Journal of Namibian Studies, 33 (2023): 5430-5458 ISSN: 2197-5523 (online)

Development Of A Worktext In Science, Technology, And Society

Jill Ann R. Paranada[1], Carmela M. Florentino[2],
Jenny Grace I. Almazan[3], Germana Gloria V. Molina[4]

[1]jillann.paranada@unp.edu.ph
[2]carmela.florentino@unp.edu.ph
[3]jennygrace.almazan.@unp.edu.ph
[4]gloria.molina@unp.edu.ph
[1]University of Northern Philippines, Tamag, Vigan City, Ilocos Sur, 2700 Philippines.

Abstract

Science, Technology, and Society is one of the new General Education courses offered under the Philippine educational reforms implementing the Enhanced Basic Education Act of 2013 (Republic Act 10533). The teaching of STS presents significant challenges in ensuring that the students acquire the necessary competencies they ought to learn. Instructional materials in STS are only slightly adequate and slightly available. The study aimed to create a worktext that could serve as a valuable resource for educating students about the course. This study's research and developmental method involved creating and evaluating the worktext. The study used the 5E model of instructional design to develop the worktext. It was evaluated for its validity in terms of content, clarity, appeal to the target user, and originality. The evaluation revealed that it is highly valid and readable by the intended target users. It is recommended that the STS worktext be used in the course's teaching-learning process and should undergo an evaluation to further validate its effectiveness and practicability. Teachers should be trained and encouraged to develop their instructional materials related to their field of specialization with the support of the university administration.

Keywords: development, worktext, instructional materials, science, technology, society, instruction.

1. Introduction

Science, Technology, and Society is one of the new General Education courses offered under the ongoing Philippine educational reforms brought about by implementing the K-12 program or the Enhanced Basic Education Act of 2013 (Republic Act 10533). This is taken by all undergraduate students regardless of their major. It introduces them to various fields of knowledge and methods for comprehending social and natural realities, assisting them in developing critical, analytical, and creative thinking abilities, as well as the capacity for multiple forms of expression and civic engagement required for citizenship in a community, a nation, and the global community. (CMO No. 20, series of 2013).

Science is one of the subjects that is offered to freshmen students. This is among the highest priorities due to its links to technology and industry (Pardo, as cited by Aninag et al., 2020). Science, Technology, and Society study how science and technology interact with the social, cultural, political, and economic factors that impact and shape them. STS aims to provide students with the reflective knowledge they need to make moral choices in the face of scientific and technological advances. Additionally, climate change and environmental awareness are required topics in this course. (CMO No. 20, series of 2013).

Considered to be in its infancy, the teaching of STS presents significant challenges in ensuring that the students acquire the necessary competencies they ought to learn. These challenges include the course itself, the teacher factor, the learner factor, the physical infrastructure, and the instructional or teaching materials.

Several predictors that contribute to the low interest and poor performance in science include a lack of skilled scientific teachers, a shortage of good textbooks, a lack of suitable tools, and the abstract character of science subjects a lack of skilled scientific teachers, a shortage of good textbooks, lack of suitable tools, and the abstract character of science subjects. Among all the instructional issues facing science education, curriculum implementers and the academic community identify that there is a deficiency in the availability and adequacy of instructional materials, especially in the new general

education courses that include Science, Technology, and Society (Bello & Olajide, 2012) Greessonbach (2013), and Science Education Institute, Department of Science and Technology (SEI-DOST) (2011).

The only resources available to students for studying are written books that include a variety of facts that must be retained verbatim but are irrelevant to daily life. It is feared that it might hinder the student's critical thinking ability. The instructor has never produced modules, workbooks, or other teaching materials to facilitate learning. In a perfect world, students should have access to adequate learning spaces where the instructional materials could facilitate their learning activities (Mohzana, 2023). As a result, one of the significant issues must undoubtedly be the necessity to structure and build IMs responsive to the country's changing environment of learners and pedagogy.

