

# Story-Based Science Learning Capsules: Its Impact on Scientific Literacy among Grade 7 Science Learners

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## ABSTRACT

### Introduction

The increasing need for learner-centered science education in the 21st century highlights the demand to develop learners who are not only competent but also scientifically literate. Scientific literacy enables learners to understand scientific concepts, think critically, and apply scientific knowledge to real-life situations. However, many Grade 7 learners struggle to fully understand abstract scientific views when presented through traditional teaching approaches and standard instructional materials. This challenge calls for emerging approaches that make science more meaningful and engaging. Among this approach is the use of story-based instructional materials, particularly Story-Based Science Learning Capsules, which incorporate narratives into science lessons to improve comprehension, retention, and interest. By presenting scientific concepts through relatable stories, learners are more likely to build deeper understanding and stronger connections to the subject matter.

This study is rooted in educational policies that emphasize the development of scientific literacy as a key learning outcome, such as the MATATAG Curriculum, better known as the Revised K to 12 Curriculum, which promotes learner-centered and context-based instruction. These policies encourage the use of varied instructional materials to address diverse learning needs and improve learning outcomes. Based on these principles, the intent of this study is to assess the impact of Story-Based Science Learning Capsules as instructional materials on the scientific literacy of Grade 7 Science learners. Particularly, it aims to determine learners' level of scientific literacy before and after exposure to the instructional tool and to evaluate the effectiveness of story-based materials in improving their knowledge of scientific concepts.

The study's significance is based on its potential to provide teachers with an alternative and innovative instructional strategy that enhances both engagement and comprehension in science classes. It benefits curriculum designers in developing more effective and learner-centered instructional materials. Despite the rising interest in interactive and narrative-based teaching approaches, a research gap still exists in the application of story-based learning specifically in science education at the junior high school level, with relation to its direct impact on scientific literacy. The gap in this study is addressed by focusing on the relationship between two major variables: scientific literacy as the learning outcome and instructional materials—specifically Story-Based Science Learning Capsules. By evaluating how these variables interact, the study contributes to the ongoing effort to improve science education through innovative and evidence-based practices.

## LITERATURE-BASED RESEARCH FRAMEWORK

This study is anchored on the Cognitive Theory of Multimedia Learning (CTML) developed by Richard E. Mayer (2001) and further refined in later editions of Multimedia Learning (2009; 2021). The theory explains that learners achieve deeper understanding when information is presented through a combination of words and meaningful visuals rather than through words alone. CTML is based on three key assumptions: learners process information through separate verbal and visual channels, each channel has a limited processing capacity, and meaningful learning occurs when learners actively select, organize, and integrate new information with their existing knowledge.

The principles of CTML support the development and use of Story-Based Science Learning Capsules, which integrate narrative texts, illustrations, diagrams, and guided learning activities to present scientific concepts. The narrative component provides a meaningful and relatable context for learning, while the visual elements help learners organize and retain information more effectively. This instructional design reduces unnecessary cognitive load and promotes active processing, enabling students to develop a deeper understanding of science concepts.

In this study, the Story-Based Science Learning Capsules serve as the instructional material designed according to the principles of the Cognitive Theory of Multimedia Learning. By presenting science lessons through engaging stories supported by relevant visuals and learning tasks, the capsules are expected to enhance learners' comprehension, critical thinking, and scientific literacy. Consequently, the theory provides a strong foundation for examining the effectiveness of Story-Based Science Learning Capsules in improving the scientific literacy of Grade 7 Science learners.

In view of the impact of story-based teaching methods is essential given the significance of scientific literacy and the difficulties encountered by science learners in Grade 7. The purpose of this study is to evaluate how story-based science learning capsules affect grade 7 learners' scientific literacy. The results of this study help science teachers, curriculum designers, and school administrators create creative teaching resources that enhance scientific literacy and encourage meaningful science learning.

