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ORIGINAL ARTICLE

Enhancing Microorganism Education: Perspectives of Science and Pre-Service Teachers on the Use of Comic Strips

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Abstract

Objectives: This study explored the development and evaluation of Bacteria Chronicle: Invisible but Mighty as an innovative instructional material for teaching science, with particular emphasis on microbiology. **Method:** Utilizing a mixed-methods approach, descriptive data were gathered from science teachers within the Department of Education (DepEd) in the Municipality of Ajuy, Iloilo, Philippines, and pre-service teachers enrolled in the Bachelor of Secondary Education major in science program at Northern Iloilo State University (NISU), Iloilo, Philippines. Complementary qualitative data was collected through interviews, focus group discussions (FGD), and open-ended questionnaires. **Findings:** The results indicated that the comic strip, as evaluated by the science teachers, was satisfactory across all criteria, with a mean score of 2.12, whereas the pre-service teachers rated it very Satisfactory across almost all criteria, and the mean score ranged from 2.48 to 2.85, except for format, writing construction, and neatness. The findings indicate generational differences in receptivity to visual and narrative learning tools. For comparing the responses of the two groups, almost all categories were significant, indicating that the innovations are appealing and have the potential to become an effective instructional material. Responses to the qualitative parts also give both strengths and areas for improvement. To make it more appealing to learners, key points should include improvements in grammar, clearer titles, varied color intensity, and humor to further engage learners. From the previous title, *Prolific Organisms Called Bacteria*, it was changed to *Bacteria Chronicle: Invisible but Mighty*. **Novelty:** This study makes a novel contribution by demonstrating that comic strips can simultaneously enhance conceptual understanding and motivation in science learning through science communication and multimedia pedagogy. It further highlights the role of institutional support and the potential of integrating comics with digital technologies in higher education to be utilized in basic education curricula.

Keywords: Comic strips; Science education; Microbiology; Instructional materials; Teacher and student engagement

1 Introduction

Recent developments in science education have focused on integrating creative and innovative approaches to improve students' engagement and understanding of science concepts. One of these innovations is the use of comic strips in the science curriculum. The use of comic strips, whether in print or digital formats, has gained recognition for decades. Comic strips combine visual storytelling with scientific concepts, promoting creativity and critical thinking and thereby improving academic performance [1]. Similarly, animation and ICT (information and information technology)-based approaches, linking virtual learning environments and multimedia resources, have demonstrated strong potential to enrich science instruction and address diverse learning needs [2]. Thus, this study was designed to evaluate a comic strip as a teaching tool for microorganisms in the basic science education curriculum in the Philippines.

Several studies confirm the effectiveness of comics and multimedia tools in enhancing students' engagement, comprehension, and academic performance across disciplines; these studies largely focus on their general significance and the strengths of these instructional materials [3]. For instance, prior work highlights comic strips' ability to simplify complex concepts, reduce cognitive load, and boost motivation. However, these methods also have notable limitations, as they can lead to a shallow understanding of the lesson if not accompanied by more detailed instructions. But if Filipino teachers keep adapting published materials, they will struggle to teach complex bacterial concepts that require detailed, accurate explanations for better understanding. Hence, they must be encouraged to create instructional materials, such as a comic strip tailored to the local context in the Philippines, to help learners better understand bacteria.

Comic strips are under science communication. One existing study often fails to integrate science communication principles in their innovations. This limits learners' ability not only to develop conceptual understanding but also to articulate scientific ideas effectively [4]. The current study was designed to enhance both in-service and pre-service science teachers by demonstrating that a comic strip is one tool that can support science communication concepts. With this, learners are the key players in communicating that science is significant to our lives. And to eradicate the notion that science is a difficult subject and instead make it fun and exciting.

