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Enhancing the Performance of Grade 8 Learners in Astronomy through Three-Dimensional Instruction

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Abstract — This study aimed to determine the effect of Three-Dimensional Instruction on the Performance of Grade 8 Learners in Astronomy. It was conducted at the Laboratory Schools of University of Rizal System-Morong Campus during the third quarter of Academic Year 2023-2024. The independent variables were the Three-Dimensional Instruction in Astronomy for Grade 8, Science 8 Astronomy topic learning competencies, pretest and posttest, and the Grade 8 learners, while the dependent variable was the level of performance of the learner-respondents. Mean and standard deviation were used to determine the level of performance, and one-sample t-test was used to identify if there was significant difference in the performance of the learners based on the results of the pretest and posttest. The researcher administered a 40-item pretest before the exposure of the selected learner-respondents to the developed material, implemented the Three-Dimensional Instruction in Astronomy for Grade 8 in the audio-visual room, administered an activity related to the material, and administered a 40-item posttest. The results revealed that the level of performance of the learner-respondents increased from Fairly Satisfactory in the pretest to Outstanding in the posttest. The results also showed a significant difference on the level of performance of the respondents since the computed p-values in all learning competencies did not exceed the 0.05 level of significance; thus, the null hypothesis was rejected. Based on the analysis of data collected and results obtained, the implementation of the developed three-dimensional instruction in Astronomy led to a substantial improvement in Grade 8 learners' performance.

Keywords: Three-Dimensional Instruction, Astronomy, Grade 8 Learners, Learner Performance, Pretest, Posttest

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I. INTRODUCTION

Science is the study of all aspects of the physical world. It involves observing natural phenomena, formulating hypotheses, and creating models based on analysis that may lead to unbiased and reliable outcomes. Astronomy, as a branch of science, studies stars, planets, and other objects in outer space. It requires three-dimensional thinking and the use of imagination because many astronomical ideas are represented through visual and nonverbal models. The use of two-dimensional images and three-dimensional models is therefore essential in helping educators provide quality educational experience.

Astronomy in education is an attractive and interesting subject especially to young learners because it deals with humankind's fascination with the mysteries of the vast and unreachable universe. It also draws concepts from mathematics, physics, chemistry, and biology (De Greeve, 2014). In science education, one of the primary goals of the curriculum is to produce science-literate individuals, confirming the relationship between the curriculum and scientific and technological information (Sensoy et al., 2018). In the current age of science and technology, teachers are expected to produce learners who are globally competitive and technologically literate.

The use of technology in teaching and learning is one of the 21st century skills. Integrating technology in education, especially in teaching astronomy and other sciences, could help students become equipped not only with knowledge but also with skills that they need. Boholano et al. (2021) stated that the use of technology to enhance instruction enables learners to be productive and requires educators to be technologically literate. Nueva (2019) also emphasized that technology integration motivates, capacitates, and prepares 21st century learners for the Fourth Industrial Revolution. This direction is supported by Republic Act 10533, which encourages the production and development of locally produced teaching and learning materials aligned with national policies and standards.

The innovative approach of Three-Dimensional Instruction in Astronomy for Grade 8 allows educators to employ practical and visually immersive teaching methods. These methods help students grasp the complex and visual nature of astronomy. Because science courses include various abstract concepts, visualizing these topics through 3D models, 3D-based videos, and presentations can be preferred because they are economical, accessible, safe, and repeatable. Sensoy et al. (2018) noted that tools that help students learn astronomy subjects are essential, particularly when the topics involve complex spatial relations. Modern technologies such as Sky Map, Star Walk 2, Stellarium, 3D pens, 3D models, and videos may also be used to enhance the study of astronomy (Kontopoulou et al., 2020).

In the Laboratory Schools of the University of Rizal System-Morong Campus, it was found that for the last three consecutive school years, the topic on space rocks in Grade 8 Science Astronomy was consistently among the least mastered competencies based on examination results. This may be due to the inadequacy of instructional materials in teaching astronomy. Based on the researcher's experience and observations, science teachers, including the researcher, often resorted to traditional teaching methods and readily available materials such as balls, flashlights, globes, and powder. Learning concepts in astronomy becomes difficult when learners are not provided with materials that captivate their imagination and foster interest in science and exploration.

The researcher was therefore prompted to develop 3D instructional material to teach the lesson with the aim of intensifying learners' curiosity and understanding of topics in science which they find difficult. The developed material could serve as a resource material and facilitate instructional and learning episodes, thereby aiding Grade 8 learners of the Laboratory Schools of the University of Rizal System, Morong Campus in constructing a deeper understanding of the subject matter.

