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

Beryl Joy A. Navarro[1*], Melba C. Olidan[2], Junifer S. Visto[3], Minie L. Bulay[4], Julie S. Berame[5]
[1]Bolhoon National High School, Surigao del Sur, Philippines
[2]Surigao State College of Technology, Surigao del Norte, Philippines
[3]Agusan del Sur State University, Agusan del Sur, Philippines
[4,5] Caraga State University, Butuan City, Philippines
*Corresponding Author e-mail: *navarroberyljoy@gmail.com*

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ABSTRACT

Aim: This study aimed to craft and utilize a contextualized comic that serves as an intervention tool to address students' low achievement on some concepts of kinematics, with emphasis on projectile motion.

Methodology: The study used one group pretest-posttest experimental design to investigate the effectiveness of the intervention tool. The Wilcoxon Signed Rank test was employed to compare students' performance before and after the conducted intervention using the contextualized comics. Shapiro-Wilk test was also utilized to determine whether the data follows a normal distribution. A universal sampling technique was employed in gathering the data. Twenty (20) fisheries students were identified as the key participants of this study. The assessment tool and the contextualized comics are two of the research instruments utilized. Both of these research instruments were evaluated by experts in terms of accuracy of content, format, and alignment to the standards to ensure their validity and reliability.

Results: The study's remarkable findings revealed that before the utilization of the contextualized comics, participants were identified as not proficient in the concepts of projectile motion. Students did not master the lesson as prevailed in their MPS of 12.8%, which is within the "not proficient" bracket. However, after the intervention of the contextualized comics, the students significantly scored higher in their posttest with an MPS of 75.2% which falls under the "proficient" level. Analysis showed that posttest scores were substantially higher compared to the pretest.

Conclusion: This signifies that the contextualized comics was an effective intervention tool to enhance students' performance on the least learned topic in Physics, particularly projectile motion.

Keywords: Contextualized comics, proficiency level, projectile motion, fisheries students

INTRODUCTION

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

tertiary level. According to Cruz (2015), 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 with all learning areas.

One of the most challenging fields in science is physics. According to Reddy (2017), physics has a reputation for being a difficult topic due to its dominant problem-solving aspect. Applied Physics is used to comprehend any other technical engineering studies and as the foundation of technology innovation. Additionally, it is one of the curriculum components in helping the students to be competent in certain skills. It also facilitates the development of the intellect, attitude, interest, skill, and creativity of the students. Physics is a course containing materials in the form of facts, concepts, principles, and procedures (Fadhilah et al., 2016).

The contextual teaching and learning approaches have been widely used in Physics subject. The use of contextual teaching and learning through Predict, Observe and Explain method is substantially effective to increase students' high-order thinking (Fayakun & Joko, 2015). Other teaching strategies, such as the use of movies, comics, conceptual maps, seminars, discussion forums, and symposia, can also aid in the learning process.

Many educational articles suggest that more innovative and creative pedagogies are needed to motivate students in science education, particularly when it comes to practical work (Henary et al., 2015). This entails taking into account students' media abilities and experiences. Students of the current generation are said to be part of the Net Generation. One of the most distinguishing characteristics of the Net Generation is that it ceased to depend on traditional forms of text-based communication. Students are frequently more engaged with visual and multimedia communication as a result of their experiences with the Internet and social networking sites. Affeldt et al (2018) 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.

Many young people have found 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. 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 (Affeldt, 2018). 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 differently, relying more heavily on pictorial information.

Lin and Lin (2016) have recommended several 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. 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 creatively. 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 to both better visual literacy and declining reading skills among today's students.

Based on 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, Kerneza and Kosir (2016) found that less motivated, disengaged students improved their content understanding and attitudes. According to the study, comics help to engage students and positively shape their opinions. 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 (Affeldt, 2018). As a creative approach to science, they can represent real-world situations that have no clear answer, be interdisciplinary, 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 (Childs et al., 2015).