In the Philippine context, comic strips are considered appropriate, inclusive, and highly acceptable instructional materials in the science curriculum [5]. Content-specific comic strips tailored to the needs of science learners are the answer to the scarcity of science equipment and resources. Thus, this study sought assistance from pre-service and in-service science teachers to evaluate the proposed comic strips as instructional materials for teaching science. The instructional designs currently in use do not adequately investigate how such materials can systematically support both cognitive and communicative competencies. These gaps reveal that, despite the proven advantages of comics and, later, multimedia tools, unanswered issues persist regarding their circumstantial relevance, depth of application to complex topics, and integration with science communication networks.

To address these limitations, this study proposes the use of specified comic strips showing vectors as instructional materials in the basic education science curriculum. Unlike prior studies that primarily underline engagement and general comprehension, this research adopts a more targeted, context-sensitive approach by integrating science communication principles and focusing on complex biological concepts.

1.1 Objective of the Study

This study explored the development and evaluation of Bacteria Chronicle: Invisible but Mighty as an innovative instructional material for teaching science, with particular emphasis on microbiology.

1.2 Conceptual Framework of the Study

Figure 1 presents the conceptual framework of the study, focusing on bacteria, given the growing importance of understanding microbiota. The research integrates comic strips as an innovative teaching strategy, highlighting the value of science communication in supporting students' learning. Science teachers and pre-service teachers were chosen as participants because of their vital role in the teaching and learning process, particularly in improving their skills in designing engaging and effective instructional materials, such as the comic strip.

Science education is a learning that helps cultivate literacy, equipping students to become informed and active citizens who may impact society, health, and the environment. Thus, the science curriculum recognizes the integral role of science and technology in daily life [6]. Findings showed that in rural areas, access to instructional materials was limited, including infrastructure, laboratory equipment, and even internet access. Thus, this is a call for the national government to invest in science facilities and teaching materials to improve the science curriculum. Teachers' training to boost their subject knowledge and pedagogical skills. Also, the introduction of comprehensive reading programs should be emphasized, as they are fundamental to their success in science. To make this possible, teachers' training and supportive environments that can boost teachers' morale

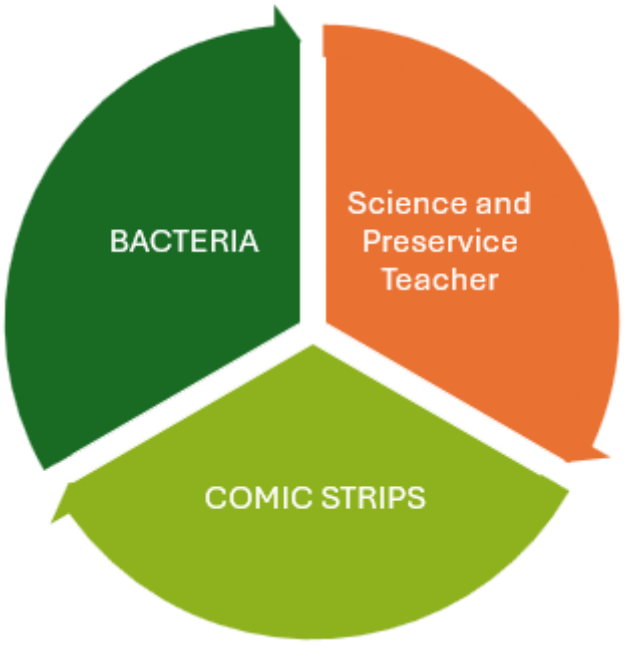


Fig 1. The Conceptual Framework of the Research Study

and job satisfaction must be prioritized [7]. By addressing these key issues, education managers, such as principals, school heads, and other key officials, must create mechanisms to improve science teachers' teaching skills, thereby contributing to national educational advancement.