Even though educators continually work to improve the educational system, curriculum revision, and syllabus enrichment are necessary to keep up with how quickly time is modernizing. Creating teaching materials is one of the curricular decisions that the individual instructor participates in. The teaching-learning process is enhanced using instructional resources, including modules, computer-assisted instruction, work manuals, and similar tools. These instructional materials are carefully, logically arranged, and structured, emphasizing practice and drills, for learning begins and progresses through experience (Garcia, 2020). Cadorna (2023) et al. added that teachers must be capable of selecting and applying a broad range of teaching strategies and learning materials. This student will engage, explore and integrate their knowledge, abilities, and understanding in different learning areas and the real world.

Development of instructional materials includes creating a working plan and the modules' accurate composition. The availability and use of instructional material on students' academic performance expedites the teaching and learning process, provides independent learning and a remedial tool to slow learners, and enhances it for fast learners (Selga, 2013).

Additionally, with the current switch from inputs-based education (IBE) to, specifically at the tertiary level, outcomes-based education (OBE). It is crucial for teachers to properly plan activities to address the focus of the teaching-learning process; students' needs should be prioritized. Today's educational landscape has changed somewhat, and the traditional teaching approach with just a chalkboard and a lecture can no longer be an effective pedagogy. Teachers handling STS must, therefore, use all the necessary means suited to the level of understanding of their students. They must make teaching-learning enjoyable by employing current instructional materials to make instruction more effective, efficient, and appealing to the learners (Nicholls, 2010). Theories concerning instructional materials assume a causal link between strategies for instruction and student learning outcomes.

Furthermore, the importance of developing self-instructional materials is emphasized. It is a strategy that offers chances to create a compelling educational plan that accepts and fosters goals and accomplishments. This period of individualized programs calls for teachers to design or prepare instructional materials tailored to specific groups of students, whether the teaching is meant for the entire class or a single student (Gibbon,2004).

Hence, teachers need to explore different instructional methods which can be applied in a classroom setting to enrich and improve instruction. This entails the creation of educational resources and activities that guarantee students complete particular learning objectives or course outcomes indicated in the curriculum and offer pertinent guidance suitable for various learning environments. These teaching resources can help teachers adopt integrated science learning and support students' comprehensive and genuine science learning. They also allow students to broaden and deepen their knowledge by providing a variety of firsthand, developmentally appropriate experiences and by assisting learners in acquiring symbolic knowledge by representing their experiences (Almazan et al., 2020).

Instructional materials may also be seen as an alternative measure to solve the usual problem encountered by teachers of not having enough

time for instruction due to the disruption of classes brought about by school activities, natural calamities, and especially during the pandemic where face-to-face classes were not possible failing the teacher to finish and deliver all the content, learning competencies, and performance standards required of the course. Hence, there is a need to resort to other modalities, such as online and offline learning methods, including take-home readings and activities where a work text could be one (Abualrob & Shah, 2012).

The knowledge is intended to be transferred to learners through print and not printed materials, which are used during the learning process as educational material. Because there are not enough high-quality, engaging textbooks and learning materials readily available to students, it is hard for them to improve their learning and technological skills. As they also significantly improve the test scores of students who use them, educational materials are essential for learning all subjects in the school curriculum. (Faize and Dahan, 2011 and Anderson, 2020)

Further, learning materials such as work texts assist the teaching-learning process. Each instructional design model emphasizes the importance of needs analysis, goal specification and design of learning objectives, materials design based on needs analysis and aims, development of appropriate instructional strategies, formative and summative evaluation, and improvement of materials based on results of the evaluation (Abualrob & Shah, 2012).

Many higher education students are already familiar with the printed module as a source of information. Numerous research has already examined its effect on students' learning in academics. Most demonstrated the value of using modular education to improve college students' knowledge and perform better (De Leon, 2023).

Aside from the module, the worktext also effectively develops critical thinking skills. Suppose educational institutions include comparable activities in their curricula; future students/citizens will be equipped with these much-needed abilities when they reach the job (Wallace & Jefferson, 2013). Also, the contents of the worktext aligned to their

passion and interest may address the cognitive needs of the students (Aureada, 2017).

Given these constraints, the researchers conceived the concept of developing a worktext, a cross between a textbook and a workbook that could be used as STS instructional materials. The primary purpose of the research was to develop a worktext in Science, Technology, and Society to fulfill the course's teaching and learning needs.