While previous studies have explored storytelling, instructional materials, learner engagement, and scientific literacy, limited research has focused on integrating these elements through Story-Based Science Learning Capsules for Grade 7 learners. Thus, the present study aims to develop and assess Story-Based Science Learning Capsules as an instructional material for enhancing scientific literacy within the context of the MATATAG Curriculum.

## METHODOLOGY

### Research Design

This study entitled “Story-Based Science Learning Capsules: Its Impact on Scientific Literacy Among Grade 7 Science Learners”, employed a combination of descriptive and quasi-experimental research designs to be able to investigate both the acceptability and effectiveness of the use of the Story-based Science Learning Capsules in improving the scientific literacy of grade 7 learners. A blended use of these designs allowed the researcher to evaluate the instructional material while also determining its impact on learners' learning outcomes.

Descriptive research design is a technique that aims to give systematic descriptions of phenomena, situations, or groups as they exist John W. Creswell, (2014). This type of research design was used in this study to determine the quality and effectiveness of the Story-Based Science Learning design. Both science teachers and science experts rated the materials in terms of their objectives, content, activities, usefulness, language and style, organization, presentation, and evaluation. The main purpose of this type of research design is to collect as much feedback and recommendations as possible regarding how appropriate, valid, and reliable these instructional materials are.

As part of the developmental phase, the Story-Based Science Learning Capsules underwent a systematic process that included planning, development, validation, revision, and finalization. Initially, the materials were designed based on curriculum competencies and principles of story-based learning. These were then subjected to expert evaluation using a structured questionnaire. The feedback gathered during this stage informed necessary revisions, making sure that the final version of the Story-Based Science Learning Capsules achieves the acceptable standards in terms of content quality, instructional design, and usability.

The assessment of acceptability was conducted using a Likert-scale survey administered to Science teachers and Science experts. The evaluation focused on the criteria, allowing the researcher to determine the level of

acceptability of the Story-Based Learning Capsules. Mean scores and descriptive interpretations were used to analyze the results, providing a clear measure of how well the materials were received by the evaluators.

On the other hand, the study employed a quasi-experimental research design is used to determine the effect of the Story-Based Science Learning Capsules on a group of participants when random assignment is not feasible. In the one-group pretest–posttest design, the same group of learners is assessed before and after the use of the material. The pretest establishes the learners’ baseline level of performance, after which the instructional material is implemented. A posttest is then administered using the same or an equivalent assessment to determine changes in performance. The difference between the pretest and posttest scores provides evidence of whether learners’ performance improved following the intervention. However, because there is no separate control group, changes cannot be attributed to the intervention with the same level of certainty as in a randomized controlled experiment. According to Paul D. Leedy & Jeanne Ellis Ormrod (2015), quasi-experimental design is appropriate in situations where random assignment of participants is not feasible, but the researcher still aims to establish possible cause-and-effect relationships between variables. This design is commonly applied in educational research conducted in natural classroom settings where intact classes are maintained during the implementation process.

In this study, two sections of Grade 7 learners participated in the implementation of the instructional materials; however, both sections were treated as one experimental group for the purpose of analysis. Prior to the implementation of the Story-Based Science Learning Capsules, the respondents were administered a pretest to determine their initial level of scientific literacy. The developed learning capsules were then utilized during the instructional period as the primary instructional material. After the implementation, the same respondents were given a posttest to measure any improvement in their scientific literacy performance. The differences between the pretest and posttest scores were analyzed to determine the effectiveness of the Story-Based Science Learning Capsules as an instructional tool in enhancing learners’ scientific literacy skills.

Furthermore, a separate section of Grade 7 learners was utilized for pilot testing to establish the validity and reliability of the research instruments prior to the actual conduct of the study. The pilot-testing phase enabled the researcher to assess the clarity, appropriateness, consistency, and reliability of the instruments before their administration to the actual respondents. Data gathered during pilot testing were excluded from the final analysis to maintain the integrity and accuracy of the study’s findings.