In the Philippines, the study of bacteria is introduced in Grade 7 during the second quarter, specifically in Part 1, Lesson 4 of the topic "Living Things and Their Environment." However, in earlier years, discussions about health-related bacteria also played a crucial role in education. Students learn about the concept of good bacteria, such as probiotics, as well as harmful bacteria that can cause diseases and various health issues in humans [6]. The current literature highlights the significant role of microorganisms in supporting the life and health of other organisms. The topics on minute organisms, such as bacteria, represent significant steps in microbiology literacy. The topics can be found in various disciplines, from preschool to college. Common topics in the curriculum include diseases viewed as harmful entities. They often focus on the negative impacts of microorganisms on humans while overlooking their vital role in the daily lives of living things. To foster a more comprehensive understanding of microorganisms, it is important to discuss both the beneficial and harmful aspects in educational curricula, thereby strengthening students' microbiology literacy [8]. As a result, despite our limited equipment, such as a microscope, learners can still appreciate and value the concept of bacteria through a visual storyline. A comic strip can be a solution to the common problems in DepEd, but teachers must take responsibility for giving details and accurate explanations of bacteria as living organisms.

The purpose of this study is to utilize comic strips as instructional materials in teaching bacteria. Comics are currently among the most popular teaching tools in contemporary society and the educational landscape. They serve as supplementary teaching tools that illustrate abstract concepts in subjects like science. They not only enhance understanding of the subject areas but also captivate students' interest, making learning both enjoyable and impactful [9]. This is confirmed by another study that found that comic strips enriched students' motivation and engagement in the activities. The combination of text and visuals to create a storyline captures interest in a scientific topic regardless of its complexity. Thus, the approach not only facilitated a deeper connection to the materials but also fostered a more immersive learning experience [10]. Furthermore, according to expert validation, comics are recognized as appropriate and commendable teaching materials across various fields. Another study comparing traditional methods to comic strips as instructional materials found that students' performance improved; hence, comic strips serve as an excellent educational resource for teaching science concepts [11]. Overall, comic strips have significant potential for the science curriculum, but training and workshops for effective implementation should always be considered, especially for topics that require equipment such as a microscope. For instance, in bacteria, students can understand characteristics and features using a microscope. But using comics, you can define different parts through words.

2 Methods

2.1 Research Design

This study used a developmental research design to evaluate comic strips about microorganisms, specifically bacteria. This design was utilized because the respondents were given time to assess the innovative output of comic strips as instructional materials for teaching bacteria. Also, to ensure accuracy and make the comic strip more relevant, qualitative elements were included.

2.2 Research Instrument

In this research paper, the instrument was a researcher-made survey questionnaire taken from interviews and related literature. The survey was divided into two parts: Part 1 covered respondents' basic personal data, and Part 2 evaluated the comic strips on details of bacteria, illustrations, grammar, and the presentation of the comics themselves. This survey questionnaire was developed from an interview conducted before the research engagements and from a review of the related literature, including published articles. Science Educators and experts in the field were invited to evaluate the content to ensure the reliability of the instruments.

For the qualitative component, the study employed interviews, focus group discussions (FGDs), and open-ended questionnaires, through which participants provided written feedback and comments on the proposed comic strips. These qualitative instruments were developed by researchers and subsequently evaluated by Biology teachers to ensure relevance and validity.

2.3 Respondents of the Study

The respondents in the study consisted of 30 science teachers from the DepEd in the Municipality of Ajuy and an additional 102 pre-service teachers enrolled in the Bachelor of Secondary Education (BSEd) major in science and the Bachelor of Elementary Education. In total, 132 respondents participated in the research study.

The sampling technique employed in this research study to guarantee a scientific research report was to take all on the use of comic strips in teaching microorganisms in the basic education curriculum of the DepEd. The respondents were selected because they are students in "The Teaching of Science," "Science, Technology and Society," and "Research." The main purpose of selecting these pre-service teachers is that they all have experience with field study and are taught to develop innovations to be used in conducting action research as prescribed for passing the subject.

2.4 Data Collection Procedure

The researchers sought permission from the relevant officials and informants by sending a letter of permission. The study did not interfere with the classroom's usual operations. The survey was conducted during the class of pre-service teachers in elementary and secondary schools during their class. The researchers personally visited the respondents' schools. They explained the purpose of the research, then distributed the comic strips and handed in the research questionnaire to evaluate the proposed comic. Each respondent was given a week to evaluate the creative outputs. Before conducting this research paper, an in-house review and other pertinent documents were prepared.

