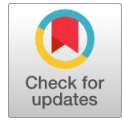


Developing the Proficiency Level of Sophomore Fisheries Students through Contextualized Comics in Projectile Motion

Beryl Joy A. Navarro, Melba C. Olidan, Junifer S. Visto, Julie S. Berame



Abstract: Projectile motion finds applications in day-to-day activities and many of the students find it hard to grasp and comprehend. In this study, the goal was to craft and utilize a contextualized comics that serves as an intervention tool to address students' low achievement on some concepts of kinematics, with emphasis on projectile motion. The study used one group pretest-posttest experimental design to investigate the effectiveness of the intervention tool. The paired t-test was also employed to compare students' performance before and after using the contextualized comics. Shapiro-Wilk test was also utilized to determine whether the data follows a normal distribution in comparing the tests used. The participants of this study were 20 sophomore fisheries students. The contextualized comics was utilized by the students after the pre-test. Findings have remarkably revealed that before the utilization of the contextualized comics, participants were identified as not proficient on the concepts of projectile motion. This implies that the students did not master the lesson as prevailed in their MPS of 12.8% which is within the "not proficient" bracket. After the conduct of intervention with the contextualized comics, the students significantly scored higher in their post-test resulting in an MPS of 75.2% which falls under the "proficient" level. Through the validation of Shapiro-Wilk test which follows normal distribution, there is a significant difference between pre-test and post-test scores after the implementation of the contextualized comics where $p < 0.001$. Thus, it signifies that the contextualized comics was an effective intervention tool to enhance students' performance on the least learned topic in physics.

Keywords: Contextualized Comics, Proficiency Level, Projectile Motion, Fisheries Students.

I. INTRODUCTION

Science is one of the core subjects taught in all school levels in the Philippines. In the K to 12 Curriculum, the teaching of Science starts from grade three to high school and the tertiary level.

Accordingly, even though there is no particular subject or time slot devoted to science before Grade III, there are competencies or standards related to science that every early learner needs to achieve. Science is integrated in all learning areas [1]. One of the most difficult and challenging fields in Science is physics. It has a reputation for being a difficult topic due to its dominant problem-solving aspect [2]. Applied Physics is used to comprehend any other technical engineering studies and as the foundation of technology innovation. As one of the curriculum components in helping the students to be competent in certain skills, it is used to develop intellectual, attitude, interest, skill and creativity. Physics is a course containing materials in form of fact, concept, principle and procedure [3]. The Contextual teaching and Learning approach have been widely used in Physics subject. The Physics subject using contextual teaching and learning through Predict, Observe and Explain method is substantially effective to increase students' high order thinking [3]. Other teaching strategies, such as the use of movies, comics, conceptual maps, seminars, discussion forums, and symposia, can also aid in the learning process. Hence, many educational articles suggest that more inventive and creative pedagogies are needed to motivate students in science education, particularly when it comes to practical work [4]. This entails taking into account students' media abilities and experiences. Teachers, pointed out, may develop different ways to interact with students in a more engaging way [5]. One of these methods is to create educational materials that are most suited to 21st Century learners. The Net Generation is a term used to characterize the current generation. One of the most distinguishing characteristics of this generation is that it is no longer reliant on traditional forms of text-based communication. Based on their experiences with the Internet, YouTube, WhatsApp, and Instagram, students are frequently more engaged with visual and multimedia communication. Several studies stated that even very young students can now quickly switch between multiple media formats and their related representations, at least in industrialized nations, yet they frequently struggle to read and understand longer texts [6].

Many young people are finding it more difficult to follow long textual instructions. They skim or neglect reading parts and try to finish the text as quickly as possible if a subject is not motivating or particularly interesting to them. Short messages put in a meaningful context provided by unique graphics like comics are more suitable for students' media experiences than traditional text-based instructions. Another issue is that students' average reading skills are deteriorating.

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This is frequently caused by the increased number of students who lack linguistic proficiency in their country's official language as a result of immigration conducted [6]. When designing educational materials for schools, this linguistic fact must be considered. One suggestion for addressing such challenges is to communicate scientific knowledge and experimental instructions in a different way, relying more heavily on pictorial information. Succeedingly, the use of instructional material can help students understand concepts and pique their attention [7]. In physics, instructional media help students visualize abstract concepts. As a result, it can help students grasp things more easily. In order to boost students' motivation, it is vital to use relevant and entertaining instructional medium [8]. It is further found out that enjoyment, engagement and positive view of using comics in the classroom are attributed to the success of using comics to deliver a certain topic [9]. There were recommended various strategies in the context of presenting science-related situations and tasks to directly include intuitive understanding for students and make it more motivating and intelligible for them [10]. Visual aids are viewed as particularly useful for conveying knowledge and putting it in understandable learning scenarios. Using cartoons or comics is one approach to do this in a creative way. Comic books, whether digital or traditional printed on paper, are often associated with the younger generation's media. The popularity of comic books has been attributed for both better visual literacy and declining reading skills among today's students.

