Development of Supplementary Instructional Material in Science, Technology, and Society: Anchored on Reciprocal Teaching

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ABSTRACT

This study designed, developed, and validated a supplementary instructional material on Science, Technology, and Society (STS) anchored on reciprocal teaching. The study involved eight prospective teacher-users and thirty prospective student-users who were purposively selected to validate the materials from one of the higher education institutions in Bukidnon. The developmental research design was employed, following the instructional development stages of Seels and Glasgow: pre-development, development, and post-development. In each of the stages were the key tasks, respectively: needs assessment covering the STS course difficult topics; writing of the material parts based on the reciprocal teaching or Fab Four for the lesson design; and, the validation of the material by experts and prospective users. Findings revealed that all the features of the instructional material were very much adequately provided. The material met the expectations of the experts and prospective users. Their comments and suggestions were incorporated to enhance the materials further. The developed supplementary instructional material can be used to teach philosophical topics in STS.

Keywords: *Supplementary Instructional Material, Science, Technology, and Society, Reciprocal Teaching*

I. INTRODUCTION

Higher education plays a crucial role in equipping students with the knowledge and skills needed for national development, emphasizing critical thinking, ethical reasoning, and interdisciplinary learning. Science, Technology, and Society (STS) is a vital interdisciplinary course in Philippine higher education, aiming to develop students' critical thinking, ethical reasoning, and understanding of the societal impact of scientific advancements. However, effective STS instruction requires structured pedagogy, well-trained faculty, and comprehensive instructional materials to bridge the gap between theoretical knowledge and real-world application.

STS education faces challenges, including inconsistent implementation, limited instructional resources, and a lack of faculty training, which hinder effective teaching and learning (Cervantes & Osmeña, 2018; Ong et al., 2017; Sarmiento, 2015). Students also struggle with grasping the philosophical and societal dimensions of STS due to its abstract nature and their limited exposure to these discussions in traditional science subjects (Mijares & Mendoza, 2018; Ole, 2020).

To strengthen STS education, the Commission on Higher Education (CHED) incorporated the subject into the revised General Education Curriculum (GEC), emphasizing interdisciplinary learning and the development of essential competencies such as critical thinking, ethical reasoning, and science communication (CHED, 2013). Despite this, the initial faculty training had a low turnout due to financial and logistical constraints, leading to gaps in instructional quality and content delivery across higher education institutions (CHED, 2017).

Filipino students' low retention rates, limited analytical skills, and difficulty engaging with abstract concepts further complicate STS instruction (UP NISMED, 2014). The lack of structured, contextualized instructional materials exacerbates these challenges, making it harder for students to connect scientific ideas with broader societal implications (Ong & Cunanan, 2015). These issues highlight the need for supplementary materials that enhance comprehension and engagement of the students and aid for the teaching instructors.

This study seeks to address these gaps by developing and validating a supplementary

instructional material for STS, anchored in the reciprocal teaching strategy (Hattie, 2009). Popularized as the "Fab Four" by Oczkus (2018), this approach—predicting, questioning, clarifying, and summarizing—promotes active learning and collaborative discussion. Given STS's interdisciplinary nature, this strategy fosters deeper understanding by guiding students through complex topics in a structured manner.

The study is grounded in Vygotsky's (1978) Sociocultural Theory, which emphasizes social interaction and scaffolding as key to learning (Kurt, 2020). Additionally, Seels and Glasgow's (1988, in Branch & Dousay, 2015) instructional development model provides a systematic approach through three stages: pre-development (needs assessment and content selection), development (material creation and expert consultation), and post-development (validation by prospective users). By applying these frameworks, this research aims to produce a validated supplementary instructional material that enhances STS education, offering a structured, engaging, and contextualized learning experience for students.

II. METHODS

This study employed a developmental research design to systematically design, develop, and evaluate supplementary instructional materials in Science, Technology, and Society (STS). The development process followed the instructional model of Seels and Glasgow (1998, in Branch & Dousay, 2015), modified by Simbulan (2011), consisting of three phases: Pre-Development, Development, and Post-Development. The instructional materials were anchored on the reciprocal teaching strategy, commonly known as the Fab Four (Oczkus, 2018), which involves predicting, questioning, clarifying, and summarizing to enhance students' comprehension and engagement.