2.5 Data Analysis Procedures

The study results were presented in a table through the rating scale checklist. A statistician helped the researchers assess data accuracy using descriptive statistics (frequencies, means, and percentages) for descriptive analysis, and, for inferential analysis, the Mann-Whitney Test was used.

3 Results and Discussion

Table 1 presents the level of satisfaction of science teachers with the use of the comic strip as instructional material in teaching bacteria.

Based on the findings, all the criteria are interpreted as satisfactory with a mean score ranging from 2.00 to 2.27. The overall findings yielded a mean score of 2.12, revealing satisfactory performance. Indicating that the instructional. The results indicate that the instructional materials were generally aligned with the learning objectives and pedagogical standards. The originality and innovation of the comic strips are well-suited to the science curriculum, demonstrating their potential as instructional

Table 1. Descriptive Statistics for Science Teachers' Satisfaction Levels on the Use of Comic Strips as an Instructional Material in Teaching Science

Criterion	N	Mean	SD	Interpretation
Content	30	2.10	0.80	Satisfactory
Format	30	2.10	0.66	Satisfactory
Presentation and Organization	30	2.13	0.78	Satisfactory
Accuracy and Up-to-datedness	30	2.17	0.65	Satisfactory
Appropriateness of Content	30	2.27	0.69	Satisfactory
Creativity and Uniqueness	30	2.23	0.82	Satisfactory
Effectiveness in Learning	30	2.07	0.79	Satisfactory
Originality of the Output	30	2.13	0.63	Satisfactory
Teaching Strategies/Approaches	30	2.27	0.79	Satisfactory
Suitability of Materials	30	2.03	0.67	Satisfactory
Writing Construction/Neatness	30	2.00	0.59	Satisfactory
Title of the Comic	30	2.03	0.67	Satisfactory
Interaction	30	2.10	0.61	Satisfactory
Critical Thinking	30	2.00	0.79	Satisfactory
Overall Satisfaction	30	2.12	0.57	Satisfactory

Note. Ratings are on a three-point Likert scale: 1 (Fair), 2 (Satisfactory), 3 (Very Satisfactory). Interpretation is based on mean ranges: 1.00–1.50 (Fair), 1.51–2.50 (Satisfactory), 2.51–3.00 (Very Satisfactory).

materials for learning about microorganisms. The innovations also reflect that the content was relatively current and factually sound, and that the structure and logical flow were acceptable for effectively facilitating students' understanding. But in the end, innovation still needs significant improvement to align with current resources and the study's intended objectives, thereby strengthening clarity and coherence and promoting higher-order thinking skills.

The results are confirmed by one study on digital comic strips, which were rated highly feasible by experts and well-accepted by students due to their visual clarity. In addition, these digital comic strips enhance students' comprehension, vocabulary, and motivation. Also, this innovation is an effective tool for improving students' reading skills and is recommended for wider use and further development[(12)]. Other results also emphasize the dual role of educational comic strips as tools for cognitive development and as having transformative potential that bridges scientific knowledge and learners' engagement[(13)]. Furthermore, the visual narrative elements in the comic simplify ideas, enhance motivation, and improve retention, thereby improving learning outcomes. This affirms that comics serve as effective pedagogical innovations that address the scarcity of traditional teaching materials[(11)]. To verify the results, a study using a comic strip to teach physics in grade 10 found strong agreement on its effectiveness as an instructional material. After use, a significant improvement in students' academic performance was very evident; hence, comic strips are a helpful and engaging instructional material in physics education[(14)]. Thus, the results confirm that comics are powerful tools for education, enriching learning experiences and addressing the scarcity of teaching materials in the science curriculum.

Table 2 exposed the level of satisfaction of preservice teachers in using comic strips in teaching microorganisms.

