grade 9 class at the same school. The findings from the pilot test informed the improvement of the instrument. Through the process of item analysis, those items that met the highest validity and reliability were selected for use. According to the difficulty and discrimination indices, 20 items were found to be invalid, unreliable, or difficult to answer and were, therefore, deleted. This process resulted in a test consisting of thirty (30) items.

The revised test was subjected to content validation. The test was checked by two science experts and the researcher's thesis adviser to determine whether the items were clear, correct, and relevant. Their inputs were considered for refining the test's structure and content.

The assessment was done twice: once as a pre-test before implementing the developed foldable graphic organizers and the other time as a post-test right after implementation. The testing conditions were standardized for both assessments to control any external factors that could affect the results. Clear test directions were provided and sufficient time was allotted.

Construction, validation, and testing proved the validity and reliability of the instrument used to measure the cognitive learning of the learners.

Questionnaire for Assessment of Affective Learning

The Affective Assessment for Grade 9 Science, presented in Appendix K of the manuscript, was administered to determine the affective learning outcomes of Grade 9 learners in Science following the implementation of Foldable Graphic Organizers. The instrument was developed based on the affective domain of Bloom's Taxonomy, which encompasses five hierarchical levels: Receiving, Responding, Valuing, Organizing, and Characterizing. The questionnaire consists of twenty (20) statements grouped into five (5) domains: (1) Interest and Motivation (Receiving), (2) Active Engagement and Participation (Responding), (3) Positive Attitude and Appreciation toward Science Learning (Valuing), (4) Integration of Scientific Values in Decision-Making (Organizing), and (5) Commitment to Scientific Practices in Daily Life (Characterizing). Each domain includes four (4) indicators designed to measure specific components of learners' affective development. The instrument was adapted and contextualized to capture learners' actual experiences in using Foldable Graphic Organizers as an instructional material in Science, thereby ensuring that the responses reflect the impact of the implementation on learners' affective learning.

A five-point Likert scale was used to measure learners' responses, with the following descriptions: 5 – Strongly Agree, 4 – Agree, 3 – Neutral, 2 – Disagree, and 1 – Strongly Disagree. The instrument was administered after learners had been exposed to the use of Foldable Graphic Organizers. To ensure validity, the questionnaire underwent content validation by science experts, who evaluated the clarity, relevance, and alignment of each item with the research objectives. Necessary revisions were incorporated based on their feedback before the final administration of the instrument. before

Data Gathering Procedure

The data gathering procedures were conducted from January to March 2026. After securing approval from the Schools Division Office of Taguig City and Pateros, the researcher coordinated with the participating school and obtained the necessary informed consent. The Foldable Graphic Organizer instructional materials were developed, validated by experts, revised, and implemented with Grade 9 learners for eight weeks. A pre-test, post-test, and affective learning test were administered to measure learners' performance. The collected data were then tabulated, analyzed, and interpreted with the assistance of a statistician. Finally, the completed manuscript was submitted to the research adviser for review and approval before the final oral defense.

Statistical Treatment

The following statistical tools for the interpretation of the results according to sub-problems were used:

1. Frequency and Percentage Distribution: This statistical tool was used to describe the demographic profile of the respondents and to present the distribution of learners according to proficiency level in the pre-test and post-test.
2. **Weighted Mean** – The weighted mean was used to determine the perceived learning gaps on cognitive and affective learning, the perceived role of Foldable Graphic Organizers in addressing the identified learning gaps, and the acceptability of the developed Foldable Graphic Organizers.
3. **Mean -** The mean was used to determine the average cognitive and affective learning performance of the Grade 9 Science learners before and after the use of Foldable Graphic Organizers. It was also used to describe the average scores in the pre-test and post-test.
4. **Dependent Samples *t*-test** – The Dependent Samples *t*-test was used to determine whether there was a significant difference in the cognitive learning performance of Grade 9 Science learners before and after using Foldable Graphic Organizers.
5. **Mean Difference** – Mean difference was used to determine the amount of change between the learners' pre-test and post-test mean scores in cognitive learning performance. It showed the extent of improvement after the use of Foldable Graphic Organizers.
6. **Ranking Distribution.** Ranking was used to determine the order or priority of the responses for each indicator based on their computed weighted mean or level of agreement. It was also employed to identify the most and predominant indicators in the study.
7. **Cohen's *d*** – Cohen's *d* was used to determine the effect size or magnitude of the difference between the pre-test and post-test scores of the Grade 9 Science learners. While the Dependent Samples *t*-test established whether the improvement was statistically significant, Cohen's *d* described how substantial or meanngful the improvement was in practical terms.

RESULTS AND DISCUSSION

The researcher investigated the effectiveness of these instructional materials across various science disciplines. Specifically, the study examined whether the materials produce different learning outcomes in terms of cognitive and affective learning when applied to science subjects such as Biology, Chemistry, Physics, and Earth Science in Grade 9 Science, as each discipline presents unique concepts and learning demands**.**

As a result, there was a significant impact on cognitive and affective learning in the learner-respondents using the Foldable Graphic Organizer in Science 9.