Conducted in a higher education institution in Bukidnon, the study involved purposive sampling of eight prospective STS teacher-users and thirty student-users who had completed the course. The Pre-Development Stage included a needs assessment to identify difficult STS topics and formulate a structured blueprint integrating reciprocal teaching. The Development Stage focused on writing and structuring lessons, ensuring engaging instructional strategies, and validating content with experts. The Post-Development Stage involved expert and user validation using evaluation criteria adapted from Micayabas (2017), Yazon (2018), and Oczkus (2010), assessing content clarity, alignment, and instructional design.

Data collected was analyzed using descriptive statistics. The output of this study was a validated supplementary instructional material designed to enhance the teaching and learning of STS through structured and interactive strategies.

III. RESULTS AND DISCUSSION

Needs Assessment Result

The needs assessment inquired on the common problems encountered by the teachers in their classes, the necessity to create instructional materials, the sequence of the presentation of the lessons, and suggestions about the material.

Table 1 presents the difficulty level of the STS topics as assessed by the instructors. The topics presented prescribed by CHED, and the topics with the highest means were considered in making the instructional materials. These topics included the following: The Society in the Face of Science and Technology, Human Flourishing, When Technology and Humanity Cross, and Why Does the Future Not Need Us: The Future with Technology.

Table 1*The Difficulty Level of STS Topics*

Topic	Mean	SD	QD
The Society in the Face of Science and Technology	3.50	0.93	D
Human Flourishing	3.50	0.71	D
When Technology and Humanity Cross	3.50	0.93	D
Why Does the Future Not Need Us: The Future with Technology	3.50	0.93	D
The Good Life	3.25	0.93	N
Industrial Revolution in the 17th Century	2.63	0.74	N
Science and Technology and Nation Building	2.63	0.52	N
Nano World	2.50	0.53	E
Gene Therapy	2.38	1.06	E
Science, Technology, and Society: World History	2.25	0.46	E

Science, Technology, and Society: Philippine History	2.00	0.93	E
Climate Change, Energy Crisis, and Environmental Awareness	1.88	0.99	E
Biodiversity and a Healthy Society	1.75	0.71	VE
The Information Age (Gutenberg to social media)	1.63	0.52	VE
Introduction to Science, Technology, and Society	1.63	0.52	VE

Legend:

VE = Very Easy, The subject matter is simple and can be easily taught without much effort;

E = Easy, The subject matter is straightforward and can be explained with basic teaching skills and methods;

N = Neutral, The subject matter requires some creativity and effort to make it interesting and may require some preparation;

D = Difficult, The subject matter is complex and requires significant effort and specialized teaching methods;

VD = Very Difficult, The subject matter is highly technical or specialized and may require advanced knowledge and strategies to teach effectively.

As shown in Table 1, the first four topics that were rated as *difficult* (D) by the STS teachers were related to the societal implications of science and technology. The topics that were difficult to teach may require additional effort and specialized teaching methods to ensure that the students understand the material. The topics rated as *neutral* (N) may require some creativity and effort and may benefit from incorporating more engaging teaching methods and material. Lastly, the topics with the lowest mean scores with the rating *very easy* (VE) and *easy* (E) were related to environmental issues, information technology, and introductory topics on science, technology, and society. These topics may not require extensive preparation to teach.

The study necessitated the identification of difficult topics to have philosophical concepts related to the nature of scientific knowledge, exploring the ethical implications of various scientific and technological developments, and examining the historical and social contexts. Teachers found it difficult to teach these philosophical concepts due to their abstract nature and difficult to grasp without a strong foundation in philosophy. At the same time, students were struggling to understand these concepts for it requires students to have background both in science and philosophy, which could be a challenge to those who were not well-verse in either discipline. These topics also were seen as less relevant or less important to the students, particularly those who did not plan to pursue careers in science and technology-related fields.

On the other hand, it is important to point out that STS philosophical concepts are crucial in developing critical thinking among students, particularly in understanding the complexities of science and technology's impact on society. Through STS, students can gain appreciation of the historical and social contexts, in which scientific and technological developments occur, as well as the ethical implications of these developments.

The result of this study, which found that teachers and students struggle with the STS philosophical concepts, aligns with Bencze and Bowen (2014) that STS philosophical topics are complex and abstract, which are difficult for the students to understand. The results are also consistent in that many students have limited prior knowledge of science or philosophy, which makes it challenging for them to understand the relevance of STS to their future careers or personal lives, leading to disinterest and lack of engagement in the course (Jafri & Ibrahim, 2016; Pedretti, 2011).