Several studies support the educational use of 3D-based materials. Stereoscopic 3D-Based Lessons use two slightly offset video streams, mimicking how the eyes perceive depth, and are viewed with special glasses to create a realistic 3D effect (Chen et al., 2021). Hruskocy et al. (2015) reported that the use of stereoscopic 3D gives learners an enhanced sense of depth and promotes memorable experiences through 3D technology. Aristeidou and Kameas (2015) stated that 3D visualization is especially valuable in demonstrating concepts related to vast scales, such as astronomy. Suprapto et al. (2018) further stated that 3D modeling using 3D applications is a form of deep learning that can help students develop visuospatial abilities.

Studies on astronomy education also show that learners often experience difficulty and misconceptions in understanding astronomy concepts. Dantic (2023) assessed that higher education students had poor conceptual knowledge of astronomy, while Serttas and Turkolu (2020) reported several astronomy misconceptions among students. Langendorf et al. (2022) attributed some student and student-teacher misconceptions to the way astronomy concepts were taught. Villaran (2023) noted that science teachers face difficulties in teaching scientific concepts, particularly due to the time spent drawing diagrams and the lack of instructional tools. These findings strengthen the need for innovative and visual approaches in teaching astronomy.

The literature reviewed in the study also emphasized the importance of understanding celestial bodies, comets, and meteor showers. Celestial bodies refer to planets, stars, moons, galaxies, space rocks, and other natural objects present in space (Ahmed et al., 2021; Raviv et al., 2021). Comets are icy bodies in planet-crossing orbits that exhibit a coma and sometimes a tail as they approach the Sun. The study of comets provides insight into the formation and evolution of the solar system because they have undergone less alteration compared to planets (Besse, 2015). Meteor showers, on the other hand, occur when Earth crosses debris streams left by comets and other active celestial bodies, offering an opportunity to explore these bodies without direct space visits (Ye et al., 2022).

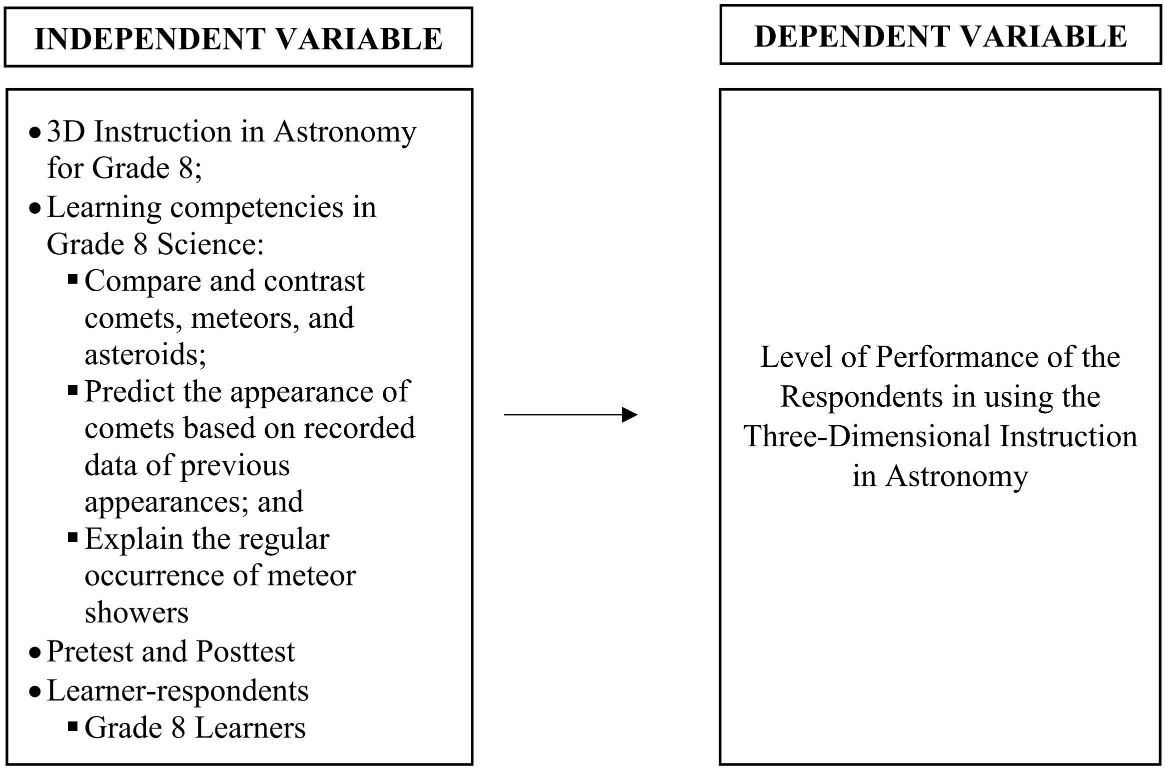

FIGURE 1
CONCEPTUAL MODEL SHOWING THE STUDY ON THE EFFECT OF THREE-DIMENSIONAL INSTRUCTION ON THE PERFORMANCE OF GRADE 8 LEARNERS IN ASTRONOMY