Per the research on the use of cartoons and comics in science teaching, graphic illustrations can lead to a greater grasp of scientific phenomena than is often realized by traditional textbooks. This is especially true when students are uneasy about the subject being discussed. After using comics to teach, it found that less motivated, disengaged students improved their content understanding and attitudes [11]. According to the study, comics help to engage students and positively shape their opinions. Moreover, visual narratives, such as comics and animation, are becoming increasingly popular as a method for science and communication instruction [12]. It has the potential to pique learners' interest and attention when communicating information. It further added that Comic books can be used as an alternate teaching medium to boost students' motivation [13] and students' visual representation and higher-order thinking skills can also be improved through the use of comic books [14].

In science education, comics provide an uncommon learning environment and an unexpected connection to popular media. They can be utilized as a vehicle for disseminating scientific information [6]. As a creative approach to science, they can represent real-world situations which have no clear answer, be interdisciplinary in nature, prove relevant to both the curriculum and students' lives, and remain highly visible and accessible. This can help students enhance their ability to deal with everyday life as well as socio-scientific challenges. Comics can also give a thorough and realistic environment, allowing the student to become more involved in science. This component, along with situational curiosity and learning about science applications in everyday life, has been recommended to improve student

motivation [15].

In Surigao State College of Technology (SSCT), many students also found it hard to deal with Physics. An analysis on the test results of the Second Year BS Fisheries students in physical science suggested that one of the least learned competencies in the course is kinematics. To address this concern, the researchers looked into possible ways on how to develop learners' proficiency level on kinematics through innovative means. The researchers were inclined to the utilization of comic-based intervention material since comics is very popular among students, thereby capturing their interest. In fact, comics can be used as a powerful supplementary teaching tool concretizing abstract concepts, especially in science lessons [16]. Comics are employed to make medieval history lessons more appealing or even to encourage students to participate in areas that are frowned upon, such as Mathematics and Physics.

II. METHODS

A. Research Design

The study used one group pretest-posttest experimental design to investigate the effectiveness of the developed intervention material in contextualized comics. The study comprised 20 participants of Bachelor of Science in Fisheries students taking up physics course. Since the main purpose of crafting the contextualized comics was to test its effectiveness as an intervention tool, the post-test performance of the students, in terms of test score, after the utilization of the contextualized comics was statistically processed, treated and interpreted. The pretest-posttest one group design was illustrated below.

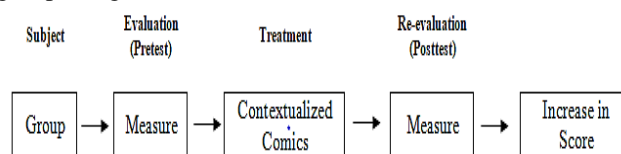


Fig. 1: One Group Pretest-Posttest Experimental Design of the Study

B. Research Locale and Participants

This study was conducted at Surigao State College of Technology (SSCT), Malimono Campus at Cagtinae in Surigao del Norte. Malimono Campus is one of the external campuses of the Surigao State College of Technology (SSCT). Before becoming part of the SDNSU system in 1998, the Malimono Campus was known as the Malimono School of Fisheries. Aside from fisheries, SSCT Malimono also offers degree programs in Marine Biology and in Secondary Education. These courses are duly recognized by the Commission on Higher Education (CHED). Malimono officially the Municipality of Malimono is a 5th class municipality in the province of Surigao del Norte, Philippines. The participants of the study were twenty (20) Second Year College Students of Bachelor of Science in Fisheries in SSCT, Malimono Campus, Surigao del Norte.