The study's findings show that, among the pre-service teachers, almost all criteria were rated very satisfactory, with mean scores of 2.53 and 2.85. Except for format, presentation organization, and writing construction and neatness, interpreted as satisfactory with a mean score of 2.25, 2.48, and 2.43, respectively. This indicates that these criteria have a high level across these aspects. The current results confirm that comic strips are an effective instructional tool for teaching science. Also, this improves students' comprehension and develops science process skills. Thus, the results recommend encouraging the creation of comic strips on other science topics[(13)]. Furthermore, another study exposed that comic strips improved higher-order cognitive skills, which is important for scientific literacy[(15)]. Also, between comic strips and traditional methods, students' reading comprehension was enhanced. This also improves students' understanding and engagement in reading[(5)]. Henceforth, the current study shows that a comic strip is a versatile instructional tool that supports comprehension, critical thinking, and active engagement across all disciplines and learning contexts.

One research study on project-based learning (PBL) in English as a foreign language (EFL) among teacher candidates found a lack of knowledge of digital tools, whereas teacher training programs highlight increased awareness of inclusive education.

Table 2. Pre-Service Teachers' Satisfaction Levels on the Use of Comic Strips as an Instructional Material in Teaching Science

Criterion	N	Mean	SD	Interpretation
Content	102	2.52	0.50	Very Satisfactory
Format	102	2.25	0.65	Satisfactory
Presentation and Organization	102	2.48	0.63	Satisfactory
Accuracy and Up-to-datedness	102	2.68	0.47	Very Satisfactory
Appropriateness of Content	102	2.75	0.46	Very Satisfactory
Creativity and Uniqueness	102	2.57	0.59	Very Satisfactory
Effectiveness in Learning	102	2.78	0.46	Very Satisfactory
Originality of the Output	102	2.81	0.39	Very Satisfactory
Teaching Strategies/Approaches	102	2.62	0.49	Very Satisfactory
Suitability of Materials	102	2.54	0.58	Very Satisfactory
Writing Construction/Neatness	102	2.43	0.55	Satisfactory
Title of the Comic	102	2.60	0.59	Very Satisfactory
Interaction	102	2.53	0.54	Very Satisfactory
Critical Thinking	102	2.85	0.36	Very Satisfactory
Overall Satisfaction	102	2.60	0.32	Very Satisfactory

Note. Ratings are on a three-point Likert scale: 1 (Fair), 2 (Satisfactory), 3 (Very Satisfactory). Interpretation is based on mean ranges: 1.00–1.50 (Fair), 1.51–2.50 (Satisfactory), 2.51–3.00 (Very Satisfactory).

They must integrate transformative technology into the curriculum to equip teacher candidates with the necessary skills to integrate digital tools[16]. Technology is an essential tool in today's educational landscape.

When pre-service teachers evaluate views and perceptions of the nature of Science (NOS) through activities, they identify specific themes that are essential to the science curriculum. These were: the course's contributions to them, the course content, and suggestions for improving the course[17]. If the activities implemented are carefully crafted, students consistently respond positively, benefiting essential science education.

The evaluation of the developed comic strip revealed significant differences across most criteria, indicating its overall effectiveness as an instructional material. Table 3 presents the results of the statistical analysis, highlighting which aspects were significant and which were not.

The *content* (U=1100.0, p=0.009), *presentation and organization* (U=1156.5, p=0.024), *accuracy and up-to-datedness* (U=888.0, p< 0.001), *appropriateness of the content (U = 946.0, p < 0.001)*, *creativity and uniqueness* (U=1202.5, p=0.043), *originality of the output* (U=655.0, p< 0.001), *effectiveness in Learning* (U=750.0, p < 0.001) and *teaching strategies and approaches* (U=1182.0, p=0.029), *suitability of materials* (U=919.0, p< 0.001), *writing construction and neatness* (U=980.0, p=0.001), *title of the comic* (U=846.5, p< 0.001), *interaction* (U=978.0, p=0.001), *critical thinking* (U=616.5, p< 0.001), and the overall (U = 757.5, p < 0.001), rated significant. The results demonstrate that the materials align well with the intended learning objectives and are considered appropriate and relevant by the evaluators. Also, this shows that the materials are well-structured, logically organized, and factually reliable, further supporting their educational suitability. This also suggests that the comic strips effectively mix novel and appealing elements that capture learners' interest. In addition, the findings indicate that the instructional materials ease comprehension and align with sound pedagogical approaches. These results together underline that the comic strips not only support content comprehension but also promote engagement, clarity, and higher-order thinking skills.