The reviewed studies further pointed out that astronomy holds many misconceptions among students. Serttas (2020) revealed that students commonly misconceive comets as dying stars falling from the sky, showing a misunderstanding of their true characteristics and origins. Senel et al. (2016) also stated that students show interest and motivation in learning astronomy but still experience difficulty in comprehending astronomical concepts. These findings indicate the need to improve the quality of applied teaching activities in astronomy subjects.

Learners' academic performance can be evaluated through indicators such as motivation, student engagement, study habits, learning environment, and the availability of learning resources (Gara, 2023). In the present study, performance was measured using pretest and posttest results. Pretesting served as an initial assessment tool to establish baseline knowledge, while post-test was used after the learning material was studied to determine the extent of learning. The pretest-posttest approach is commonly used in behavioral and educational research to measure change resulting from an intervention (Pan et al., 2021).

This study focused on determining the effect of the developed Three-Dimensional Instruction on the Performance of Grade 8 Learners in Astronomy.

Specifically, it sought to answer the following questions:

1. What is the level of performance of the respondents in Three-Dimensional Instruction in Astronomy, as revealed by pretest and posttest results with respect to:
   1.1. comparing and contrasting comets, meteors, and asteroids;
   1.2. predicting the appearance of comets based on recorded data of previous appearances; and
   1.3. explaining the regular occurrence of meteor showers?
2. Is there a significant difference on the level of performance of the respondents in in Three-Dimensional Instruction in Astronomy as revealed by pretest and posttest results?

The study tested the null hypothesis that there is no significant difference on the level of performance of the respondents in three-dimensional instruction in Astronomy as revealed by pretest and posttest results.

Literature Review

Astronomy Learning and the Need for Visual-Spatial Instruction

Astronomy is a science topic that requires learners to understand objects, movements, positions, distances, and relationships that are often beyond direct classroom observation. Unlike some science topics that can be demonstrated through simple laboratory activities, astronomy frequently depends on models, diagrams, simulations, and visual representations. De Greeve (2014) emphasized that astronomy draws from several fields of science and involves concepts that require imagination and spatial understanding. Sensoy et al. (2018) also pointed out that science education aims to develop scientifically literate learners who can understand scientific and technological information.

In this context, astronomy instruction should not rely only on verbal explanation or static pictures. Learners need teaching materials that can help them visualize space objects and events more clearly. This is especially important for Grade 8 learners because astronomy topics such as comets, meteors, asteroids, and meteor showers involve motion, position, scale, and recurring celestial patterns. Without appropriate visual support, learners may memorize terms without fully understanding how these objects and events are related.

Technology Integration in Science Education

Technology integration has become an important part of science teaching because it allows teachers to present abstract concepts in more concrete and engaging ways. Boholano et al. (2021) stated that technology-enhanced instruction helps learners become more productive and also requires teachers to be technologically literate. Nueva (2019) also emphasized that technology integration helps prepare learners for the demands of the Fourth Industrial Revolution. These ideas support the use of digital and visual materials in science classrooms, especially when the lesson involves concepts that are difficult to observe directly.

The use of technology in teaching astronomy is also aligned with the need for locally developed instructional materials. Republic Act 10533 supports the production and development of teaching and learning materials that are aligned with educational standards. For astronomy instruction, this means that teachers may use available technologies such as astronomy software, simulations, videos, and visual models to improve learners' understanding. The original manuscript specifically mentions tools such as Sky Map, Star Walk 2, Stellarium, 3D pens, 3D models, and videos as possible supports for astronomy teaching.

Three-Dimensional Learning Materials in Astronomy

Three-dimensional learning materials are especially relevant in astronomy because many astronomy concepts require depth perception, spatial reasoning, and mental visualization. Chen et al. (2021) described stereoscopic 3D-based lessons as materials that use two slightly offset visual streams to create a depth effect when viewed with special glasses. Hruskocy et al. (2015) reported that stereoscopic 3D can give learners an enhanced sense of depth and create memorable learning experiences. Aristeidou and Kameas (2015) also explained that 3D visualization is useful in demonstrating concepts that involve vast scales, such as astronomy.