At Surigao State College of Technology (SSCT), many students also found it hard to deal with Physics. An analysis of 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 how to improve learners' proficiency levels in kinematics through innovative means. The researchers were inclined to the utilization of comic-based intervention material since comics were very popular among students, thereby capturing their interest. In fact, according to Akcanca (2020), comics can be used as a powerful supplementary teaching tool for a concretizing abstract concept, especially in science lessons. 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.

This study aimed to develop the proficiency level of students on projectile motion. Specifically, it sought to answer the following queries:

1. What is the proficiency level of the students on projectile motion in the pretest?
2. What is the gain score from pretest to posttest after the implementation of contextualized comics on students?
3. Is there a significant difference between the scores obtained in the pretest and posttest after the implementation of contextualized comics?

Hypothesis

H0: There is no significant difference between the scores obtained in the pretest and posttest after the implementation of contextualized comics.

Hα: There is a significant difference between the scores obtained in the pretest and posttest after the implementation of contextualized comics

METHODS

Research Design

The study employed a quasi-experimental research design using the 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 courses. The main purpose of crafting the contextualized comics was to test their effectiveness as an intervention tool in improving the proficiency level of the students in projectile motion. The pretest performance of the students and their posttest scores after the utilization of the contextualized comics were statistically analyzed and interpreted to determine if a significant increase took place. The pretest-posttest one-group design was illustrated below.

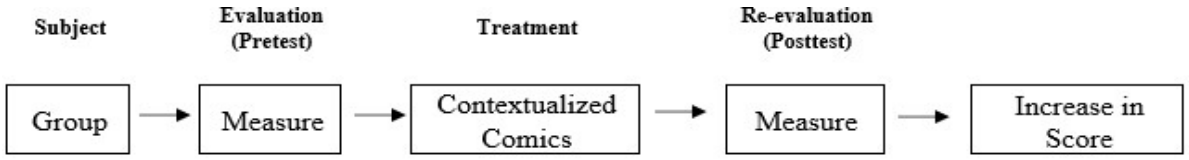

Figure 1. One group pretest-posttest experimental design of the study

Sample and Sampling Technique

This study was conducted at Surigao State College of Technology (SSCT), Malimono Campus at Cagtinae, Malimono, Surigao del Norte. The said school is 33 kilometers away from Surigao City. Buses and motorized vehicles may be used to reach the destination.

SSCT - Malimono Campus is one of the external campuses of the Surigao State College of Technology. 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 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. Based on the Philippine Statistics Authority (PSA) Census last 2015, it has a population of 18,054 people.

The study used a universal sampling technique. Here, sample selection occurs when not all members of the population have the same likelihood of being included in the sample, and the probability of selection for each individual is unknown (Richard & Margaret, 1990). The researchers favored a universal sampling strategy to be undertaken by the participants since they are the ones with knowledge of Physics subject and could provide the necessary data to test the study hypothesis. Thus, 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.

Research Instruments

There were two instruments used in this study, the contextualized comics and the assessment tool or the pretest-posttest questionnaire. Contextualized comics were one of the intervention materials that can be used to promote active learning in the classroom. The comics were designed to help students to increase and deepen their skills, knowledge, and understanding of science concepts. The contextualized comics that were used as an intervention tool in this study underwent different stages before it was utilized.

Planning Stage. This stage specifies the researchers' job of identifying the least learned competency of the BS Fisheries students in the Physics course. It also allows the researchers to determine the specific intervention tool to be utilized and to identify what simplified contents will be included considering the learning performance of the students.

Development Stage. This stage presents explicit preparation for 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 were 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 were evaluated in terms of accuracy of content and alignment to the standards by three validators who are experts in the field of science. Areas that were found defective were corrected.