C. Quality Check

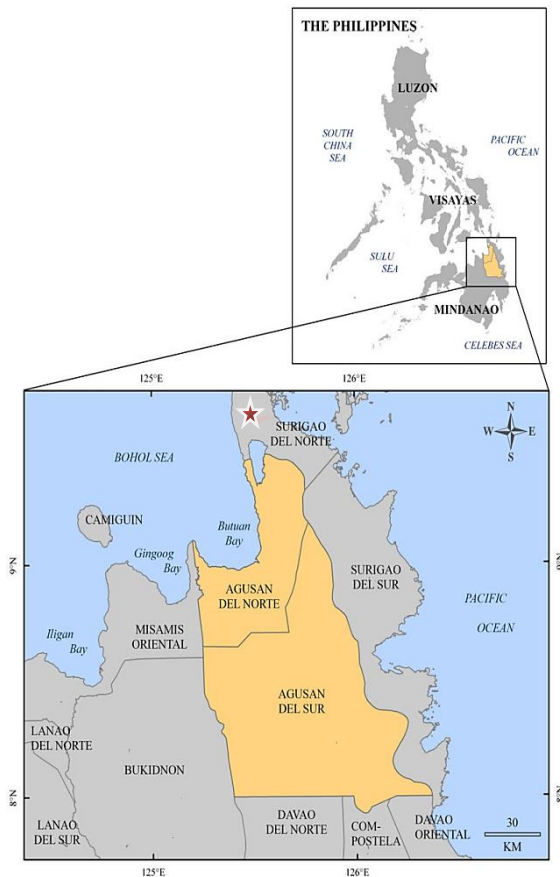


Fig. 2: Map of Surigao State College of Technology, Malimono Campus, Surigao del Norte

D. Sampling Technique Used

The study used a universal sampling technique. Here, the selection of samples is where not all the people in the population have the same profitability of being included in the sample and each one of them, the probability of being selected is unknown [17]. The researchers preferred use a universal sampling technique that may provide the useful information to test the hypothesis of this research.

E. Instrumentation

The contextualized comics is one of the instruments used in this study. It is one of the intervention materials that can be used to promote active learning in the classroom. The comics is designed to help students to increase and deepen their skills, knowledge and understanding of science concepts. The researchers used a (25) twenty-five-item assessment tool in a form of test questionnaire on physics with a specific topic about projectile motion that has (2) two parts. The first part consists of a (10) ten-item multiple choice questions that belong to easy and average level. The second part is a (3) three-item problem solving test (5 points each) that belongs to the difficult level. To assure that the problem-solving items are subjectively scored, a rubric was used on students' answers. The test questionnaire and rubric were verified by the expert instructors and secondary school teachers who are experts in the field of Physics to assess the extent of core content knowledge of the students with regards to the topic.

The test questionnaire was established through pre-test and post-test on the participants of this study. A pre-test was conducted before the developed comics is provided. On the other hand, the post-test was conducted after they were given the developed contextualized comics.

F. Data Gathering Procedure

The contextualized comics that were used as an intervention tool in this study underwent different stages of implementations. Planning Stage. This stage specifies the researchers' job of identifying the least learned competency of the BS Fisheries students in Physics course. It also allows the researchers to determine the specific intervention tool to be utilized and identify what simplified contents will be included considering the learning performance of the students. Development Stage. This stage presents explicit preparation of crafting the intervention material. The researchers developed a script that will serve as the context of the comics. Drafts of the script were presented to subject matter experts for revision. Through the help of an animator, the comics was then crafted. Validation Stage. This stage involves the determination of the degree of validity of the intervention material and other tools to be utilized in this study. The comics was reviewed to assure the validity of its content. Test questionnaires were also validated to ascertain that they are appropriate to the learning capacity of the students. Implementation Stage. This stage lays down the process of implementing the crafted intervention tool. The researchers administered a test regarding projectile motion, and this served as the pre-test. The students who scored below 75% were identified. Then, the researcher provided the intervention tool to the identified less proficient students in the form of comics. The same set of test questionnaire that was given during the pre-test was administered as post-test. Then, the researcher tabulated the test scores obtained during the pre-test and the post-test. Finally, the data gathered were analysed to determine the impact of contextualized comics on the proficiency level of the students.

G. Statistical Treatment of Data

The following statistical techniques were used in the analysis and interpretation of data. Mean, Median and Standard Deviation were used in describing the student-participants' performance in kinematics based on the result of the pre-test and post-test before and after the utilization of the contextualized comics. T-test was used to find out if there is a significant difference between the scores obtained by the learners before and after the utilization of the contextualized comics. The Shapiro-Wilk test was also used to find out the normality distribution of the data.

III. RESULT

As presented in Table 1, it shows the proficiency level of the students on Projectile Motion in pretest. The performance level of the students on Projectile Motion during the conduct of the pre-test was not proficient with a mean of 12.80%, median score of 14% and a standard deviation of 6.03.

