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Research Article

PARABOLIC INSTRUCTIONAL DEVICE: IT'S EFFECTIVENESS IN TEACHING CONCEPTS OF PROJECTILE MOTION

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Abstract

The study constructed and developed Parabolic Instructional Device in Teaching Concept of Projectile Motion in Physics and determined the acceptability and its effectiveness on the performance of learners. The study utilized Research and Development, Quasi-experimental and Descriptive-comparative Research Design. The statistical tools used in the study were average weighted mean, standard deviation, Cohens' d effect and T-test for dependent and independent sample. The data gathered from validation sheets were treated statistically through average weighted mean and were discussed qualitatively.

Keywords: Parabolic Instructional Device, Effectiveness, Projectile Motion.

INTRODUCTION

Education enriches people's understanding of themselves and the world. It improves the quality of their lives and leads to broad social benefits for individuals and society. Education raises people's productivity and creativity and promotes entrepreneurship and technological advances. It plays a very crucial role in securing economic and social progress and improving income distribution. The growth of technology in the twenty-first century drives the use of internet resources in education. Learning subject matter with technology is different from learning to teach that subject matter with technology. Ascension into the twenty-first century brings new set of tools, communication, information and work that is unique and different. Given this shift, education must turn to incorporate computer-based and electronic technologies that integrates learning within the context of the academic subject areas. One of the challenges that school face in terms of learning is to develop critical thinking skills among students especially, in science education. However, it is difficult to teach because it is composed of variety of skills. These skills include, for example, identifying assumptions, identifying and dealing with equivocation, making value judgments, analyzing arguments, asking and answering questions of clarification and/or challenge, judging the credibility of a source, and so on. In addition, twenty first century students have unique learning preferences. The idea of personalizing instruction has led some educators to recommend a blended learning environment which use technology in the teaching-learning process (Ozdamli, 2016). The K to 12 Program in Philippine Educational System covers Kindergarten and 12 years of basic education that provides sufficient time for mastery of concepts and skills, develop lifelong learners, and prepare graduates for tertiary education, middle-level skills development, employment, and entrepreneurship. In the 2018 Program for International Student Assessment conducted by the Organization for Economic Co-operation and Development, the Philippines ranked dead last in all three areas of assessment Reading, Mathematics, and Science.

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It shows that the quality of a nation's educational system cannot be fully attributed to how much it spends on its students. The Department of Education implemented the Sulong Edukalidad: Addressing the Challenge of Quality Basic Education under the DepEd Memorandum no. 166, s. 2019:

The result of the Programme for International Student Assessment (PISA) as emphasized by the Department of Education Secretary in her message reveals that Philippines is the last in terms of reading and near the least terms of science and mathematics. Such draw us to concrete our efforts to intervention for quality education.

The Four Pillars of Sulong Edukalidad were as follows: Curriculum review, Improving the learning environment, Teacher's upskilling and reskilling, and Engagement of stakeholders for support and collaboration. The third pillar further suggest that they want the teachers to absorb, to be able to innovate and be adaptive to the changing times.

As we need to comply with the implementation of K to 12 Basic Education Curriculum as stipulated in the Republic Act 10533 also known as Enhance Basic Education Act of 2013 using the spiral approaches in teaching. In its declaration of policy, it states:

…every graduate of basic education shall be an empowered individual who has learned through a program that is rooted on sound education principles and geared towards excellence, the foundations for learning throughout life, the competence to engage in work and be productive, the ability to coexist in fruitful harmony with local and global communities, the capability to engage in autonomous , creative and critical thinking skills, and the capacity and willingness to transform others and one's self.