The researchers also used a (25) twenty-five-item assessment tool in a form of a test questionnaire on physics with a specific topic about projectile motion that has (2) two parts. The first part consists of (10) ten-item multiple choice questions that belong to an easy and average level. The second part is a (3) three-item problem-solving test (5 points each) that belongs to the difficulty level. A rubric was used to rate students' answers to ensure that the problem-solving items are subjectively scored.

The test questionnaire and rubric were reviewed by the instructors and secondary school teachers who are experts in the field of Physics to assess the extent of core content knowledge of the students about the topic. The reliability of the questionnaire was established by administering 15 copies of the said instrument to the college students of SSCT-Malimono who were not included in the sample used for the study. Their responses were subjected to reliability analysis.

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

Data Gathering Procedure

Before the conduct of the study, the researchers asked permission through a request letter to the Campus Director of SSCT – Malimono Campus. Upon approval, the researchers wrote a letter to the respondents asking for their permission to participate in the study. The respondents voluntarily signed a consent form, and the confidentiality of their profiles was considered.

The researchers administered a projectile motion test, which served as the pretest. The students who scored below 75% were identified. Then, the researchers provided an intervention tool in the form of comics to the identified less proficient students. The same test questionnaires were administered throughout the pretest and posttest. Then, the researchers tabulated the test scores obtained during the pretest and the posttest. Finally, the data gathered were analyzed to determine the impact of contextualized comics on the proficiency level of the students.

Statistical Treatment of Data

The following statistical techniques were used in the analysis and interpretation of data. Mean, Median, and Standard Deviation was used in describing the student-participants performance in Projectile Motion based on the result of the pretest and post-test before and after the utilization of the contextualized comics. Wilcoxon Signed Rank 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 determine whether the data follows a normality distribution.

RESULTS AND DISCUSSION

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

Table 1. The proficiency level of students on Projectile Motion in pretest

	N	Mean	Median	SD	Remarks
Pretest	20	12.80	14.00	6.03	Not Proficient

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

Based on the table, 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 a low level. The findings of Keskin (2015) can help shed light on this claim as he observed that students have little motivation when learning with textbooks, and their ability to remember important facts is also low.

Other studies that share similar findings are that of Cordova et al. (2019) and Samosa (2021) who both claimed that students find it hard to grasp Science concepts and answer problem-solving questions, especially in the absence of supplementary materials. Since the students' performance on the topic of concern is low, there is a need to develop 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 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 illustrations in science education can lead to a greater grasp of scientific phenomena than is generally achieved by traditional textbooks (Affeldt, 2018).

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.

Table 2. Comparison of the scores obtained in the pretest and the posttest

	N	Mean	Median	SD	Remarks
Pretest	20	12.80	14.00	6.03	Not Proficient
Posttest	20	75.20	80.00	8.27	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 pretest and the posttest. As shown in the table, the average gain score from the pre to post-test was 62.4%, as depicted in the difference in 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.

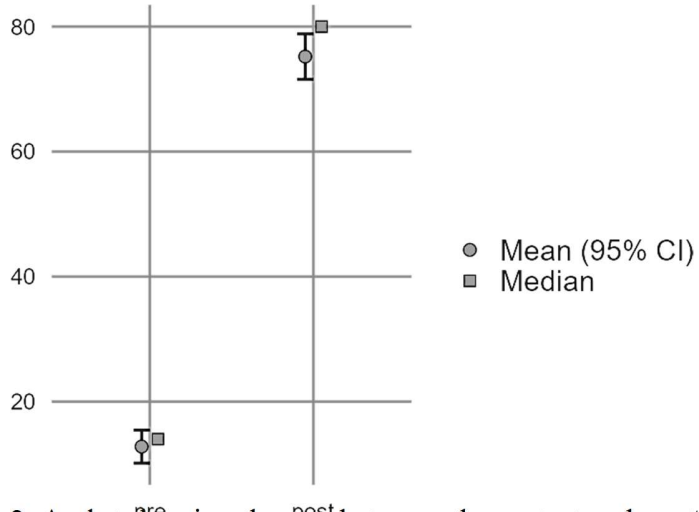

Figure 2. A plot showing the gap between the pretest and posttest scores

The plot also reveals a significant gap between the pre and post-test scores. However, post-test scores are more dispersed than the pretest scores as shown by the values of the standard deviation. In addition, the median score of the posttest is way above the 95% confidence interval.