Profile of the Respondents

The respondents were composed of representatives from five secondary schools in the Division of Taguig City and Pateros, which came out in the non-probability sampling. The selection of the teacher-respondents was made through total enumeration since the total population is small-scale only. A total of sixteen (16) Science experts and thirty-one (31) Science teachers participated in the survey through total enumeration sampling.

To assess and determine the significant difference in their cognitive and affective learning in Grade 9 Science, 79 identified Grade 9 learners who came from 2 sections at Western Bicutan National High School participated in the study. There are 41 learners from Grade 9 - Titanium, and 38 learners from Grade 9 – Aluminum.

SUMMARY

The salient findings of the study are as follows:

On the perceived learning gaps on cognitive and affective learning among Grade 9 Science learners.

The Science teachers evaluated that Grade 9 Science learners had Very Great Significant Gaps in cognitive and affective learning, as shown by the overall weighted mean of 4.34. The highest identified gap was the learners' limited appreciation of the relevance of science concepts to real-life situations with a weighted mean of 4.58, followed by limited critical thinking skills during Science discussions with 4.48, difficulty understanding abstract Science concepts with 4.45, and difficulty connecting prior knowledge to current lessons and interpreting results and making generalizations, both with 4.42. The lowest-rated indicators were learners' difficulty in following step-by-step procedures during activities with a weighted mean of 4.10 and lack of motivation and participation in Science activities with 4.06. However, both were still interpreted as a Great Significant Gap.

On the perceived role of Foldable Graphic Organizers in addressing learning gaps in Grade 9 Science.

The Science teachers strongly agreed on the perceived role of Foldable Graphic Organizers in addressing the learning gaps in Grade 9 Science, as shown by the overall weighted mean of 4.45. The highest-rated indicator was that Foldable Graphic Organizers make Science lessons more enjoyable for learners with a weighted mean of 4.65, followed by promoting positive attitudes in relating science concepts to real-life situations. with 4.58, helping learners simplify complex Science concepts with 4.55, and supporting learners in answering higher-order thinking questions and increasing learners' interest in Science lessons, both with 4.48. The lowest-rated indicators were that Foldable Graphic Organizers promote improving learners' communication of ideas with a weighted mean of 4.29 and enhance learners' problem-solving skills with 4.26. However, both were still interpreted as Strongly Agree.

On the proposed Foldable Graphic Organizers based on the findings.

Based on the identified learning gaps and the perceived role of Foldable Graphic Organizers, the proposed instructional materials were the researcher-developed Foldable Graphic Organizers for Grade 9 Science covering Quarter 1 to Quarter 4 lessons. These materials were mapped according to the learners' cognitive and affective learning needs, particularly in understanding abstract concepts, recalling Science terms, interpreting diagrams and processes, developing critical thinking and problem-solving skills, and relating Science concepts to real-life situations. The proposed Foldable Graphic Organizers covered Grade 9 Science topics in Biology, Chemistry, Earth and Space, and Physics. These included lessons such as Respiratory System, Circulatory System, Healthy Lifestyle, Electronic Structure of Matter, Ionic and Covalent Compounds, Formation of Ions, Volcanoes, Geothermal Energy, Climate, Constellation, Projectile Motion, Momentum and Impulse, Conservation of Momentum, and Conservation of Mechanical Energy.

On the acceptability of Foldable Graphic Organizers in teaching complex Grade 9 Science concepts.

4.1. Objectives. The Foldable Graphic Organizers were assessed as Highly Acceptable in terms of objectives, with a composite mean of 4.84. The objectives were rated highly in terms of alignment with learning

competencies, appropriateness to the lessons, clarity of presentation, and direction of skills and knowledge to be developed.

4.2. Content. The Foldable Graphic Organizers were assessed as Highly Acceptable in terms of content, with a composite mean of 4.77. The content was rated highly in terms of being curriculum-based, clear, logically sequenced, grade-level appropriate, and helpful in communicating Science ideas.

4.3. Activities. The Foldable Graphic Organizers were assessed as Highly Acceptable in terms of activities, with a composite mean of 4.82. The activities were rated highly in terms of alignment with lesson objectives, ease of use, promotion of better understanding, and reinforcement of key Science concepts.

4.4. Usefulness. The Foldable Graphic Organizers were assessed as Highly Acceptable in terms of usefulness, with a composite mean of 4.80. The materials were rated highly in terms of simplifying complex concepts, increasing learners' interest, organizing lesson content, supporting lesson presentation, and promoting study habits.

4.5. Language and Style. The Foldable Graphic Organizers were assessed as Highly Acceptable in terms of language and style, with a composite mean of 4.74. The language and style were rated highly in terms of clarity, appropriateness to Grade 9 learners, suitability for classroom instruction, and appeal to students.