This law ensures that learning is meaningful for the learners, by promoting that the curriculum is learner-centered, relevant, responsive, and research-based. It also recommends the application of pedagogical strategies that are constructivist, inquiry-based, collaborative and integrative. One of these

strategies is a Problem Based Learning (PBL). This strategy demonstrates a learner centered instruction, allowing the students to solve real life problems, permits them to collaborate with their classmate and develop critical thinking skill. Science is practiced and taught in a language—English—that is not easily comprehended by many Filipinos, contributing to the discipline being perceived as overly complicated. As such, even those who finish their schooling may not fully appreciate Science and the principles it attempts to instill (Banastao, 2019). Science outreach, after all, has tended to be directed to those already with resources, rather than pervading the sectors needing greater exposure to the field. Science education has encountered numerous challenges, including a lack of resources for teaching and learning, time management, a lack of material understanding, students' failure to understand the lessons presented, and a lack of enthusiasm for science among students. It is coming to light that the current public education system is not effectively equipping Filipino students with the skills and knowledge requirements of their age.

There is evidence that well-designed and developmentally appropriate devices, software and other digital resources can have a positive impact on young children's learning, provided that they are strategically integrated into meaningful learning activities (Delos Reyes, 2018). As young people and children are now growing in a technology-rich environment, they are already familiar with and use electronic devices daily to learn. Educational resources, including devices, assist teachers in simplifying difficult subjects so that learners effectively understand the fundamentals. Many students in high school and college careers include physics as a scientific requirement and a steppingstone to solving problems in other fascinating subjects. Physics is excellent preparation for almost any career because it teaches students how to analyze complex problems and provides them with a strong quantitative foundation that can be applied to any technical field. *Projectile motion* is a key part of classical physics, dealing with the motion of projectiles under the effect of gravity. The object is called a projectile, and its path is called its trajectory. As an object travels through the air, it encounters a frictional force that slows its motion called air resistance. Air resistance does significantly alter trajectory motion, but due to the difficulty in the calculation, it is ignored in introductory physics. There are a couple of elements that students need to understand well to get the idea of projectile motion. Most of learners starts by memorizing different equations and problems encountering two-dimensional motion that leads to confusion about horizontal and vertical motion. The separation of the notion of acceleration from the notion of velocity also contributes to the confusion of learners. As a result, the learners develop their own misconceptions and personal theories of projectile motion by generalizing the ideas they acquire from observation of object in everyday situations (Urone, 2020).

Instructional Device

It is a must to undergo certain development in the education system. A slow, evolutional change wherein the traditional means of teaching must be altered into technology- based. Such alterations in teaching would be the integration of technology to day-to-day lessons inside the academe. With this, the retention of knowledge of the students will grow. In this era, where technology is widely known and used by most people which actually helps in their daily living, it is indeed advantageous if this will be integrated to teaching. Interactive learning is advantageous as it helps establish a friendly atmosphere among the participants and have them connect with each other as stated by Bakytgul *et al.* (2016). It helps boost learner self-reliance and self-assurance, helps the instructor to encourage students towards working together, enables learners to overcome the fear of a language barrier, helps mitigate authoritarian teacher rule, keeps everyone engaged in activity, assists low-achieving students, and has participants make an active and continual use of the knowledge and experience gained earlier (Klarin, 2000).

According to Adan (2019), an Instructional material is a device developed or acquired to assist or facilitate teachers in transmitting, organized knowledge, skills and attitude to the learners within an instructional situation. It is an indispensable tool in the teaching and learning process. Learners learned best if teachers present materials for active learning. Inadequate use or lack of instructional materials negates the objective of teaching. Moreover, it is also observed that participation of learners and their performances in classroom is affected, if it does not totally depend, on the use of instructional materials. Additionally to the study of Hill (2024), Instructional materials act as an intermediate between the instructor and learners. They could also serve as impetus for the process of teaching and learning. It is used to capture the attention of learners to avert monotony. Teaching requires the use of instructional materials, which are especially crucial for new instructors. All facets of teaching are dependent upon instructional resources for teachers. For background knowledge on the subject they are teaching, they require resources. When they first start teaching, young educators typically do not have a wealth of experience to draw from. When planning lessons, teachers frequently employ instructional materials. It has been noted that using instructional materials effectively can lead to both teaching and learning. The successful use of sufficient and high-quality teaching resources in the classroom can demonstrate the value of these resources for both teaching and learning according to Tety (2016). Teachers use instructional materials as a strategic tool for planning and delivering instruction. This is because, in the absence of instructional materials, they enable the teacher to clarify an idea. This makes learning more comfortable for the pupils, which improves their academic achievement.