But one criterion, the *format* (U=1352.5, p=0.285), was rated not significant; thus, it suggests that the specific formatting aspects did not significantly affect evaluators' assessments of the materials' effectiveness.

The results of this study align with other published papers that emphasize the effectiveness of comic strips in enhancing knowledge of the subject areas, as well as engagement and motivation, even in science teaching and learning[13]. This study also validates that visual and interactive resources enhance learning, fostering critical thinking and sustaining interest in learning[18].

Table 4 shows the responses of the selected participants on the qualitative side of this study.

The responses from in-service and pre-service science teachers to the proposed innovations revealed both strengths and areas for improvement. First, most responses suggest consulting English experts on grammar and revising for clarity and greater impact on learners. The character drawings were excellent, but the colors are too light; the authors should add humor to the

Table 3. Comparing Satisfaction Levels Between Science Teachers and Pre-Service Teachers on the Use of Comic Strips as an Instructional Material in Teaching Science

Criterion	U	p	Interpretation
Content	1100.0	0.009	Significant
Format	1352.5	0.285	Not Significant
Presentation and Organization	1156.5	0.024	Significant
Accuracy and Up-to-datedness	888.0	<0.001	Significant
Appropriateness of Content	946.0	<0.001	Significant
Creativity and Uniqueness	1202.5	0.043	Significant
Effectiveness in Learning	750.0	<0.001	Significant
Originality of the Output	655.0	<0.001	Significant
Teaching Strategies/Approaches	1182.0	0.029	Significant
Suitability of Materials	919.0	<0.001	Significant
Writing Construction/Neatness	980.0	0.001	Significant
Title of the Comic	846.5	<0.001	Significant
Interaction	978.0	0.001	Significant
Critical Thinking	616.5	<0.001	Significant
Overall Satisfaction	757.5	<0.001	Significant

Note. p-values are for two-tailed tests and rounded to three decimal places. U is the Mann-Whitney statistic. Differences are significant at $p < .05$, with pre-service teachers rating higher. Interpretation: Significant ($p < .05$, difference exists); Not Significant ($p \geq .05$, no difference).

Table 4. Responses of In-service and Pre-service Science Teachers on the Comic Strip on Bacteria

Comments and Suggestions
Seek help from English experts to enhance the grammar.
Improve the title
The illustration is great, but the colors are too light
Add humor to make it easier for the reader
I hope this innovation can be accessible very soon
This innovation is important to make learners understand microbial balance in our ecosystem
Also, this innovation can inspire more students to like science

script to make it more engaging. Both agreed that innovation's potential could enhance microbial balance within the ecosystem, inspiring great interest among students in science. The title also improved from the first, which was "Prolific Organisms Called Bacteria." Based on the evaluator's suggestions and comments, we agreed to adopt the new title *"Bacteria Chronicles: Invisible but Mighty."* They highlighted that the title effectively captures the essence of the content. This indicates that teachers found the title engaging, memorable, and likely to spark students' curiosity, thereby increasing the likelihood that students will be interested in microbiology.

This confirms that comic strips not only enhance students' engagement and understanding but also introduce some innovative and effective strategies for the science curriculum. This indicates that comics can serve as powerful tools in science education, particularly for complex topics such as bacteria [19]. To verify, one study reported that respondents improved their ability to infer and communicate scientific concepts effectively when comics strips were utilized as a teaching tool [13]. Even though there were limited studies on comic strips, this innovation remains highly engaging and effective for personal growth and language development [20]. Another study of comic strips found that their use enhances the learning experience [18]. Science teachers and future educators must adapt the use of comic strips across all grade levels in science subjects.