Theoretical Framework and Literature Review

Developing instructional materials, particularly a worktext, draws on various theoretical underpinnings from education, psychology, and instructional design. These theoretical foundations provide a solid framework for creating effective instructional materials that promote active learning, engagement, and knowledge retention. Some vital theoretical underpinnings that served as the basis of the study include constructivism, cognitivism, and experientialism.

A significant learning theory, constructivism, is particularly relevant to the teaching and learning of science. Piaget proposed that people build new knowledge from their experiences through assimilation and accommodation. According to constructivism, learning is a process in which students create new ideas and concepts based on their past knowledge and newly acquired information. The constructivist teacher is a facilitator who pushes students to create their knowledge inside a predetermined framework or structure (Herr, 2007). This theory contends that worktexts ought to be created in a way that motivates students to actively engage with the material, investigate ideas through practical applications, and draw connections between theory and practice.

The 5E instructional model is one of the finest ways recommended for teaching within a constructivist learning approach, according to Ergin, Kanli, and Ünsal (2008).

The 5E teaching model is viewed by Ergin, Kanli, and Ünsal (2008) as one of the most desirable approaches for teacher training in a constructivist approach. The 5E instructional model can help students

move from understanding concrete experiences to applying principles (Llewellyn,2007). The 5E educational paradigm is based on the Atkin and Karplus learning cycle, used in the Science Curriculum Improvement Study (SCIS) program in the early 1960s. Engage, Explore, Explain, Elaborate, and Evaluate are the five phases of teaching and learning (Bybee et al., 2006).

This evidence-based approach effectively guides science teaching and learning. It promotes active, constructivist learning, in which students draw on prior knowledge, pose questions, engage in hands-on experiences, and conduct exploratory and formal investigations to develop their explanations for scientific phenomena. Through literacy skills, students are allowed to demonstrate and reinforce their progress in understanding. They are actively participating in the learning process. Science inquiry skills and an understanding of the nature of science are developed by students (Australian Academy of Science, n.d.).

Meanwhile, Bloom's taxonomy gives educators a common language to discuss and share teaching and evaluation strategies. Though taxonomy can determine specific learning outcomes, it is primarily employed to evaluate learning on various cognitive levels. Bloom's taxonomy is a tool that educators can use to give pupils more opportunities to develop their metacognitive skills. This can be achieved by developing learning activities based on Bloom's revised taxonomy, which will positively influence students' metacognition and allow them to participate actively in the educational process. Practical learning of a fascinating lesson using Bloom's taxonomy can lead to promising results and objectives. Taxonomy serves as a framework to assist instructors in categorizing the statements used to forecast students' ability to learn due to the learning activities carried out in class.

First and foremost, using taxonomy helps instructors examine learning objectives regarding behavior, allowing them to consider what the student can do with the instruction. A learning objective in action verbs shall indicate the most appropriate way of assessing skills and knowledge learned. And learning goals considering Bloom's taxonomy

highlight the need for including learning objectives that require higher levels of cognitive skills that lead to deeper learning and transfer of knowledge and skills to a greater variety of tasks and contexts (Adams, N. E., 2015).

Another theory that inspired the researchers in this study is cognitivism. Cognitivism relates to how information is collected, organized, preserved, and retrieved in a person's mind. The cognitive theory says that the brain works as a computer or an information processor. Therefore, The cognitivist approach regards learning as an internal mental process beyond visible behavior. In the classroom, cognitivism provides beneficial learning settings that grow through interactive mental activities that promote students' cognitive abilities. For example, when students listen to thought-provoking questions, their brains are tutored to travel from their present knowledge to find solutions.

Cognitivists believe that humans learn from thinking. They think learning from our experiences can change our behavior to take advantage of new information. Knowledge is considered part of the internal process, which is not a product. The cognitive learning theory holds that the acquisition of knowledge arises when learners learn to think through problems in an active way.