Learner's Proficiency Level

In an actual classroom environment, technology was used as methodology, content, and platform to manage classes hence, an individual learner is drawn in by the stimulating engagement across the pillars of the classroom. Technology in the classroom not only gives students a boost of motivation and energy, but it also encourages active learning, which is an important pedagogical objective. The equitable, pertinent, and demanding learning opportunities that proficiency-based learning can offer can engage all students and help them develop the work habits, knowledge, and abilities needed to succeed in the twenty-first century according to Fitzsimmons (2017). Learners are living in a globalized environment where instantaneous worldwide communication and fast access to knowledge are made possible by technology. In response to this dynamic world, today's educational institutions offer learning possibilities that necessitate good communication, innovative problem-solving, both in-person and virtual collaboration, and the application of critical thinking abilities.

According to Corte (2018), many challenges, including educating students for lifelong learning, growing the number of graduates, and adapting to larger and more homogeneous student populations, are facing higher education globally. Improving the learning proficiency of learners can significantly aid in resolving each of these pressing issues. Higher levels of proficiency facilitate a deeper understanding of concepts and improve the application of information. In their professional or academic domains, this results in improved performance and knowledge. As stated by Reyes (2019), highly proficient learners possess the ability to operate autonomously and efficiently control their learning procedures. As learners gain more expertise, they frequently find the topic to be more interesting and stimulating. This autonomy can result in more individualized and effective learning experiences. A more pleasurable and effective learning environment may result from this more participation. In general, raising proficiency levels can have a big impact on a learner's job advancement, personal development, and academic performance.

The study of Khasawneh (2023) indicates that instructional devices have an opportunity to improve student engagement, as demonstrated by the high levels of student participation and collaboration. Teachers often have high regard for educational gadgets because they recognize how well they may support students' self-directed learning. Variability in the results and attitudes toward the usage of educational devices across various educational levels highlights the need for customized approaches. The favorable transmit information shown between students' opinions on mobile learning and their subsequent academic success further emphasized the importance of students' attitudes in predicting academic achievements.

On the other hand, the study of Ross (2018) utilize an educational device in mathematics. He pointed out the positive effect of mathematical manipulative materials on third grade students' participation, engagement, and academic performance. Using technology to teach mathematics has several advantages, such as encouraging cycles of proof, illustrating mathematical ideas through real-world scenarios, cutting down on time spent on laborious computations, sharpening students' attention to key concepts, and presenting math in ways that make sense to students. Findings revealed that the students' academic performance increased after using manipulatives in mathematics. The concept of Geometry in Mathematics has it's applications cutting across all facets of daily life activities, and in spite of the numerous merits of geometry to the learners, there has been a constant decline in the achievement of student in the concept. The study of Iji et. al (2014) revealed the effect of the educational device on students' achievement in Geometry at the Upper Basic Education level. The study concluded that the students taught with the instructional materials in Geometry improved in their geometry achievement as compared to the control group. Similarly, Cruz (2017) revealed that the use of multi-sensory instructional device experienced a greater amount of learning and was found effective in enhancing the Grade 10 Mathematics competencies. The study utilize multisensory teaching approaches thru multi-sensory instructional device inGrade 10 Mathematics that involves the use different senses, such as sight, sound, touch, and movement to engage students in learning. Multisensory instruction strategies and methods in Grade 10 Mathematics increase learning by engaging students on multiple levels. By doing consequently, different techniques support students in creating deeper connections with the content, which improves accessibility and memorability.