Table - I: Proficiency Level of Students on Projectile Motion in Pre-test

	N	Mean	Median	SD	Remarks
Pre-test	20	12.8	14	6.03	Not Proficient

Note: Highly Proficient (90-100%); Proficient (75-89%); Nearly Proficient (50-74%); Low Proficient (25-49%); Not Proficient (0-24%)

Table 2 presents the comparison of the scores obtained in the pre-test and the post-test. As shown in the table, the average gain score from the pre to post-test was 62.4%, as depicted on the difference of the mean scores of the pre and post-test. It is also good to note that the median scores of the pre and post-test were significantly higher than the average scores. If the mean is less than the median, the distribution of the scores is negatively skewed.

Table – II: Comparison on the Scores Obtained in the Pte-Test and Post-Test

	N	Mean	Median	SD	Remarks
Pre-test	20	12.8	14	6.03	Not Proficient
Post-test	20	75.2	80	8.27	Proficient

Note: Highly Proficient (90-100%); Proficient (75-89%); Nearly Proficient (50-74%); Low Proficient (25-49%); Not Proficient (0-24%)

The plot also reveals a significant gap between the pre and post test scores. However, post-test scores are more dispersed than the pre-test scores as shown by the values of the standard deviation. In addition, the median score of the post-test is way above the 95% confidence interval. Based on the afore-mentioned statistical data analysis, the overall mean score of the post-test for this study is higher than the overall mean score of the pre-test, thus showing improvement in the students' results after the intervention. Students had a positive view towards comics in general and majority of them agreed that using comics made the lessons fun and interesting. The data stated above show that the students are now proficient on the competency about projectile motion. This further implies that the contextualized comics had a great help to students who did not master the concepts in Kinematics. This is because the students gained a clearer and better understanding of the topic through the aid of the comics. Comprehension was improved by transforming technical jargons to simplified terms and by using a relatable scenario of basketball to depict how projectile motion works. Another factor that can be attributed to the increase of the learners' performance is the aesthetic appeal of the comics which prompts students' motivation to learn.

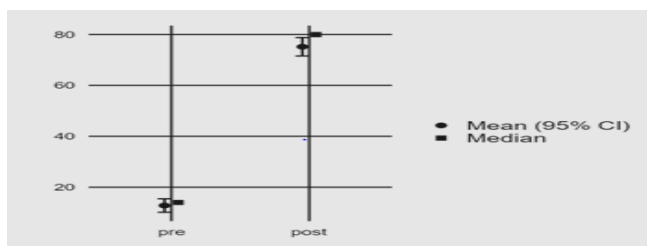

Fig. 3. A Plot Showing the Gap Between the Pre-test and Post-test Scores

Table 3 shows the summary of the paired T-test on the students' proficiency level before and after the comics was utilized. Paired Samples T-test was conducted to determine

whether there is a significant difference in the pre-test and post-test scores of the students. As a rule of thumb, if the p-value is lesser than the α -level (usually 5% or 0.05), then there is a significant difference. Otherwise, there is no significant difference between the two sets of scores. There is a highly significant difference between pre-test and post-test scores after the implementation of the contextualized comics ($p < .001$). The claim can be substantiated since the data follows a normal distribution as shown in Table 4.

Table – III: Summary of the Paired T-Test on the Students' Proficiency Level Before and After the Implementation of the Contextualized Comics Paired Samples T-Test

			Statistic	df	P
Pre	post	Student's	-30.29	19	< .001

Note: Level of Significance: $\alpha = 0.05$

Table – IV: Normality Test (Shapiro-Wilk)

			W	P
pre	-	Post	0.95	0.338

Note: A low p-value ($p < 0.05$) suggests a violation of the assumption of normality

IV. DISCUSSION

As presented in the Table 1 above, the low scores obtained by the students imply that they find it hard to answer questions related to projectile motion. One factor that can be attributed to this is that the basic concepts of the topic are not clear to the learners. Although the basic concepts of Projectile motion can be read in textbooks, many students get bored when reading lengthy discussions. That is why their performance on the test was at the low level. It is also found that it can help shed light to this claim as he observed that students have little motivation when learning with textbooks, and their ability to remember important fact is also low [18] and using comics to encourage positive attitudes in students towards the lesson or subject [19]. Additionally, it highlighted that the use of comics as instructional media has been widely used to improve learning [20].

Meanwhile, several studies have shared similar findings that students find it hard to grasp Science concepts and answer problem solving questions especially in the absence of supplementary materials [21,23]. Since the students' performance on the topic of concern is low, there is really a need to develop an intervention material that will supplement their learning. Supplementary resource materials are additional instructional aids that are useful in teaching science. This material helps to promote motivation, which is one of the key factors influencing learning. Because comics are popular among youth, the researchers decided to develop them as an intervention material. Several studies show that comic books can help students improve their understanding of difficult science concepts. The use of visual images or graphic illustration in science education can lead to a greater grasp of scientific phenomena than is generally achieved by traditional textbooks [6]. The goal of creating and using comics was to boost students' enthusiasm and interest in the subject.