One study found that, in addition to enhancing students' interest and engagement, comic strips also provide meaningful learning activities and improve English language skills. Also, this is considered practical and easy to use, and it reduces lesson preparation time. Thus, the teachers stated that comic strips can comfort and be used in future teaching; this can help with teachers' professional development and improve English Language teaching practices [21]. Also, a study on the use of comic media in biology education found that students had a better understanding of concepts when using these teaching resources [22].

In the science curriculum, one common challenge is that many students perceive science as a boring subject. This negative perception often stems from heavy emphasis on formulas, definitions, and technical drawing, which can make learning difficult, abstract, and less engaging. Thus, using comic strips as learning materials could be a good strategy in the science curriculum.

A study on the comic strip as teaching material for the human reproductive system and its practicality shows an average level of practicality. In terms of effectiveness, the innovation was highly effective, as students rated it very highly[23]. Even though some ratings are only average, these results indicate that using comics as a teaching tool has always had a positive impact on students.

4 Conclusions

The study's findings indicate that in-service teachers rated the innovations as satisfactory, while pre-service teachers rated them as very satisfactory. Statistical analysis further revealed a significant difference across key instructional dimensions. This affirms that comic strips are effective tools for teaching and learning science, particularly in comprehension, engagement, and science process skills. The findings highlight generational differences in receptivity to visual and narrative-driven learning resources and underscore the need for targeted professional development for experienced educators. Qualitative feedback further enriches these findings, revealing that while the illustrations, creativity, and educational relevance were praised, refinements in grammar, title clarity, color intensity, and the incorporation of humor could enhance accessibility and engagement. Importantly, teachers recognized the potential of *Bacteria Chronicles: Invisible but Mighty* to improve learners' comprehension of microbial balance and to foster interest in science, emphasizing the dual role of such innovations in promoting both understanding and motivation. These results contribute to the growing literature on science communication and multimedia pedagogy, demonstrating that well-designed comic strips can bridge conceptual understanding with creative engagement. The study highlights the importance of integrating visual storytelling, humor, and pedagogical rigor in instructional materials, providing a model for future educational innovations that can inspire both teachers and students to actively engage with complex scientific concepts. The novelty of this research lies in the development and experimental validation of a localized, content-specific comic strip that applies science communication principles in the Philippine education context. This innovation can address the limited availability of contextualized and concept-focused instructional tools in the science curriculum. Unlike previous research, this study focuses on engagement, a multidimensional, statistically grounded evaluation of the teaching materials' effectiveness. Further, this study addresses the research gap by providing contextualized teaching materials on microscopic concepts, fostering conceptual understanding and communication, and using a systematic evaluative framework involving both in-service and pre-service science teachers. Further, future studies should focus on enhancing the visual and linguistic elements of the materials. Also, using digital tools for an interactive format to make it more interesting is suggested. A longitudinal investigation is also advised to assess long-term learning outcomes and retention. These efforts will further strengthen the role of innovative instructional tools in science curriculum, not only in the Philippines but worldwide.

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6 Conflict of Interest

The authors have declared no conflict of interest.

7 Authors Contributions

Fernan Peniero Tupas: Conceptualization, funding acquisition, creating the comic strips, validation, formal analysis, writing—original draft preparation, writing—review and editing, project administration

Ma. Ivy V. Agreda: Writing—original draft preparation, writing—review and editing, project administration

Rhealyn B. Paguia-Babar: creating methodology, validation of the data, and providing resources
Jocelyn A. Arambola: Validation of paper, instruments, and other materials
Mary Ann M. Tuando**:** Statistical Analysis, Review, and editing
Jaspher L. Pastrano: Formal analysis, methodology, and editing of the manuscript
Reah Ann A. Torre: Review the content of the comic strip, analysis of statistical results, and refinement of the manuscript

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