Acceptability of Instructional Device

Generally, developed instructional materials can be classified as primary and secondary aids and outlines used in effective teaching and learning. Hence, it is the ability of the teachers to ensure the quality, acceptability, and appropriateness upon utilizing the developed instructional material. Instructional materials may guide the learners to acquire more information so as to bring the appreciation on the topic being delivered according to Portana (2021). A crucial component of the teaching and learning process is the instructional material. Instructional materials are vital because they prevent rote learning and recitation, which can quickly take over a session and become very important to both the teacher and the students. Instructional Materials such as devices that are acceptable are essential in capturing the interest and make possible enhancement of students learning experiences. Teachers can devise their own instructional materials if it follow some criteria in the design and construction as embedded in Article XIV, section 5 of the 1987 Philippine Constitution. It can serve as an effective medium in the teaching and learning process according to Cruz (2017). Using instructional resources, such as devices, to teach physics increases students' motivation to study and facilitates the process of assimilation and memorizing of the subject according to Adan (2019). Additionally, it aids in maintaining the student's focus. It offers instructors and students of physics a relevant and valuable source of information.

The study of Banastao *et al.* (2019) founds that interactive instructional materials such as instructional device in Mechanics caters the needs of the students to experience learning firsthand. The study undergone a process and validation and found that the instructional device effectively bridges the learning gap and the attitude of learners' positive perceptiveness in analyzing the basic science concepts that are important in the different fields of physics particularly in Mechanics. Similar study of Flores *et al.* (2017) adduced that construction and use of Interactive Instructional Device are necessary to reinforce and teach scientific concept particularly in Gas Laws. The instructional device in Gas Law undergone prior evaluation from the experts and science teachers to ensure the quality and validity before the utilization to the classroom settings. According to the study, the use of instructional device that incorporates experiential learning for students allows them to actively participate in the teaching-learning process and successfully manage it.

The study of Abaño *et al.* (2017) found that the constructed instructional device about Free-falling bodies successfully simulates the interactive mechanism of a freely-falling object . The free falling device was evaluated by panel of experts and instructors and found to be acceptable in demonstrating the idea of free-falling bodies. The instructional device was utilize by the students in an actual classroom and found that there is significant difference on the use of device in contrast with traditional learning activities. The instructional device developed effectively help the learners to understand and grasp the concept of Motion and effect of gravity to certain falling object. Adding depth to the understanding of acceptability of instructional device, Aberos *et al.* (2016) also designed an

interactive instructional material on Acceleration Instructional Device for Secondary Science as an aid in teaching-learning process. The device demonstrates a simulation that determines the acceleration of a moving object or in motion. The device priorly undergoes a validation from the experts and science instructors before the utilization in an actual classroom setting. Based on the findings, it was found out that the Acceleration Instructional Device for Secondary Science as an aid in teaching-learning process is acceptable and it can be used as an interactive instructional device in teaching physics. It is essential to evaluate and assess instructional materials such as devices . Evaluating the effectiveness of an instructional device helps in determining whether the desired learning outcomes are achieved. It guarantees that the tool will help learners comprehend and remember the content. Additionally, it enables teachers to determine whether the device is suitable for a range of students, including those with different learning styles, special needs, and prior knowledge levels.

RESEARCH METHODOLOGY

This study employed a combination of research and development, quasi-experimental design, descriptive and comparative methods to comprehensively determine the processes involved in the construction of instructional device, the acceptability and its effectiveness to learners. Research and Development method was employed and played a vital role in the development of Parabolic Instructional Device. This involves planning and design, construction, try-outs and validation, revision and evaluation of the instructional device. By utilizing the R&D method, the study sought to assess the preparation and construction Parabolic Instructional Device. The quasi-experimental design was used in the try-out phase of the study to determine the effectiveness of using Parabolic Instructional Device to learners. The pre-test and post-test were administered to both experimental and control classes to compare, analyze, and measure the learner's learning extent and improve strategies in specific least learned competencies in science. The descriptive method was used to describe the proficiency of learners in pre-test and post-test on the topic Projectile Motion, the processes involved in the construction of Parabolic Instructional Device, and the experts' and teachers' evaluation. The comparative method was used to compare the performance of the learners by getting the difference of the scores in pre-tests and post-tests. It was also used to compare the proficiency of control and experimental classes on the topic Projectile Motion.