Suprapto et al. (2018) further noted that 3D modeling can help develop learners' visuospatial abilities. This is important because students studying astronomy need to imagine how objects move in space, how celestial bodies differ from one another, and why some events occur regularly. In the present study, the three-dimensional instructional material was designed to target the least mastered Grade 8 astronomy competencies. The developed output used realistic astronomical software such as Solar System Scope, Universe Sandbox, and Stellarium, and it was converted into stereoscopic anaglyph 3D format using red/cyan 3D glasses.

Learners' Difficulties and Misconceptions in Astronomy

Several studies show that learners commonly experience difficulty in understanding astronomy concepts. Dantic (2023) found that students may have poor conceptual knowledge of astronomy. Serttas and Turkolu (2020) also reported several astronomy misconceptions among students, while Langendorf et al. (2022) linked some misconceptions to the way astronomy concepts are taught. Villaran (2023) noted that science teachers may experience difficulty in teaching scientific concepts because of the time needed to prepare diagrams and the lack of appropriate instructional tools.

These findings are important to the present study because the identified Grade 8 astronomy topics require more than simple recall. Learners need to compare and contrast comets, meteors, and asteroids; predict the appearance of comets based on previous records; and explain the regular occurrence of meteor showers. These competencies involve classification, pattern recognition, and conceptual explanation. If learners only receive text-based or lecture-based instruction, misconceptions may remain because the spatial and visual nature of the topic is not fully addressed.

Astronomy Content: Comets, Meteors, Asteroids, and Meteor Showers

The astronomy content of the study focuses on space rocks and related celestial events. Ahmed et al. (2021) and Raviv et al. (2021) described celestial bodies as natural objects found in space, including planets, stars, moons, galaxies, and space rocks. Besse (2015) explained that comets are icy bodies that may develop a coma and tail when they approach the Sun, and that their study helps provide information about the formation and evolution of the solar system. Ye et al. (2022) described meteor showers as events that occur when Earth passes through debris streams left by comets or other active celestial bodies.

These topics are appropriate for three-dimensional instruction because they involve motion, position, appearance, and recurring patterns. For example, understanding a comet's appearance requires learners to connect its position near the Sun with the development of a coma and tail. Understanding meteor showers requires learners to visualize Earth crossing a stream of debris. These ideas are difficult to fully explain through words alone. A three-dimensional material can help learners see relationships among objects and events, making the content more understandable and meaningful.

Learner Performance and Pretest-Posttest Assessment

Learner performance is often influenced by motivation, engagement, study habits, learning environment, and the availability of learning resources. Gara (2023) identified these factors as possible indicators of academic performance. In the present study, learner performance was measured using pretest and posttest results. The pretest established the learners' initial level of understanding before exposure to the instructional material, while the posttest measured their performance after using the developed three-dimensional instruction.

Pan et al. (2021) explained that the pretest-posttest approach is commonly used in educational and behavioral research to measure change after an intervention. This approach is aligned with the purpose of the present study because it aimed to determine whether the use of Three-Dimensional Instruction in Astronomy improved the performance of Grade 8 learners. The original study used a 40-item pretest and posttest based on the Grade 8 astronomy competencies, and the test underwent validation, item analysis, and reliability testing.

Synthesis

The reviewed literature shows that astronomy is a visual and spatial science subject that requires learners to understand objects and events that are often difficult to observe directly. Studies on astronomy education indicate that learners commonly experience misconceptions and poor conceptual understanding, especially when topics are taught mainly through verbal explanation, static images, or limited instructional tools. This problem is directly related to the Grade 8 astronomy competencies covered in the present study, particularly the lessons on comets, meteors, asteroids, and meteor showers.

The literature also shows that technology-supported and three-dimensional learning materials can help address these difficulties by making abstract and spatial concepts more concrete. Studies on stereoscopic 3D, 3D visualization, and 3D modeling support the use of immersive materials in lessons that involve depth, movement, scale, and spatial relationships. Since learner performance can be measured through pretest and posttest results, the reviewed literature provides a clear basis for examining the effect of Three-Dimensional Instruction in Astronomy on Grade 8 learners' performance.

Therefore, the present study is grounded on the idea that three-dimensional instruction can serve as an appropriate visual and technology-supported approach for teaching difficult astronomy topics. By using 3D-based materials aligned with Grade 8 astronomy competencies, the study addresses learners' difficulties in understanding space rocks and related celestial events while also providing a measurable basis for determining improvement in academic performance.