Additionally, comics were chosen to encourage students to read texts more thoroughly and focus on the task at hand. Further, comics also can be used as an alternative medium to increase students' motivation significantly and assist them to understand Newton's law concepts easier [25]. This study's findings are consistent with those who discovered that comics in science education may be both engaging and effective at imparting science knowledge to a wide range of students [6]. They identified comics as a viable method for attracting hard-to-reach students, as well as the fact that comics may pique the interest of a broader range of learners. These claims were also supported [28] who stated that comics serve as a medium that bridges understanding of more complex texts and helps students to better enjoy reading. Comic stimulates learning activities of students because the language used is more common and easier to understand. It further pointed out that central to the engaging quality of comics as a learning tool is their defining characteristic that they are art, often paired with words, used to relay a narrative [25]. Furthermore, the language in comics can transform rigid science into simple science that can be accessed and understood by students [26][31]. That is why they are a good educational tool to improve knowledge. Moreover, comics are a good educational tool to increase knowledge. Since they are an attractive form of media and are easy to understand by students, comics are effective in preventing student boredom.

Based on the results of this study, it is evident that contextualized comics significantly increased students' proficiency level on the topic of concern. This corroborates that graphic illustrations improve memory among students compared to traditional methods, which use only text books [18]. Furthermore, the use of comics as an educational tool to enhance learning has already been tested to be effective. This had been used as early as 1949 as an instructional tool for special needs and lower ability students [19]. They stated that teaching using comics that follows a storyline would create a sense of adventure that will make learning more motivating for the students. Students in today's society would normally prefer visuals over heavy text, especially in the era where the Internet has been widely used at homes and the way messages are conveyed online is appealing to them. This claim is reinforced that students' interest increased on science topics when the comic module was used [22] [27,28]. This increase is caused by the humor elements that were injected into the teaching and learning process, which made learning fun. Additionally, comics uses simplified text where a person uses the graphics to easily understand the content. Visual is more easily understood and interpreted compared with writings. In the meantime, the use of comics would increase students' engagement in the classroom [29]. The two key features that are present in comics are visual arts and also humor, which are imperative in attracting students' interest. Visual does not only enhance learning but also extend students' knowledge so that they are able to create their own understanding of the concepts that are present in the comics. Meanwhile, the use of humor in comics will help students remember content for a long time. The implication of using comics in the classroom is that it facilitated in developing the quality of students' performances both on the lessons and also the test. Comics helped improve students' interest in learning as well as students' engagement and it is a promising instructional tool

in the learning process. The findings of this study suggested that comics have a potential in the education setting and can be used as a tool to make the learning process meaningful for the students [30].

V. CONCLUSION

Kinematics may be found difficult by the students in different aspects of learning. The concept of projectile motion in physics gives us a broad idea of changing objects especially in its orientation and position. With the aid of contextualized comics, learning Kinematics is easier to understand while having fun and being entertained by the concepts of art. In this study, students who have not experienced reading comics material that is developed and contextualized for their learning find the problems tough to answer, garnering very low scores. Noticeably, after reading the contextualized comics, they have earned higher scores. Thus, the elevated post-test scores of the students who took the pre-test with very-low scores imply that the use of contextualized comics to discuss certain concepts of projectile motion is significant and efficacious (Kurniawati et al. [30] [24]). On the other hand, In addition to conventional textbooks, supplementary learning materials should also be given to students for them to better understand scientific concepts. Science teachers should use innovative intervention materials to re-teach the concepts and skills that are least-learned by students. A developed learning material should use common and easy to understand words so that students can easily comprehend it. In order to develop competence in the area of physical science, training for science teachers for adaptation of arts and technology shall be actively given for effective and efficient learning techniques. There should be regular monitoring of all science teachers in the school system to ensure that a quality education is provided. Innovative supplementary materials for other subjects should also be made to address the least mastered competencies and skills.

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DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

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- **Funding Support:** This article has not been sponsored or funded by any organization or agency. The independence of this research is a crucial factor in affirming its impartiality, as it has been conducted without any external sway.

- **Ethical Approval and Consent to Participate:** The data provided in this article is exempt from the requirement for ethical approval or participant consent.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Authors Contributions:** The authorship of this article is contributed equally to all participating individuals.

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