Cognitive theorists posit that human learning stems from the process of thinking. They assert that through assimilating experiences, we can adapt our actions to incorporate novel information. This perspective views knowledge as an integral part of internal mental processes rather than a static outcome. The cognitive learning theory asserts that knowledge acquisition occurs when learners actively engage in critical problem-solving. Advocates of this theory contend that human learning emerges from cognitive engagement, where experiences prompt behavioral adjustments. They emphasize the role of active thinking in the learning process, contrasting it with the mere absorption of facts and procedures. This approach highlights the importance of active participation, where students tackle meaningful tasks demanding the application of their cognitive abilities, in contrast to passive learning, which entails rote memorization. (Structural Learning, n.d.).

Experiential learning theory, proposed by David Kolb (2014), emphasizes the importance of learning through direct experience and reflection. Worktexts can incorporate experiential learning by providing real-life scenarios, simulations, and problem-solving tasks that require learners to apply their knowledge in practical situations.

As per Lev Vygotsky, a Soviet psychologist, interaction is pivotal in facilitating learning. Moreover, the cognitive growth of humans is shaped by the cultural context they are embedded in, influencing both the content and manner of their thinking. Vygotsky emphasized that children make better progress when guided by adults. However, for this guidance to be practical, it should be confined within a specific range, termed the "Zone of Proximal Development" (ZPD). This ZPD is the space between tasks a child can accomplish independently and those that are excessively challenging to undertake alone, thus lying beyond their current abilities.

The structure formulated by Vygotsky offers a valuable instrument for creating suitable classroom activities aligned with our student's abilities. Teaching significantly beyond or below this level would be counterproductive. Nonetheless, the instructor must steer the process, ensuring that learning commences when the student demonstrates capability, employing a scaffolding approach. This scaffolding technique requires that the teacher provides learners with enough individualized support building on prior knowledge, and the "whole picture" is divided into small, interconnected pieces (Sudirtha, G., Widiana, W., and Adijaya; M.A., 2022).

Instructional materials play a crucial role in education, serving as tools that facilitate the teaching and learning process. They encompass many resources, such as textbooks, workbooks, multimedia presentations, online modules, and manipulatives. Recent research has found that instructors employ a wide range of teaching resources, even when a specific curriculum is needed, suggested, and made available (Wang et al.,2021).

Moradi et al. (2018) emphasized the significance of high-quality instructional materials in enhancing teaching effectiveness and student learning. Instructional materials can provide clear and organized content, offer varied representations of information, and cater to

diverse learning styles, leading to improved understanding and retention of knowledge.

Instructional materials that blend instructional content with practice exercises and activities have improved learning outcomes. Students tend to perform better on assessments and retain information more effectively when using these instructional materials than traditional textbooks or workbooks, focusing solely on content delivery (Defino et al., 2022).

Within educational institutions, crafting instructional resources is a crucial element that can enhance student learning and contribute to attaining academic aims. Educators should prioritize advancements in these materials, engaging in research and advocating for contemporary, inventive approaches to enhance the educational framework. (Kapur, R. 2019).

Workbooks have been investigated in science, technology, engineering, and mathematics (STEM)education as practical tools for promoting hands-on learning, problem-solving skills, and critical thinking. Integrating theoretical knowledge with practical exercises in workbooks to enhance students' understanding of STEM subjects is emphasized. (Araza, 2023)

The worktext, an instructional material, primarily aims to make topics systematic and exciting by incorporating activities. The fundamental concepts and principles are explained clearly and with concise explanations or examples to facilitate the learning process anchored in different learning principles (Cadorna and Cadorna (2009).

Given their significance, it is essential that generated instructional materials go through validation to give better education. The evaluation can provide accurate assessments of the appropriateness of learning resources intended for use by students. The process includes planning and development. Reyes and De Guia (2015) evaluated their created worktext for content, clarity, appeal, and originality. Their findings showed that instructional materials such as worktext must be user-friendly and present ideas and concepts. Thus, it becomes helpful to both the learners and the teacher utilizing the material.