The integration of these two research designs enabled the study to address both product evaluation through descriptive design and instructional effectiveness through quasi-experimental design. This blended approach provided a more comprehensive understanding of how the Story-Based Science Learning Capsules function not only as a validated instructional material but also as an effective instructional tool in enhancing the scientific literacy of Grade 7 learners.

## **Research Locale and Participants**

The study was conducted in public secondary schools in the Division of Taguig City and Pateros during School Year 2025–2026. The participants included Grade 7 learners, Science teachers, and Science experts who were participated based on the requirements and objectives of the study. The Grade 7 learners of Western Bicutan National High School served as the primary participants in determining the impact of the Story-Based Science Learning Capsules on scientific literacy, while Science teachers and experts provided data on the utilization, acceptability, and evaluation of the instructional materials.

## **Sampling Technique**

The researcher used a combination of developmental and quasi-experimental research approaches. Participants were selected through voluntary response sampling, wherein Grade 7 learners, Science teachers, and Science experts participated based on their willingness and availability to take part in the study. The Grade 7 learners were grouped using intact classes for the quasi-experimental phase, while Science teachers and experts voluntarily participated in the evaluation and validation of the Story-Based Science Learning Capsules.

## Research Instrument

The study used researcher-developed survey questionnaires and a scientific literacy test to gather the data needed to address the research objectives. The instruments were designed to ensure that the items were clear, relevant, and aligned with the study's variables and objectives.

- 1. Survey Questionnaire on the Extent of Utilization and Problems Encountered by Science Teachers.** This instrument aimed to determine how frequently the Grade 7 Science teachers integrated the Story-Based Science Learning Capsules into their teaching, the extent of their utilization, and the problems encountered during their implementation.
- 2. Survey Questionnaire on the Acceptability of the Story-Based Science Learning Capsules.** This instrument aimed to assess the acceptability and suitability of the Story-Based Science Learning Capsules as instructional materials based on objectives, content, activities, usefulness, language and style, organization, presentation, and evaluation.
- 3. Scientific Literacy Test.** This instrument aimed to measure the learners' level of scientific literacy through two major indicators: **(1) Understanding Methods of Inquiry that Lead to Science Knowledge** and **(2) Understanding Investigations that Lead to Science Knowledge**, covering nine scientific literacy skills.

## Data Gathering Procedure

The data gathering process was conducted from November 2025 to March 2026 in a systematic and ethical manner. Necessary permissions were secured from the Division of Taguig City and Pateros and the public secondary schools before administering the validated survey questionnaires. The results guided the development of the Story-Based Science Learning Capsules, which were evaluated by Science teachers and experts based on eight criteria. After validation, a scientific literacy pretest was administered, followed by the implementation of the learning capsules among the Grade 7 learners handled by the researcher. A posttest and feedback survey were then conducted to determine changes in scientific literacy and gather insights on the materials. Finally, all collected data were organized, tabulated, and analyzed using appropriate statistical methods to determine the impact of the Story-Based Science Learning Capsules on learners' scientific literacy. The completed manuscript was submitted to the research adviser for review and approval before the final oral defense.

## Statistical Treatment

The following statistical tools were employed to analyze and interpret the data in relation to the specific sub-problems of the study:

- 1. Frequency.** It was the actual response to a specific item/question in the questionnaire where the respondents tick choices.
- 2. Percentage.** This was used as descriptive statistics that describe a part of a whole.
- 3. Mean Performance Score (MPS)** This was used to determine the performance level of the learners in the pretest and posttest.
- 4. Weighted Mean and Ranking.** The Weighted Mean was a primary descriptive statistical tool employed to determine the central tendency of responses across several key variables in the study: Utilization, Problems Encountered, and Acceptability of Story-Based Science Learning Capsules.
- 5. Paired Samples t – Test.** (McLave, Dietrich and Sinrich, 1999) This was used to measure the degree of difference between the pretest and posttest mean scores of the Grade 7 learners.