The study also supports the idea that STS courses aim to develop critical thinking among students and that the philosophical topics are necessary and relevant in teaching STS (Cuyegkeng, 2019; Lee, 2018; Ole, 2020). Bialystok (2017) mentioned that promoting philosophy across the curriculum requires educating teachers before they can teach it to their students. These philosophical topics of STS are unfamiliar to the teachers; thus, they face difficulties teaching them.

Furthermore, the common problems the teachers encountered in their respective classes support the findings. For example, questions were raised if students understood the concept from the book or the learning material. Only a few of them could answer. As observed, students only asked questions when directed by the teacher because they were likely to be shy and reluctant to ask for fear of being ridiculed by their classmates. Teachers

also mentioned that students lacked understanding of what they read and were likely to copy and repeat what their classmates previously answered, suggesting a need for clarifying the concept. The students also often requested the teachers to repeat the discussions, or the instructions, which underscores the importance of summarizing.

The teachers acknowledged further the necessity of creating instructional materials for STS to facilitate these students' understanding of the concept. They proposed incorporating updated and relevant issues and authentic and feasible activities that align with the student's cognitive capacity level. Additionally, the teachers recommended including online resources and using visually appealing materials to enhance the students' engagement with the subject matter.

The findings of this need assessment align with previous research, which has also identified factors in the development of instructional materials. De la Torre (2018) conducted a similar study that also resulted in the design of a module. Other studies have identified similar factors to warrant the development of instructional materials, including the difficulty in understanding the material, a lack of learning resources (Widiyante et al., 2016), and a limited variety of learning resources (Harahap et al., 2019). Additionally, needs assessment could be done through interviews (Nugraha et al., 2018) or site visits (Tolentino et al., 2020).

Design of the Supplementary Instructional Materials

Designing effective instructional material is an essential component of successful teaching and learning. As a result of the needs assessment, this material covers the following topics: The Society in the Face of Science and Technology, Human Flourishing, When Technology and Humanity Cross, and Why Does the Future Not Need Us: The Future with Technology. The needs assessment further led to the use of Fab Four (Oczkus, 2018) or the reciprocal teaching strategy to present the lessons of STS.

Reciprocal teaching (Hattie, 2009) or Fab Four by Oczkus (2018), is a collaborative technique that enables students to become teachers in pairs or small discussions circles, empowering them to take on roles and take turns leading discussion. This model engages students in reading, talking, thinking, viewing, and writing based on the four features: predicting, questioning, clarifying, and summarizing. Moreover, these features could be used interchangeably to facilitate the development of essential skills.

Table 2 shows the instructional design model of the study. The features of the Fab Four, which are predicting, questioning, clarifying, and summarizing provide anchorage for the presentation of the lessons in the instructional material. The Fab Four is a scaffold technique that serves as a more direct and structured approach to comprehending texts, emphasizing the implementation of various comprehension strategies while prioritizing metacognition and self-reflection (Oczkus, 2018). This model has been proven to be an effective tool in promoting students' development of a deeper understanding of the text while enhancing their confidence and efficacy as learners.

Table 2 *Instructional Design Model of the Study*

Features	Description
Predicting	The predicting feature enables students to activate their prior knowledge by making predictions based on what they infer from the text. This allows students to make connections between the new material and their real-life experiences, thus enhancing their understanding of the concept.
Questioning	The questioning feature involves formulating questions to guide students in understanding the topic comprehensively. Students take turns asking each other questions before, during, or after the presentation of the material. This approach helps students critically analyze the text and stimulates their thinking abilities.
Clarifying	The clarifying feature entails presenting detailed information on the topic to help students gain an in-depth understanding. This allows students to maintain their understanding of the concept and conduct further research. It enables students to reflect on the ideas discussed, which enhances their learning.

Summarizing	The summarizing feature requires students to develop concise statements that identify the main idea of the topic. This includes synthesizing and re-stating the key points and supporting details, which allows students to apply their understanding. Summarizing is a crucial skill that helps students to retain and recall information accurately.

The use of reciprocal teaching strategy is supported by the claims of Stricklin (2011) that each of the features of reciprocal teaching contributes to student success. Predicting encourages students to read actively and helps them form a purpose for reading. Additionally, questioning fosters comprehension as students must first understand what they read from the material before asking their peers. It follows that when students are unable to generate questions, it may indicate that they did not understand the reading content or when they could not think of any questions to ask their peers (Yang, 2010). Clarifying words and ideas helps students make connections and evaluate the text (Zendler & Reile, 2018). Lastly, summarizing helps students concentrate on the main idea and supporting details of the text, allocating attention, and monitoring their understanding (Thurston et al., 2020).