II. METHODOLOGY

The researcher used quasi-experimental method of research given that the aim of the study was to determine the effect of three-dimensional instruction on the performance of Grade 8 learners in Astronomy. Long (2014) explained that quasi-experimental research shares similarities with experimental research by involving manipulation of an independent variable, but differs from experimental research because of the absence of a control group, random selection, random assignment, and/or active manipulation. White and Sabarwal (2014) also stated that this design tests causal hypotheses and is often used when a control group cannot be created or random selection cannot be performed. Based on the nature of the data and information collected and analyzed using pretest and posttest, the researcher determined that a quasi-experimental research design was suited to the study.

The study was conducted at the Laboratory Schools of University of Rizal System-Morong Campus in the province of Rizal. The University of Rizal System operates with the prime mandate of providing instruction, research, extension, and production services to the public. The Laboratory Schools of URS-Morong Campus also offer different science activities such as Science Quiz Bee, Science Poster Making Contest, and Sibol Agham to provide learners with hands-on learning experiences and foster curiosity, critical thinking, and deeper understanding of the natural world.

The respondents of the study were sixty (60) Grade 8 learners of the Laboratory Schools as learner-respondents. In the Laboratory Schools of the University of Rizal System, Morong Campus, class sectioning is determined by students' general weighted averages from the previous academic year. As a result, each section comprises a heterogeneous group of students with diverse academic backgrounds and abilities. In addition, twelve (12) expert-validators composed of science teachers and instructors handling science subjects with astronomy topics from the University of Rizal System-Morong Campus and astronomy experts were selected through purposive sampling.

After the colloquium, the researcher revised the manuscript to secure a permit to conduct the study and proceeded with the development of the Three-Dimensional Instruction in Astronomy for Grade 8. The researcher analyzed the least mastered content areas in Junior High School Astronomy based on previous examination data from the last three years. The identified focus learning areas were the Grade 8 astronomy competencies: compare and contrast comets, meteors, and asteroids; predict the appearance of comets based on recorded data of previous appearances; and explain the regular occurrence of meteor showers.

The researcher developed the three-dimensional instructional materials in astronomy to target the identified least mastered astronomy topics. In developing coherent and suitable lesson content and ideas, the researcher referred to the existing Department of Education curriculum guide for Grade 8 Science and other relevant resources for the identified learning areas. The developed output consisted of two (2) parts of the 3D-insruction in astronomy, designed to cover all learning competencies for the Grade 8 Science astronomy topic. The researcher used realistic astronomical software such as Solar System Scope, Universe Sandbox, and Stellarium. The developed output was converted into stereoscopic anaglyph 3D format using red/cyan 3D glasses. The researcher crafted the 3D glasses using a template from the website 'A Craft A Day' and readily available materials such as cardboard and cellophane.

After the output was developed, it underwent content validation by six (6) science teachers and instructors handling science subjects with astronomy topics and six (6) astronomy experts, for a total of twelve (12) expert-validators. The researcher made modifications to the output based on the suggestions and recommendations of the expert-validators. The researcher then sought approval from the University President, Campus Director, and Principal for the conduct of the study in the Laboratory Schools of University of Rizal System-Morong Campus.

The researcher constructed a Table of Specifications based on the learning competencies of Grade 8 Science in Astronomy and prepared a researcher-made test. The test underwent content validation by a group of experts at URS-Morong Campus, item analysis, and test-retest reliability analysis. Following the item analysis, the researcher modified the test questions, resulting in a forty (40)-item test. The test-retest reliability analysis yielded a reliability coefficient of 0.91, verbally interpreted as Highly Reliable. The test served as both the pretest and posttest administered to the Grade 8 learners.

To test the level of performance of the learner-respondents, the researcher administered the 40-item pretest prior to the exposure of the selected learner-respondents to the developed output. Afterwards, the researcher sought approval to use the audio-visual room for the independent learning process and implementation of the developed Three-Dimensional Instruction in Astronomy for Grade 8. This was followed by an activity related to the developed material. The researcher then administered the 40-item posttest. The collected data were tallied, checked, analyzed, and submitted to the University Statistical Center for statistical treatment. Mean and standard deviation were used to determine the level of performance, while one-sample t-test was used to determine if there was a significant difference on the level of performance based on pretest and posttest results.