## RESULTS AND DISCUSSION

### Profile of the Respondents

The respondents consisted of three groups, (59) Grade 7 learners, (32) Science teachers, and (16) Science experts from five public secondary schools in the Division of Taguig City and Pateros. The study involved voluntary participation sampling was used across all respondent groups. This ensured complete inclusion of available participants and adequate representation where necessary, thereby enhancing the reliability and validity of the findings.

### Summary

The following are the salient findings of the study:

#### 1. On the extent of utilization of Story-Based Science Learning Capsules in teaching Grade 7 Science learners in the Division of Taguig City and Pateros:

The study found that the Story-Based Science Learning Capsules were utilized only to a slight extent by science teachers, suggesting that their integration into science instruction remains limited. Teachers also encountered several challenges in their use, with the most notable being the limited availability of ready-made story-based science learning capsules appropriate for Grade 7 learners.

#### 2. On the problems encountered by science teachers in using Story-Based Science Learning Capsules:

The findings revealed that the most frequently encountered problem was the limited availability of ready-made Story-Based Science Learning Capsules appropriate for Grade 7 learners, which obtained a weighted mean of 3.72 and was verbally interpreted as Often Encountered. Other commonly encountered concerns included difficulty aligning the capsules with learning competencies, learners focusing more on the story than the scientific concepts, and the additional workload required in preparing or adapting story-based instructional materials. Meanwhile, difficulty in assessing learners' understanding when using Story-Based Science Learning Capsules was the least encountered problem, with a weighted mean of 2.59 interpreted as Rarely Encountered.

#### 3. On the proposed Story-Based Science Learning Capsules:

The developed Story-Based Science Learning Capsules were designed as narrative-driven instructional materials intended to simplify complex Grade 7 Science concepts through storytelling, guided activities, visual representations, and inquiry-based tasks. The materials integrated Science topics such as atomic models, matter, measurement, scientific investigation, Life Science, Force, Motion and Energy, and Earth and Space Science concepts. The instructional materials were structured systematically to promote meaningful learning, learner engagement, conceptual understanding, and scientific inquiry.

Furthermore, the developed capsules directly addressed the instructional challenges encountered by Science teachers by providing ready-to-use, competency-aligned, learner-centered, and visually supported instructional resources.

#### 4. On the acceptability of the Story-Based Science Learning Capsules as assessed by science teachers and science experts:

- 4.1. Objectives. The objectives obtained an overall composite mean of 4.85, verbally interpreted as Highly Acceptable.
- 4.2. Content. The content obtained an overall composite mean of 4.80, verbally interpreted as Highly Acceptable.

- 4.3. Activities. The activities obtained an overall composite mean of 4.79, verbally interpreted as Highly Acceptable.
- 4.4. Usefulness. The usefulness of the learning capsules obtained an overall composite mean of 4.84, verbally interpreted as Highly Acceptable.
- 4.5. Language and Style. The language and style obtained an overall composite mean of 4.90, verbally interpreted as Highly Acceptable.
- 4.6. Organization. The organization of the learning capsules obtained an overall composite mean of 4.80, verbally interpreted as Highly Acceptable.
- 4.7. Presentation. The presentation obtained the highest overall composite mean of 4.93, verbally interpreted as Highly Acceptable.
- 4.8. Evaluation. The evaluation component obtained an overall composite mean of 4.87, verbally interpreted as Highly Acceptable.

In summary, the Story-Based Science Learning Capsules obtained an overall composite mean of 4.85, verbally interpreted as Highly Acceptable, indicating that both Science teachers and Science experts perceived the instructional materials as highly suitable and effective for Grade 7 Science instruction.