Thus, integrating the Fab Four in the instructional material will help the students improve their critical thinking and communication skills (De Leon, 2017; Garinger et al., 2015; Matala & Mendoza, 2015). These are positive considerations of the strategy; however, Choo et al. (2011) stressed that it is essential also to consider that it could be time-consuming to follow the procedures from one strategy to another, proceeding from predicting to questioning, clarifying, and summarizing.

Development of the Supplementary Instructional Material

The instructional material's development began with identifying the difficult topics and the strategy to present the lessons. Conducting a needs assessment identified the gaps and provided information that could be used to develop the material (Altschuld, 2010). This material is described as supplementary material (Richards, 2001, as cited in Cahyaningrum et al., 2016; Remillard & Heck, 2014), which is a nonrequired instructional material, but the teachers and students could use to encourage learning, enhance motivation, and provide support in their class (Shaw, 2020).

Moreover, the developed instructional material has the following components: cover page, foreword, table of contents, topic title page with a small illustration, topic outline, learning outcome, and learning objectives, priming activity, discussion of the content, and different activities presented using the Fab Four, assessment, and references.

The cover page of the material illustrates the interrelationship of science, technology, and society. The blue background is a satellite map of the Philippines, emphasizing the country's central role in scientific and technological advancements. These discoveries include the endemic fauna and flora and a glimpse of Manila's modern urban landscape, representing an advanced society. Furthermore, the cover page showcases different philosophers who have contributed to the content discussing the implications of science and technology to society in this material. This cover page implies that the lessons are contextualized to the Philippine setting.

Moreover, the foreword discusses the rationale of the instructional material, including its anchorage on the reciprocal teaching strategy. The table of contents shows the organization of the contents, allowing the user to navigate quickly and locate the specific information they are looking for. Every topic included a small illustration to communicate the theme to the readers visually. This part also included the learning outcome and objectives to provide the reader with a clear understanding of what they can accomplish after engaging with the material. The learning outcome is the ultimate goal of the material, as prescribed by the CHED. In contrast, the learning objectives are specific, measurable, and achievable targets that the reader must meet to achieve the learning outcomes.

The material incorporated a priming activity to set the stage for an engaging and interactive learning experience. The discussion started with an introduction, followed by the content and activities arranged according to the Fab Four. Each activity is purposeful to enhance specific skills. Contextualized rubrics provided the readers with clear and specific

criteria for evaluating their performance concerning the learning objectives. The material is concluded with an assessment for the students to answer. The assessment tasks evaluate the reader's comprehension of the material and measure whether they have met the learning outcomes and objectives. Lastly, a references page is included to provide the readers with a list of sources cited in creating the material. Figure 3 shows the different parts of the developed supplementary instructional materials in STS anchored in reciprocal teaching.

Moreover, upon the completion of the material, the researcher subjected it to initial critiquing by the experts. The experts conducted an initial evaluation during the development process.

The size of the material can impact its usability and accessibility. Using a smaller size may make it easier for students to handle and navigate the material (Saunders, 2020). Adding pre- and post-assessments is necessary to assess the students before and after engaging with the material (Tan, 2019). The availability of the writing space allows students to engage with the material. A picture or visual representation of the topic could capture the student's attention. These factors are strongly supported by Tindal-Ford et al. (2017), which emphasize the importance of creating visually engaging and appealing instructional material to capture the students' attention and maintain their interest.

Incorporating visual aids and multimedia elements in supplementary materials can positively impact student engagement, motivation, and comprehension (Park & Lee, 2016; Reiser & Dempsey, 2018). These results further agree with Rogayan & Dollete (2019) that instructional material should include differentiated activities, address immediate needs, and encourage creative and critical thinking among the students. Hence, visually appealing and engaging instructional material could encourage critical thinking and creativity among the users.

Validation of the Supplementary Instructional Material

The experts, prospective teacher-users, and prospective student-users validated the developed supplementary instructional material. This section presents the rating of the experts on the material based on the content, constructive alignment, clarity and appropriateness, and instructional design and technology. The summary of the experts' ratings on the supplementary instructional material is in Table 5.

Table 3 shows the summary of the indicators used by the experts to rate the development of the instructional material. These indicators include the content, constructive alignment, clarity and appropriateness, and instructional design and technology. All the indicators were rated as *very much evident* (VME) by the panel of experts, which means that all the features of the instructional material are very much adequately provided.