III. RESULTS AND DISCUSSION

This section presents the level of performance of the Grade 8 learners in the developed Three-Dimensional Instruction in Astronomy for Grade 8 as revealed by the pretest and posttest results, and the significant difference on their level of performance based on the same results.

Table 1 shows that the posttest results yielded higher average mean scores compared to the pretest results for learners' performance in each learning competency. The first learning competency obtained a pretest mean score of 5.70 with a standard deviation of 1.89, verbally interpreted as Satisfactory. In the posttest, it obtained a mean score of 11.35 with a standard deviation of 1.99, verbally interpreted as Outstanding. The low pretest mean score can be attributed to learners' lack of familiarity with the similarities and comparison of comets, meteors, and asteroids prior to their exposure to the developed material.

TABLE 1
LEVEL OF PERFORMANCE OF THE RESPONDENTS ON THE DEVELOPED THREE-DIMENSIONAL INSTRUCTION IN ASTRONOMY, AS REVEALED BY THE PRETEST AND POSTTEST RESULTS

Learning Competencies	Pretest			Posttest		
	Mean	SD	VI	Mean	SD	VI
1. Compare and contrast comets, meteors, and asteroids	5.70	1.89	Satisfactory	11.35	1.99	Outstanding
2. Predict the appearance of comets based on recorded data of previous appearances	4.85	1.80	Fairly Satisfactory	10.43	1.62	Outstanding
3. Explain the regular occurrence of meteor showers.	4.08	1.78	Fairly Satisfactory	10.33	1.21	Very Satisfactory
Total	**14.63**	**3.59**	**Fairly Satisfactory**	**32.11**	**3.56**	**Outstanding**

The second learning competency obtained a pretest mean score of 4.85 with a standard deviation of 1.80, verbally interpreted as Fairly Satisfactory, and a posttest mean score of 10.43 with a standard deviation of 1.62, verbally interpreted as Outstanding. The third learning competency obtained a pretest mean score of 4.08 with a standard deviation of 1.78, verbally interpreted as Fairly Satisfactory, and a posttest mean score of 10.33 with a standard deviation of 1.21, verbally interpreted as Very Satisfactory. This was made possible through the immersive and educational utilization of the developed material, leading to a positive effect on enhancing learners' understanding of the regular occurrence of meteor showers.

In summary, the results showed improvement in the level of performance of the respondents in each learning competency. The total mean score increased from 14.63 with a standard deviation of 3.59, interpreted as Fairly Satisfactory, to 32.11 with a standard deviation of 3.56, interpreted as Outstanding. The results of the study showed that the Grade 8 respondents from the Laboratory Schools of the University of Rizal System-Morong Campus benefited from the developed three-dimensional instruction in Astronomy for Grade 8. The findings also demonstrated that the output effectively fulfilled the learning competencies for Grade 8 Science in Astronomy topics.

Based on Table 2, it was statistically found out that there is a significant difference on the level of performance of Grade 8 learners on the learning competencies: compare and contrast comets, meteors, and asteroids; predict the appearance of comets based on recorded data of previous appearances; and explain the regular occurrence of meteor showers. The obtained p-value of .000 did not exceed the .05 level of significance. Thus, the null hypothesis was rejected. This reveals that the Grade 8 learners' posttest scores were significantly higher than their pretest scores.

TABLE 2
SIGNIFICANT DIFFERENCE ON THE LEVEL OF PERFORMANCE OF THE RESPONDENTS ON THE DEVELOPED THREE-DIMENSIONAL INSTRUCTION IN ASTRONOMY, AS REVEALED BY THE PRETEST AND POSTTEST RESULTS

Learning Competencies		Mean	SD	Mean Diff	t	df	p-value	HO	VI
1. Compare and contrast comets, meteors, and asteroids	Pretest	5.70	1.89	4.650	18.418	59	.000	R	S
	Posttest	11.35	1.99						
2. Predict the appearance of comets based on recorded data of	Pretest	4.85	1.80	4.350	19.528	59	.000	R	S
	Posttest	10.43	1.62						

previous appearances									
3. Explain the regular occurrence of meteor showers	Pretest	4.08	1.78	4.350	20.745	59	.000	R	S
	Posttest	10.33	1.21						
Total	**Pretest**	**14.63**	**3.59**	**13.350**	**40.447**	**59**	**.000**	**R**	**S**
	Posttest	**32.11**	**3.56**						

Beyond the advantageous interactive elements inherent in the developed three-dimensional instruction in astronomy, students' engagement with its comprehensive content significantly deepened their understanding of the subject matter. This underscores the pivotal role of immersive learning experiences in achieving the desired learning goals and validates the effect of 3D-based instructional methods. With the immersive and educational utilization of the developed material, students were able to grasp the fundamentals and acquire insights into the nuances of the subject matter.