## **5. On the impact of Story-Based Science Learning Capsules on the scientific literacy of Grade 7 learners:**

The results revealed substantial improvement in the learners' scientific literacy performance after exposure to the Story-Based Science Learning Capsules. In terms of Understanding Methods of Inquiry that Lead to Science Knowledge, the overall mean increased from 37.7, verbally interpreted as Average, to 75.7, interpreted as Moving Towards Mastery. In terms of Organizing, Analyzing, and Interpreting Quantitative Data and Scientific Information, the overall mean increased from 41.2, interpreted as Average, to 75.7, interpreted as Moving Towards Mastery. Overall scientific literacy increased from a pretest mean of 39.4, verbally interpreted as Average, to a posttest mean of 75.7, verbally interpreted as Moving Towards Mastery.

## **6. On the test of significant difference between the pretest and posttest performances of the respondents:**

The findings revealed that there was a statistically significant difference between the pretest and posttest performances of the respondents across all scientific literacy indicators. Understanding Investigations that Lead to Science Knowledge Sub-Indicators obtained a computed test value of -16.2 with a p-value less than 0.001, while Organizing, Analyzing, and Interpreting Quantitative Data and Scientific Information obtained a computed test value of -12.2 with a p-value less than 0.001. Overall Scientific Literacy obtained a computed test value of -15.7 with a p-value of 0.001. Since all computed p-values were less than the 0.05 level of significance, the null hypothesis was rejected, indicating significant improvement in the scientific literacy performance of Grade 7 learners after exposure to the Story-Based Science Learning Capsules.

## **CONCLUSIONS**

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

1. Science teachers frequently utilize Story-Based Science Learning Capsules as part of their instructional practices in teaching Grade 7 Science, particularly in lesson planning, learner engagement, inquiry activities, and concept development.
2. Science teachers encounter instructional and logistical challenges in the implementation of Story-Based Science Learning Capsules, particularly in relation to the availability of ready-made instructional

materials, alignment with learning competencies, learner comprehension differences, and preparation workload.

3. The developed Story-Based Science Learning Capsules serve as learner-centered and competency-aligned instructional materials that effectively integrate storytelling, inquiry-based learning, and scientific concepts to support meaningful Science learning experiences.
4. The Story-Based Science Learning Capsules are highly acceptable to both Science teachers and Science experts in terms of objectives, content, activities, usefulness, language and style, organization, presentation, and evaluation.
5. The use of Story-Based Science Learning Capsules significantly improves the scientific literacy skills of Grade 7 learners, particularly in scientific inquiry, evidence evaluation, quantitative reasoning, data interpretation, and scientific decision-making.
6. There is a significant difference between the pretest and posttest performances of Grade 7 learners, indicating that the Story-Based Science Learning Capsules are effective instructional tool in enhancing learners' scientific literacy competencies.

## RECOMMENDATIONS

Based on the findings and conclusions of the study, the following recommendations are offered:

1. Science teachers may continue integrating Story-Based Science Learning Capsules into Grade 7 Science instruction to promote learner engagement, scientific inquiry, conceptual understanding, and scientific literacy development.
2. Schools and educational administrators may provide additional instructional resources, training, and technical support to assist teachers in the effective development and implementation of story-based instructional materials in Science education.
3. Instructional material developers may further improve and expand the Story-Based Science Learning Capsules by incorporating additional activities, multimedia resources, differentiated tasks, and assessment strategies to address diverse learner needs.
4. Science teachers may utilize story-based instructional approaches not only for classroom discussion but also for assessment and enrichment activities to maximize their instructional effectiveness.
5. Future researchers may conduct similar studies involving larger samples, different grade levels, or other subject areas to further validate the effectiveness of Story-Based Science Learning Capsules in enhancing learners' scientific literacy and academic performance.
6. Future studies may also explore other variables related to story-based instruction, such as learner motivation, engagement, retention, creativity, and critical thinking, to provide a broader understanding of its educational impact.

## REFERENCES

### Numbered References

1. Alshammari, M. (2024). Constructivism in education: Exploring the contributions of Piaget, Vygotsky, and Anastasiou.
2. Anastasiou, P. (2022). Using digital storytelling in science: Meaning making with students aged 10–12 years old (Doctoral dissertation, The Open University). Open Research Online.