Table 3 *Summary of the Expert's Rating on the Supplementary Instructional Material*

Indicators	Mean	SD	QD
Content	4.87	0.35	VME
Constructive Alignment	4.93	0.26	VME
Clarity and Appropriateness	4.87	0.35	VME
Instructional Design and Technology	4.47	0.52	VME
Overall	4.79	0.42	VME

Legend: VME – Very Much Evident (QS: The features are very much adequately provided)

These ratings indicate that the materials have been carefully developed and can be relied upon to perform well and meet their intended purpose. The results indicate that the instructional material is well-designed, relevant, and effective in meeting the users' needs and expectations. The high ratings on the indicator of content, constructive alignment, and clarity and appropriateness suggest that the content is comprehensive, aligned with the learning outcomes, and well-presented, respectively.

On the other hand, the lower rating on the instructional design and technology indicator suggests some room for improvement in the use of technology and design elements in the developed instructional material. One possible reason for this slightly low mean rating is the presence of long and unclear links or URLs in the material, which could

lead to difficulty in access and navigation. This can result in a lack of engagement and frustration among students, which can negatively impact their learning experience. In order to improve the use of technology and design elements, there is a need to consider using more user-friendly platforms and tools, such as interactive simulations or multimedia resources, that are easier to navigate and engage with.

The findings of the present study are consistent with Ramli et al. (2020) that emphasized the significance of media assistance in scaffolding student learning, while Ramos et al. (2016) and Kim and Bonk (2013) suggested that including technology can make the instructional material interactive and relevant for the users. Moreover, the study also aligns with the findings of Torrefranca (2017) and Calatrava (2017), who highlighted the negative impact of unclear pictures and thumbnails, font style and sizes, subtitles, and instructions of the instructional design effectiveness.

Furthermore, the study's findings align with Dantic (2023), which emphasizes that effective learning for students is achieved through an appropriate instructional design that considers the students' strengths and weaknesses. Designing effective instructional materials requires consideration of the student's needs and abilities to achieve learning outcomes.

Hence, instructional designers and educators should ensure that the visual elements and integration of technology used in the material are clear, engaging, and relevant. Clear and concise instructions, appropriate font style and size, and media assistance can enhance the effectiveness of instructional materials. This technique can improve the materials' effectiveness, enhance the students' engagement, and facilitate their understanding and interpretation of the content.

In this section, the data are on the validation of the prospective teacher and student-users on supplementary instructional material based on the learning objectives, content, assessment activities, and integration of the reciprocal teaching strategy (Yazon, 2018; Oczkus, 2010). Table 4 shows the overall mean rating of the validation done by the prospective teacher users is *very much evident* (VME) which means that of the supplementary instructional material adequately addressed all the necessary features. Specifically, the prospective teacher-users found the material met the standards for each indicator including the learning objectives, integration of reciprocal teaching strategy, content, and assessment activities.

Table 4 *Summary of Validation by the Prospective Teacher Users on the Supplementary Instructional Material*

Indicators	Mean	SD	QD
Learning Objectives	4.88	0.34	VME
Integration of Reciprocal Teaching Strategy	4.88	0.33	VME
Content	4.70	0.46	VME
Assessment Activities	4.55	0.64	VME
Overall	4.75	0.46	VME

Legend: VME – Very Much Evident (QS: The features are very much adequately provided)

As shown in the Table, all indicators have the rating of *very much evident* (VME), which generated the qualifying description that all the features are very much adequately provided in the instructional material. The findings suggest that the learning objectives and the reciprocal teaching strategy is an effective approach to enhancing the learning outcomes. The well- structured content also suggests that the learning objectives were clearly defined and that the instructional design was effective in facilitating learning. Although the indicator for assessment activities was rated as Very Much Evident (VME), it received the lowest mean score that would indicate the need for revisions.

This may suggest that the assessment activities did not align perfectly with the learning objectives. The assessment activities are essential components of the learning process, and their alignment with the learning objectives is critical to ensure that they are effective in measuring student achievement. These findings highlight the importance of continuous evaluation and improvement of instructional materials to ensure they remain practical and relevant to learners.

Hence, teachers and instructional designers could use this experience to prioritize revising student assessment activities. Furthermore, the prospective teacher users provided general feedback on the materials. The comments below are their authentic and unedited statements.