The observed improvement in results after the respondents were exposed to the developed Three-Dimensional Instruction in Astronomy for Grade 8 confirmed that it offers a dynamic and effective method that can enhance learners' learning experiences by providing immersive, interactive, and engaging visual complex concepts of astronomy and multimedia elements. This is supported by De Greeve (2014), who stated that one effective way to teach science subjects like astronomy is through the use of three-dimensional materials as an aid to instruction because astronomy includes visual topics about relationships among objects in space that require wider imagination.

Abykanova et al. (2016) also stated that the implementation of technologies improves and facilitates astronomy classes by using modern visual aids, since it is difficult for students to understand astronomical processes and concepts using traditional visual aids. Tanjung et al. (2023)

further noted that 3D-based learning materials attracted attention, increased learning interest, motivated students, and looked attractive. In connection with these studies, the present findings indicate that the use of 3D-Based Lessons in Astronomy for Grade 8 positively contributed to the improvement of learners' performance in the identified Grade 8 astronomy competencies.

IV. CONCLUSION

Based on the findings of the study, the implementation of the developed Three-Dimensional Instruction in Astronomy for Grade 8 successfully achieved the learning competencies for Grade 8 Science in Astronomy topics, leading to a substantial improvement in learners' performance.

Based on Mayer's Multimedia Learning, the developed material effectively used multimedia elements for engaging and immersive presentation. The significant impact on improving Grade 8 learners' performance was evidenced by the pretest and posttest results.

V. RECOMMENDATIONS

1. The developed Three-Dimensional Instruction in Astronomy for Grade 8 may further be evaluated by science teachers so that it can be used as an instructional material in teaching astronomy topics to Junior High School learners.

2. The Three-Dimensional Instruction in Astronomy for Grade 8 may be registered and patented to safeguard the researcher's proprietary rights to the study.

3. An extensive Three-Dimensional Instruction in Astronomy could be developed to cover the entire focus content of astronomy in the Junior High School.

4. Future researchers may conduct a parallel study utilizing the same methods to develop 3D materials in other fields of science and to improve the features of the developed output and utilized 3D glasses designed for visually impaired individuals.

REFERENCES

[1.] Abykanova, B., Nugumanova, S., Yelezhanova, S., Kabylkhamit, Z., & Sabirova, Z. (2016). The use of interactive learning technology in institutions of higher learning. *International Journal of Environmental & Science Education, 11*(18), 12528–12539. https://files.eric.ed.gov/fulltext/EJ1124626.pdf

[2.] Ahmed, F. O. M., & Kurnaz, M. A. (2021). Determining students' mental models about the Sun, Earth, and Moon celestial objects for sustainable learning in astronomy education in Libya. *African Educational Research Journal, 9*(3), 825–832. https://doi.org/10.30918/AERJ.93.21.091

[3.] Aristeidou, M., & Kameas, A. (2015). Building technology and science experiences in 3D virtual world. *Procedia Computer Science, 65*, 259–268. https://doi.org/10.1016/j.procs.2015.09.075

[4.] Besse, G., Mousis, O., Ali-Dib, M., Hoefner, S., Koschny, D., & Hager, P. (2015). On the evolution of comets. *Space Science Reviews, 197*, 271–296. https://doi.org/10.1007/s11214-015-0148-9

[5.] Boholano, H. B., Cajes, R. C., & Boholano, G. S. (2021). Technology based teaching and learning in junior high school. *Research in Pedagogy, 11*(1), 98–107. http://research.rs/wp-content/uploads/2021/06/2217-7337_v11_n01_p098.pdf

[6.] Chen, S. Y., Chu, H. C., & Chen, Y. S. (2021). A review of the literature on the educational effects of 3D stereoscopic displays. *Computers & Education, 161*, Article 104077. https://doi.org/10.1016/j.compedu.2020.104077

[7.] Dantic, M. P. (2023). Development and validation of instructional material in astronomy. *International Journal of Multidisciplinary: Applied Business and Education Research, 4*(1). https://doi.org/10.11594/ijmaber.04.01.03

[8.] De Greve, J. P. (2014). Challenges in astronomy education. *Proceedings of the International Astronomical Union, 5*, 642–667. https://doi.org/10.1017/S1743921310010884

[9.] Department of Education. (2016). *K to 12 basic education curriculum: Science curriculum guide*. https://www.deped.gov.ph/wp-content/uploads/2019/01/Science-CG_with-tagged-sci-equipment_revised.pdf