3. Archer, L., & DeWitt, J. (2023). Understanding the science capital of early adolescents: Implications for scientific literacy. *Research in Science Education*.
4. Babao, F. J. L., Ordijan, A. P., Pauchano, J. A. B., & Siva, R. F. V. (2024). The use of graphic storytelling in enhancing reading comprehension of Grade Seven learners [Unpublished bachelor's thesis]. Central Philippine University.
5. Baltikian, M., Kärkkäinen, S., & Kukkonen, J. (2024). Assessment of scientific literacy levels among secondary school students in Lebanon: Exploring gender-based differences. *EURASIA Journal of Mathematics, Science and Technology Education*, 20(3), em2407. <https://doi.org/10.29333/ejmste/14279>
6. Babilio, C. R., & Sigua, E. M. S. (2022). Development and validation of multimedia-based instructional module in Science 7. *International Research Journal of Science, Technology, Education, and Management*, 2(1), 152–162. <https://doi.org/10.5281/zenodo.6496847>
7. Batac, K. I. T. (2021). Development and validation of a nature of science-based online course in evolution by natural selection (Master's thesis, De La Salle University). Animo Repository. [https://animorepository.dlsu.edu.ph/etdm\\_scied/9/](https://animorepository.dlsu.edu.ph/etdm_scied/9/)
8. Belisario, J. M., & Paglinawan, J. L. (2025). The relationship between instructional materials availability and student engagement in science. *International Journal of Research and Innovation in Applied Science (IJRIAS)*, 10(5), 263–270. <https://doi.org/10.51584/IJRIAS.2025.100500025>
9. Bilbao, P. P., Corpuz, B. B., Llagas, A. T., & Salandanan, G. G. (2021). *The teaching profession* (3rd ed.). Lorimar Publishing.
10. Bremner, N. (2023). Self-directed learning and student-centred learning: Justificatory narratives and context-appropriate standards. *Research in Education*.
11. Cavalcante, L. S. (2022). *Contação de histórias: Uma forma lúdica de promoção do letramento científico* [Master's dissertation, Universidade de Brasília]. Repositório Institucional da Universidade de Brasília.
12. Cebesoy, U. B. (2021). The effect of teaching science through storytelling on students' academic achievement and opinions about practice. *International Journal of Progress in Education*.
13. Conjunta, G. V., & Conjunta, M. V. (2022). *Exploring children's literature: Reading for knowledge, understanding, and pleasure*. Lorimar Publishing, Inc.
14. Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.
15. Croce, K. A. (2020). *Developing science literacy in the 21st century*. Information Age Publishing.
16. Dela Cruz, K. J. G. (2022). Historical vignettes: An approach to bring back students' interest in science (Master's thesis, De La Salle University). Animo Repository. [https://animorepository.dlsu.edu.ph/etdm\\_scied/27/](https://animorepository.dlsu.edu.ph/etdm_scied/27/)
17. Department of Education. (2016). Policy guidelines on daily lesson preparation for the K to 12 basic education program (DepEd Order No. 42, s. 2016). Department of Education.
18. Department of Education. (2021). General and technical specifications of learning resources (DepEd Memorandum No. 164, s. 2021). Department of Education.
19. Department of Education. (2023, September 8). DepEd Memorandum No. 054, s. 2023: Pilot implementation of the MATATAG curriculum. <https://www.deped.gov.ph/>
20. Department of Education. (2024, July 23). DepEd Order No. 010, s. 2024: Policy guidelines on the implementation of the MATATAG Curriculum.
21. Esguerra, C. T. (2025). Student-crafted digital storytelling (DST) for enhancing STEM students' conceptual understanding of evolution and the origin of biodiversity (Master's thesis, De La Salle University). Animo Repository. [https://animorepository.dlsu.edu.ph/etdm\\_scied/77/](https://animorepository.dlsu.edu.ph/etdm_scied/77/)
22. Falculan, C. F. (2025). Instructional scaffolding strategies, inquiry-based teaching approach and leadership skills among elementary science teachers. *Asia Pacific Journal of Management and Sustainable Development*, 13(1), 56–64. <https://doi.org/10.70979/CXMB7834>
23. Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.
24. Fuchs, H. U., & Dumont, E. (2025). Narrative approaches in science education: From conceptual foundations to gamification. *Chemistry Proceedings*.