"I really salute you for coming up with this wonderful IM. This is a huge help to the academe." (Teacher 1)

"A substantial, informative, and engaging instructional material. It is self-contained." (Teacher 2)

"Overall, the IM is well-prepared and fit for use." (Teacher 3)

"Once again, congratulations, Ma'am, for this initiative and innovative topic. Your IM will be a big help to the department." (Teacher 4)

The findings of this study affirm the claims of Paredes (2015) and Gustiani et al. (2017) on the importance of proper explanation and readability in instructional materials. Revisions may be done to have clear and specific directions, simple language, a variety of activities, and clarity of the content to improve the material (Anzures, 2022). These findings align with Medina and Baraquia's (2023) views, who stated that a well-designed module should be self-sufficient and organized and provide a structured learning experience with clear learning outcomes and assessments. A comprehensive approach that prioritizes students' learning is necessary for effective module design.

Table 5 summarizes the prospective student users' validation of the supplementary instructional materials. The overall mean rating suggests that all the criteria provided in the instructional materials are *very much evident* (VME), indicating that the use of reciprocal teaching strategy, content, learning objectives, and assessment activities are adequately provided. It shows that the highest mean rating is about integrating the reciprocal teaching strategy. This strategy allows students to take on the role of a teacher by asking questions, clarifying concepts, summarizing ideas, and making predictions. It encourages active learning and improves critical thinking skills, which leads to better understanding of concepts. The student users also observed that the content was engaging and stimulating, which encouraged students to participate actively in the learning process.

Table 5*Summary of Validation by the Prospective Student Users on the Supplementary Instructional Material*

Criteria	Mean	SD	QD
Integration of Reciprocal Teaching Strategy	4.77	0.46	VME
Content	4.67	0.51	VME
Learning Objectives	4.66	0.53	VME
Assessment Activities	4.60	0.56	VME
Overall	4.68	0.51	VME

Legend: VME – Very Much Evident (QS: The features are very much adequately provided)

Additionally, the learning objectives ensure that the material is well-designed lessons and could help guide the students. The use of multimedia materials enriched the teaching and learning process. It is evident in the comments of the students presented below. On the other hand, the lowest mean rating is on the assessment activities, but it was still rated as VME. This validation suggests that while the assessment activities were considered effective, there is still room for improvement and calls for reviewing and revising the activities included in the material.

"I like the cover page (photo) for every lesson because honestly, it has captured my interest and curiosity." (Student 1)

"The titles of the main topics are attention-raising for it was constructed in a way that excite the curiosity of the students." (Student 2)

Furthermore, the developed instructional material is promising in improving the teaching and learning process by allowing teachers to effectively deliver topics and engage students in active learning. The developed instructional material effectively meets the learning objectives and engages the learners in content that integrates reciprocal teaching. It means that the material could be a valuable tool for educators to use in enhancing the teaching and learning of science, technology, and social topics (Dhakal, 2020; Sagge & Bacio, 2022). The study further agrees with Luzano (2020) that effective learning material has clear instructions for the activities, and the words to be used should also be suited to the reading comprehension level of the students.

IV. CONCLUSION AND RECOMMENDATIONS

Based on the result and findings of the study, the following conclusions are made:

1. The STS teachers found it difficult to teach philosophical topics in Science, Technology, and Society, thus, it is important to design instructional materials that can help the teachers deliver the topics effectively.

2. The instructional design model was the Fab Four or the reciprocal teaching strategy which provided an opportunity for the students to develop critical thinking, comprehension, metacognition, and self-reflection skills.

3. The supplementary instructional materials developed are anchored on reciprocal teaching and are visually appealing and engaging.

4. The developed supplementary instructional materials in STS anchored on reciprocal teaching provided the necessary features of an instructional material.

The following recommendations are drawn from the findings of the study:

1. The developed and validated Supplementary Instructional Materials in Science, Technology, Society anchored on Reciprocal Teaching may be used by the STS instructors to teach the philosophical topics of STS.

2. The visual elements and technology integrated into the instructional material may be revised to make it clearer, more engaging and relevant to encourage critical thinking and creativity among the users.

3. A closer investigation on the developed supplementary instructional material may be conducted to revise how the objectives and assessment activities were written for continuous evaluation and improvement.

4. The administration may encourage the teachers to develop instructional materials, prioritize teacher training and professional development, and allocate resources to develop assessment tools and techniques.

5. Future research studies may further investigate the acceptability and effectiveness of using supplementary instructional material through an experimental study.

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