RESULTS AND DISCUSSION

Proficiency level in pre-test of control and experimental class of School Year 2022-2023 and School Year 2023-2024 on the topic Projectile Motion was determined. Table 1 presents the data on the result of Proficiency Level of learners of School Year 2022 to 2024 and revealed that the computed value for School Year 2022-2023 of the control class was 19.08% and the experimental class was 20.67%. On the other hand, the computed value for School Year 2023-2024 of the control class was 13.33% and the experimental class was 17.11%. Both classes of School Year 2022 to 2024 had a verbal interpretation of Beginning. Parabolic Instructional Device were evaluated by Ten (10) Panel of Experts and Instructors with emphasis on the features of Instructional device as simulation and manipulative. Table 2 and 3 presents the data on the manipulative and simulation features of Parabolic Instructional Device based from the expert's evaluation. The manipulative features of Parabolic Instructional device had a weighted mean of 4.56 while the simulation features had 4.60. Parabolic Instructional Device were also evaluated by Ten (10) teachers from the field of Science and Technology with emphasis on the indicators along on its Functionality, Accuracy, Durability, and Safety. Table 4 to 7 presents the data and evaluation of Science Teachers on the Parabolic Instructional Device. Based from the table, the Functionality had a weighted mean of 4.30; the Accuracy had a weighted mean of 3.72 ; the Durability had a weighted mean of 3.74 ; and Safety had a weighted mean of 3.89. Proficiency level was computed to determine the proficiency level in post-test of control and experimental class from School Year 2022-2023 and School Year 2023-2024. Table 8 shows the performance level post-test result for School Year 2022-2023 of the Control and Experimental class. Based from the table, it was inferred that for School Year 2022-2023 the control class had a computed post-test result value of 43.22% while the experimental class had 70.67%. While for School Year 2023-2024 the control class had computed post-test result value of 45.51% and the experimental class had 70.67%.

The difference between the pre-test and post-test means result of both control and experimental classes from School Year : 2022-2023 and School Year: 2023-2024 were computed to determine the significant difference on the student's performance on the topic Projectile Motion. Table 9 and 10 presents the pre-test and post-test result for School Year 2022-2023. Based from table 9, the computed t- value of control class and experimental class in pre-test was 1.1211 lesser than tabular value of 1.6715. Table 10 revealed that the post-test computed t-value was 13.035 greater than the tabular value of 1.6715 based both on 58 degrees of freedom at 0.05 level of significance. Table 11 and 12 presents the pre-test and post-test result for School Year 2023-2024. Based from table 11, , the computed t-value of control and experimental class in pre-test was 1.7031 greater than the tabular value of 1.6715. Table 12 revealed that the post-test computed t-value was 11.174 greater than the tabular value of 1.6715 based both on 58 degrees of freedom at 0.05 level of significance. The Effectiveness of Parabolic Instructional Device was determined by the difference in the Pre-test and Post-Test result of the control and experimental classes from School Year 2022-2023 to School Year 2023-2024. Based from table 13, The control and experimental group of School Year 2022-2023 obtained the Cohens' D Result of 2.4512 while the control and experimental group of School Year 2023-2024 obtained the Cohens' D Result of 2.3675.