25. Gormally, C., Brickman, P., & Lutz, M. (2012). Developing a Test of Scientific Literacy Skills (TOSLS): Measuring undergraduates' evaluation of scientific information and arguments. *CBE—Life Sciences Education*, 11(4), 364–377. <https://doi.org/10.1187/cbe.12-03-0026>
26. Haden, C. A., et al. (2023). Science in stories: Implications for Latine children's science learning through home-based language practices. *Frontiers in Psychology*, 14, 1096833. <https://doi.org/10.3389/fpsyg.2023.1096833>
27. Heryani, R., et al. (2024). Promoting language and scientific literacy through children's literature: A systematic literature review. *Salud, Ciencia y Tecnología*, 4(1), 77–91. <https://dialnet.unirioja.es/servlet/articulo?codigo=9872694>
28. Hougham, R. J. (2020). Science to story, story to social. *Connected Science Learning*.
29. Jiménez-Valverde, G. (2025). Narrative approaches in science education: From conceptual understanding to applications in chemistry and gamification. *Encyclopedia*, 5(3), 116–132.
30. Karakoyun, F., & Alper, A. (2021). Digital storytelling: Developing 21st century skills in science education. *European Journal of Educational Research*.
31. Lederman, N. G., & Lederman, J. S. (2021). Nature of science and scientific inquiry as foundations for scientific literacy. *Journal of Science Teacher Education*.
32. Leedy, P. D., & Ormrod, J. E. (2015). *Practical research: Planning and design* (11th ed.). Pearson.
33. Mayer, R. E. (2023). *Multimedia learning* (3rd ed.). Cambridge University Press.
34. Miller, E. M. (2021). The impact of visual literacy in secondary science education (Master's thesis, Bethel University). Spark Repository.
35. Montebon, D. R. T., & Orleans, A. V. (2021). Contextualized science instruction and learners' attitudes toward science. *Asia Pacific Journal of Management and Sustainable Development*.
36. Osborne, J., & Pimentel, D. (2024). Inquiry-based science education and scientific reasoning development. *Research in Science Education*. <https://www.sciencedirect.com/science/article/abs/pii/S0738059324000257?via%3Dihub>
37. Pavey, A. M. (2020). Science literacy: An undergraduate alternative to traditional introductory science courses (Master's thesis, Ball State University).
38. Rubin, N. T., & Traverro, A. S. (2022). Fostering reading level and story comprehension through MARITES (Marungko Approach Reading Intervention to Elementary Schoolers) with mentor-mentee arrangement. *International Research Journal of Science, Technology, Education, and Management*, 2(3), 18–25. <https://doi.org/10.5281/zenodo.7136494>
39. Santos, M. L. (2023). Story-based instructional materials and their effect on students' scientific literacy (Unpublished master's thesis). University of the Philippines.
40. Usman, A. (2025). Development of Articulate Storyline media based on socioscientific issues to improve science literacy of elementary students (Master's thesis, Surabaya State University).
41. Veneracion, E. V. (2023). Motivation, learning strategies, and academic performance in science among Grade 8 students in the new normal. *Psychology and Education: A Multidisciplinary Journal*, 15(3), 242–259. <https://doi.org/10.5281/zenodo.10171150>
42. Yumang, M. G. C. (2024). Connecting classroom science to social realities: Exploring senior high school students' scientific literacy in the Earth and Life Science course (Master's thesis, De La Salle University). Animo Repository.