4.6. Organization. The Foldable Graphic Organizers were assessed as Highly Acceptable in terms of organization, with a composite mean of 4.77. The organization was rated highly in terms of ease of use, clear labeling, arrangement of sections, and presentation of relationships between main ideas and details.

4.7. Presentation. The Foldable Graphic Organizers were assessed as Highly Acceptable in terms of presentation, with a composite mean of 4.77. The presentation was rated highly in terms of clarity, visual organization, explanation of processes and relationships, and support for learners' comprehension.

4.8. Evaluation. The Foldable Graphic Organizers were assessed as Highly Acceptable in terms of evaluation, with a composite mean of 4.81. The evaluation component was rated highly in terms of alignment with competencies and objectives, clarity of questions, appropriateness to Grade 9 learners, and promotion of critical thinking.

On the impact of using Foldable Graphic Organizers on cognitive learning among Grade 9 learners.

For cognitive learning, the Grade 9 Science learners obtained a pre-test mean score of 27.5, interpreted as Low. After the use of Foldable Graphic Organizers, their post-test mean score significantly increased to 86.0, interpreted as Closely Approximating Mastery. The Dependent Samples *t*-test revealed a statistically significant difference between the pre-test and post-test scores, with $t = -52.0$ and $p < .001$, leading to the rejection of the null hypothesis. Moreover, Cohen's *d* value of -5.85 indicated an extremely large effect size. These findings show that the use of Foldable Graphic Organizers has a significant and positive impact on the learners' cognitive learning performance.

On the impact of using Foldable Graphic Organizers on affective learning among Grade 9 learners.

For affective learning, the learners strongly agreed that Foldable Graphic Organizers positively supported their affective learning, as reflected by an overall mean of 4.65. Among the affective learning variables, Commitment to Scientific Practices in Daily Life obtained the highest mean of 4.67, followed by Positive Attitude Toward Science Learning and Integration of Scientific Values in Decision-Making, both with a mean of 4.66. This was followed by Interest and Motivation with 4.65, and Engagement and Participation with 4.59. All variables were interpreted as Strongly Agree, indicating that the materials helped enhance learners' commitment, positive attitude, motivation, engagement, and appreciation of Science learning.

CONCLUSIONS

Based on the findings of the study, the following conclusions are drawn:

1. Grade 9 Science learners experience notable cognitive and affective learning gaps, particularly in relating Science concepts to real-life situations, developing critical thinking skills, understanding abstract concepts, connecting prior knowledge to current lessons, and interpreting results and making generalizations.

2. Science teachers recognize the value of Foldable Graphic Organizers in addressing learning gaps, especially in making Science lessons more enjoyable, improving learners' communication of ideas, simplifying complex Science concepts, supporting higher-order thinking, and increasing learners' interest in Science lessons.

3. The proposed Foldable Graphic Organizers are appropriate instructional materials for Grade 9 Science because they were developed based on the identified learning gaps and aligned with the learners' cognitive and affective learning needs across Biology, Chemistry, Earth Science, and Physics lessons.

4. The Foldable Graphic Organizers are highly acceptable in terms of objectives, content, activities, usefulness, language and style, organization, presentation, and evaluation, indicating that the materials were suitable for teaching complex Grade 9 Science concepts.

5. The use of Foldable Graphic Organizers has a significant positive impact on learners' cognitive learning. The learners' cognitive performance improved from Low to Closely Approximating Mastery.

6. The use of Foldable Graphic Organizers has a significant positive impact on learners' affective learning. Their affective responses showed Strong Agreement in learners' commitment, positive attitude, confidence, interest and motivation, engagement, and participation in Science learning.

RECOMMENDATIONS

Based on the findings and conclusions established, the following recommendations are suggested:

1. Science teachers may integrate Foldable Graphic Organizers in teaching Grade 9 Science concepts, especially in lessons that require learners to understand abstract ideas, interpret diagrams and processes, solve problems, connect prior knowledge, and relate concepts to real-life situations.

2. The developed Foldable Graphic Organizers may be used as supplementary instructional materials to improve learners' cognitive learning, particularly in recalling concepts, organizing information, analyzing ideas, interpreting results, and applying Science concepts in different learning tasks.

3. Teachers may use Foldable Graphic Organizers to strengthen learners' affective learning by encouraging interest, motivation, active participation, confidence, appreciation, and positive attitude toward Science lessons.

4. School administrators may support the use of Foldable Graphic Organizers by assisting in material preparation, reproduction, teacher training, and sharing of best practices in using visual and interactive learning tools.

5. The developed Foldable Graphic Organizers may be reviewed and refined based on learners' performance, teachers' observations, and expert feedback to further improve their objectives, content, activities, usefulness, language and style, organization, presentation, and evaluation.

6. Future researchers may conduct similar studies using a larger population, longer implementation period, other grade levels, or other subject areas to further validate the effectiveness of Foldable Graphic Organizers on cognitive and affective learning.

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