Table 1. Pre-test Proficiency Level of Control and Experimental Class for School Year 2022-2023 and School Year 2023-2024

	Class	Proficiency level (%) pre-test	Interpretation
School Year 2022-2023	Control	19.08	Beginning
	Experimental	20.67	Beginning
School Year 2023-2024	Control	13.33	Beginning
	Experimental	17.11	Beginning

Interpretation	**Range**
Beginning	1.00 to 24.9
Developing	25.0 to 49.9
Approaching Proficiency	50.00 to 74.9
Proficient	75.00 to 100

Table 2. Manipulative Features of Parabolic Instructional Device

Indicators	Weighted Mean	Interpretation	Rank
The instructional device can be manipulated through the use of its different components (track, sensors, programs, and stand).	4.60	Highly Acceptable	1.5
The device along with its components can be easily operated whenever a simulation is conducted.	4.60	Highly Acceptable	1.5
The tactile experience adds a dimension of learning. Easier to relate to real world application.	4.50	Highly Acceptable	3
Average Weighted Mean	4.56	Highly Acceptable	

Legend:

Rating	Interpretation
4.21 - 5.00	Highly Acceptable
3.41 - 4.20	Acceptable
2.61 - 3.40	Moderately Acceptable
1.81 - 2.60	Fairly Acceptable
1.00 - 1.80	Not Acceptable

Table 3. Simulation Features of Parabolic Instructional Device

Indicators	Weighted Mean	Interpretation	Rank
The device clearly simulates the Idea of Projectile Motion	4.80	Highly Acceptable	1
The instructional device and its components are mentally and physically activating.	4.60	Highly Acceptable	2
The instructional device and its components are engaging and fun.	4.40	Acceptable	3
Average Weighted Mean	4.60	Highly Acceptable	

Table 4. Teachers Evaluation of Parabolic Instructional Device in terms of Functionality

Indicators	Weighted Mean	Interpretation	Rank
The instructional device put meaning to the content for a particular lesson in projectile motion	4.8	Highly Acceptable	1
It is enjoyable, stimulating, challenging, and engaging to use this Instructional Device.	4.78	Highly Acceptable	2
This Instructional device can help me to better understand the information written in the textbooks.	4.7	Highly Acceptable	3
The Instructional Device operates well with less to no problems.	3.78	Acceptable	4
This Instructional device can easily and independently be used.	3.6	Acceptable	5
Average Weighted Mean	4.30	Acceptable	

Table 5. Teachers Evaluation of Parabolic Instructional Device in terms of Accuracy

Indicators	Weighted Mean	Interpretation	Rank
The obtained data from the device have the same or almost near to the computed value using the kinematics equation.	4.2	Acceptable	1
Alterations in the mass, angle of inclination, and distance shows different yet accurate values.	4.1	Acceptable	2
There are no observable changes to the operations of the device even repetitive usage is done.	3.3	Moderately Acceptable	3
The data acquired in every simulation are consistent.	3.2	Moderately Acceptable	4
Average Weighted Mean	3.72	Acceptable	

Table 6. Teachers Evaluation of Parabolic Instructional Device in terms of Durability

Indicators	Weighted Mean	Interpretation	Rank
The Instructional Device is stable when being used.	4.22	Acceptable	1
The Instructional Device is sturdy with strong foundations that can withstand repetitive usage.	3.56	Acceptable	2
The device is handy and easy to bring.	3.44	Moderately Acceptable	3
Average Weighted Mean	3.74	Acceptable	

Table 7. Teachers Evaluation of Parabolic Instructional Device in terms of Safety

Indicators	Weighted Mean	Interpretation	Rank
Electric wirings in the device are properly insulated and kept from being exposed to avoid hazards.	4.11	Acceptable	1
The device can easily be transferred from one point to another.	3.67	Acceptable	2
Average Weighted Mean	3.89	Acceptable	

Table 8. Post-test Proficiency level of Control and Experimental Class for School Year 2022-2023 and School Year 2023-2024

	Class	Proficiency Level (%) POST	Interpretation
School Year 2022-2023	Control	43.22	Developing
	Experimental	70.67	Approaching Proficient
School Year 2023-2024	Control	45.51	Developing
	Experimental	68.22	Approaching Proficient

Interpretation	Range
Beginning	1.00 to 24.9
Developing	25.0 to 49.9
Approaching Proficiency	50.00 to 74.9
Proficient	75.00 to 100

Table 9. Difference between the Pre-test Means of the Control and Experimental Group for School Year 2022-2023