[10.] Gara, N. M. R., & Cruz, N. F. M. F. D. (2023). Academic performance of Grade 8 learners in science during face-to-face class at General Emilio Aguinaldo National High School. *World Journal of Advanced Research and Reviews, 19*(1), 563–579. https://doi.org/10.30574/wjarr.2023.19.1.1367

[11.] Hruskocy, C., & Foster, S. (2015). Now in 3D: Teaching and learning. https://www.researchgate.net/publication/277732080_Now_in_3D_-_Teaching_and_Learning

[12.] Kontopoulou, M. T., & Drigas, A. (2020). Natural sciences teaching by using ICTs to individuals with special educational needs. *International Journal of Management and Humanities*. https://doi.org/10.35940/ijmh.A1129.125420

[13.] Langendorf, R., Schneider, S., & Hessman, F. V. (2022). Learning and teaching astronomy with digital tools promotes pre-service physics teachers' digital competencies. *Astronomy Education Journal, 2*(1). https://doi.org/10.32374/AEJ.2022.2.1.021bp

[14.] Long, R. L. (2014). *A quasi-experimental control group design study to determine the effect of integrating character education into a high school social studies curriculum through storytelling*. https://core.ac.uk/display/58825598

[15.] Mayer, R. E. (2020). *Multimedia learning* (3rd ed.). Cambridge University Press. https://doi.org/10.1017/9781316941355

[16.] Nueva, M. G. C. (2019). A literature on the current technology in education: An examination of teachers' use of technology and its association to digital inequality in school. https://www.dlsu.edu.ph/wp-content/uploads/pdf/conferences/arts-congress-proceedings/2019/CP-04.pdf

[17.] Pan, S. C., & Sana, F. (2021). Pretesting versus posttesting: Comparing the pedagogical benefits of errorful generation and retrieval practice. *Journal of Experimental Psychology: Applied*. https://doi.org/10.1037/xap0000345

[18.] Raviv, A., & Dadon, M. (2021). Teaching astronomy in kindergarten: Children's perceptions and projects. *Athens Journal of Education, 8*(3), 305–328. https://www.athensjournals.gr/education/2021-8-3-4-Raviv.pdf

[19.] Republic Act No. 10533. (2013). *Enhanced Basic Education Act of 2013*. Official Gazette of the Republic of the Philippines. https://www.officialgazette.gov.ph/2013/05/15/republic-act-no-10533/

[20.] Senel, T., & Çepni, S. (2016). Effects of the enriched 5E model on students' conceptual change: Astronomy sample. *Kastamonu Education Journal, 24*(4), 1785–1803. https://dergipark.org.tr/tr/pub/kefdergi/issue/27734/327561

[21.] Sensoy, O., & Yildirim, H. I. (2018). The effect of technological pedagogical content knowledge based training programs used in astronomy classes on the success levels of science teacher candidates. https://files.eric.ed.gov/fulltext/EJ1181201.pdf

[22.] Serttas, S., & Türkoglu, A. Y. (2020). Diagnosing students' misconceptions of astronomy through concept cartoons. *Participatory Educational Research, 7*(2), 164–182. https://doi.org/10.17275/per.20.27.7.2

[23.] Suprapto, P. K., Bin Ahmad, M. Z., Chaidir, D. M., Ardiansyah, R., & Diella, D. (2018). Spatial intelligence and students' achievement to support creativity on visuospatial-based learning. *Jurnal Pendidikan IPA Indonesia, 7*(2), 224–231. https://journal.unnes.ac.id/nju/index.php/jpii/article/view/14322

[24.] Tanjung, F., Ampera, S., Sitompul, H., & Jahidin, I. (2023). Development of 3D-based learning modules for university students. *International Journal of Education in Mathematics, Science and Technology*. https://doi.org/10.46328/ijemst.2715

[25.] Villaran, R. (2023). Factors affecting the performance in science of Grade Six pupils in Sta. Cruz Elementary School. https://ejournals.ph/article.php?id=21412

[26.] White, H., & Sabarwal, S. (2014). *Quasi-experimental design and methods*. Methodological Briefs: Impact Evaluation 8. UNICEF Office of Research. https://www.unicef-irc.org/KM/IE/img/downloads/Quasi-Experimental_Design_and_Methods_ENG.pdf

[27.] Ye, Q., & Jenniskens, P. (2022). Comets and meteor showers. *arXiv*. https://doi.org/10.48550/arXiv.2209.10654