Based on the afore-mentioned statistical data analysis, the overall mean score of the posttest for this study is higher than the overall mean score of the pretest, thus showing improvement in the students' results after the intervention (Batilantes, 2022). Students had a positive view of comics in general and the majority of them agreed that using comics made the lessons fun and interesting. The data stated above show that the students are now proficient in the competency of the 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 jargon 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 in the learners' performance is the aesthetic appeal of the comics which prompts students' motivation to learn.

This study's findings are consistent with those of Affeldt et al. (2018), who discovered that comics in science education may be both engaging and effective at imparting science knowledge to a wide range of students. 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 by Kurniawati (2017) who stated that comics serve as a medium that bridges understanding 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. Tribull (2017) also 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.

Furthermore, Sari (2019) stated that language in comics can transform rigid science into simple science that can be accessed and understood by students. That is why they are good educational tools to improve knowledge. Moreover, the comic is 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.

Table 3. Summary of the Wilcoxon Signed Rank test on the students' proficiency level before and after the implementation of the Contextualized Comics

			W	df	P
Pretest	-	Posttest	0.000		< .001

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

Table 3 shows the summary of the Wilcoxon Signed Rank test on the student's proficiency level before and after the comics were utilized. Wilcoxon Signed Rank test was conducted to determine whether there is a significant difference in the pretest and posttest 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 pretest and posttest 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 4. 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

Based on the results of this study, it is evident that contextualized comics significantly increased students' proficiency levels on the topic of concern. This corroborates the findings of Keskin (2015) which showed that graphic illustrations improve memory among students compared to traditional methods, which use only textbooks. Furthermore, the use of comics as an educational tool to enhance learning has already been tested to be effective. According to Musa et al. (2019), comics had been used as early as 1949 as an instructional tool for special needs and lower ability students. They stated that teaching using comics that follow 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 when in the era where Internet has been widely used at home and the way messages are conveyed online is appealing to them. This claim is reinforced by the study by Krishnan and Othman (2016) who found out that students' interest increased in science topics when the comic module was used. This increase is caused by the humor elements that were injected into the teaching and learning process, which made learning fun. Additionally, comic uses simplified text where a person uses the graphics to easily understand the content. Visuals are more easily understood and interpreted compared with writings.

The study by Toh et al. (2017) mentioned that the use of comics would increase students' engagement in the classroom. The two key features that are present in comics are visual arts and also humor, which is imperative in attracting students' interest. Visual does not only enhance learning but also extend students' knowledge so that they can create their understanding of the concepts that are present in the comics. Meanwhile, the use of humor in comics will help the student remember the content for a long time.

The implication of using comics in the classroom is that it facilitated in improving the quality of students' performances both in the lessons and also in the test. Comics helped advance 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 potential in the education setting and can be used as a tool to make the learning process meaningful for the students.

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 their 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 the comics material that was developed and contextualized for their learning found the problems tough to answer, garnering a very low mean score of 12.80. Noticeably, after reading the contextualized comics, their scores escalated by 62.4%. Therefore, this remarkable increase in the mean scores implies that the use of contextualized comics to discuss certain concepts of projectile motion is significant and efficacious. On the other hand, in addition to conventional textbooks, supplementary learning materials should also be given to students so they 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 very common and easy-to-understand words so that students can easily comprehend them. 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 quality education is provided. Innovative supplementary materials for other subjects should also be made to address the least mastered competencies and skills.

Conflict of Interest

There was no conflict of interest confirmed by the authors.

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