Statistical measures	Control	Experimental
N	30	30
Mean	2.8	3.1
Standard Deviation	1.0635	1.0619
Mean Difference	0.3	
Significance Level	0.05	
Degrees of Freedom	58	
Computed t-Value	1.1211	
Tabular t-Value	1.6715	
Interpretation	There was no significant difference	

Table 10. Difference between the Post-test Means of the Control and Experimental Group for School Year 2022-2023

Statistical measures	Control	Experimental
N	30	30
Mean	6.47	10.6
Standard Deviation	1.4076	1.9226
Mean Difference	4.13	
Significance Level	0.05	
Degrees of Freedom	58	
Computed t-Value	13.035	
Tabular t-Value	1.6715	
Interpretation	There was a significant difference	

Table 11. Difference between the Pre-test Means of the Control and Experimental Group for School Year 2023-2024

Statistical measures	Control	Experimental
N	30	30
Mean	2.03	2.51
Standard Deviation	1.2576	1.2507
Mean Difference	0.48	
Significance Level	0.05	
Degrees of Freedom	58	
Computed t-Value	1.7031	
Tabular t-Value	1.6715	
Interpretation	There was a significant difference	

Table 12. Difference between the Post-test Means of the Control and Experimental Group for School Year 2023-2024

Statistical measures	Control	Experimental
N	30	30
Mean	6.87	10.23
Standard Deviation	1.306	1.524
Mean Difference	3.36	
Significance Level	0.05	
Degrees of Freedom	58	
Computed t-Value	11.174	
Tabular t-Value	1.6715	
Interpretation	There was a significant difference	

Table 13. Effectiveness of Parabolic Instructional Device to Science Learners of School Year: 2022 to 2024

School Year	Groups	Numerator (m)	Denominator (sd)	Cohen's (D)	Interpretation
2022-2023	Control	6.47	1.4076	2.4512	Large Effect
	Experimental	10.6	1.9226		
2023-2024	Control	6.87	1.306	2.3675	Large Effect
	Experimental	10.23	1.524		

Legend:

Effect	Range
Small Effect	0.0 to 0.49
Medium Effect	0.5 to 0.79
Large Effect	More than 0.8

Conclusion

Based from the findings, the pre-test proficiency level result of both control and experimental class from School Year 2022-2023 and School Year 2023-2024 had a verbal interpretation of beginning. There were several steps followed in the construction of Parabolic Instructional Device and the manipulative and simulation features of Parabolic Instructional Device were both Highly Acceptable. The Parabolic Instructional Device was Acceptable to teachers in terms of Functionality, Accuracy, Durability, and Safety. The post-test performance level result from School Year 2022-2023 of control class was found developing and experimental class was approaching proficient, while the post-test performance level result from School Year 2023-2024 of control group was found developing and experimental group was approaching proficient .For School Year 2022-2023, there was no significant difference in the pre-test result of learners while there was a significant difference in the post-test result; for School Year 2023-2024 there was a significant difference in the pre-test and post-test result of the learners; and the Parabolic Instructional Device had Large effect in the performance of both experimental classes of School Year 2022-2023 and School Year 2023-2024.

Recommendations

The study recommends to consider the results and analyze the try-out phase to thoroughly improve the assessment and the lesson delivery to the diverse learners. The Parabolic Instructional Device may be introduced as a supplementary material in teaching concepts of Projectile Motion to Science Learners; the teacher may also develop Arduino based software applications to obtain the measurement of half trajectory considering the device can be set up in half trajectory mode. Develop varied learning activities using the device that responds to the diversity of learners and Improve the visuals of the Instructional Device to help the learners arouse the interest and attention. Ports are also great option to install in the device as the data's obtained can be projected in the screen and can be seen by learners during demonstration. Improve the quality of test based on desired and essential learning competencies particularly the application of the concept to the real-world setting and also integrate and consider the higher order thinking skills in each test item to be given to the students.

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