An alternate approach to evaluating the work guide involves examining its components, including Lesson Objectives, Lesson Inputs, Lesson Application, and Lesson Enrichment, as well as assessing its clarity, usefulness, suitability, adequacy, timeliness, language, writing style, formatting, illustrations, and how it is presented. The lectures, tasks, exercises, and information should be easily understood, direct, and uncomplicated. The lessons should offer ample information and encourage learners' critical thinking abilities. The activities should be fitting, engaging, self-motivating, and adaptable for classes with varying numbers of students. (Espinar and Ballado, 2016)

Selga (2013) determined the availability and adequacy of instructional materials and the needed topics in Science, Technology, and Society. The research revealed a lack of sufficient and suitable instructional materials in Science, Technology, and Society. As a result, there is a requirement to create a study-specific work guide for this subject. The work guide produced by the research was assessed based on the validity of its activities in terms of content, layout, and readability. The study's policy recommendations suggest a need to allocate instructional materials appropriately. If new materials are being developed, they should be created accurately and tailored to their intended users. Moreover, instructional materials should be effectively utilized appropriately and with the expected level of quality.

By integrating these theoretical underpinnings and the criteria or indicators of the cited studies, the researchers developed a dynamic and effective educational resource material in Science, Technology that aligns with the principles of active learning, engagement, and meaningful application of knowledge, contributing to improved learning outcomes for intended learners of the course.

Research Objectives

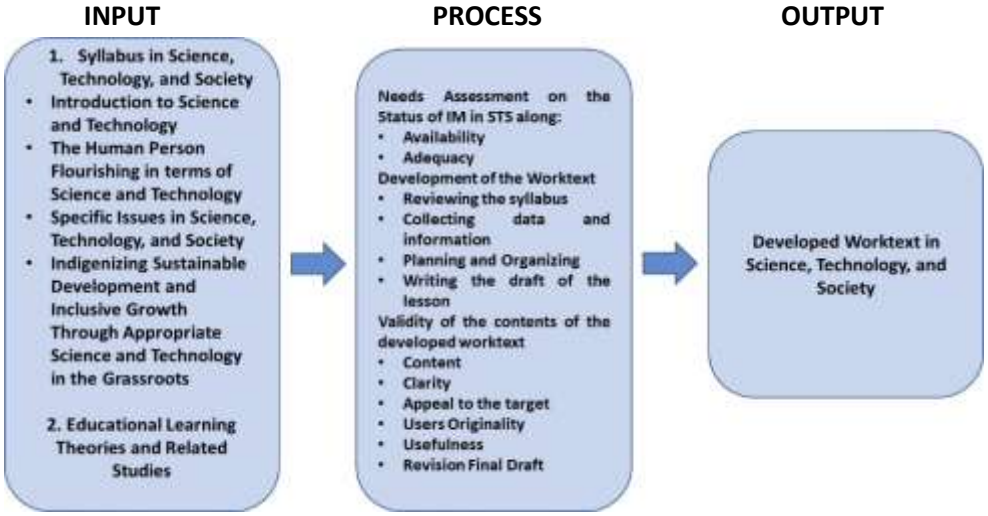
This study aimed to develop and validate a Worktext in Science, Technology, and Society. Specifically, it sought to assess the availability and adequacy of the instructional materials in STS; describe how the following topics may be developed into a worktext: Introduction to Science and Technology; The Human Person Flourishing in Terms of Science and Technology; Specific Issues in Science, Technology, and Society; and Indigenizing Sustainable Development and Inclusive Growth Through Appropriate Science and Technology in the

Grassroots; determine the level of validity of the worktext developed in terms of Content, Clarity, Appeal to the target Users, Originality, and Usefulness; and ascertain the readability of the developed worktext in Science, Technology, and Society.

Conceptual Framework

The conceptual framework is based on Bloom's evaluation model of instructional materials in teaching and learning.

Figure 1. Research Paradigm



The Course syllabus in Science, Technology, and Society is the input variable. The process variable includes Needs Assessment on the Status of Instructional Material in STS and the Development of the Worktext. The expected output is the Developed Worktext in Science, Technology, and Society.

2. Research Methodology

The descriptive approach and research and development design were used in this research. Because this study investigated characteristics linked to the availability and appropriateness of instructional materials, descriptive research design was appropriate. It is developmental because it leads to the creation of STS learning material.

The respondents in assessing the adequacy and availability of learning materials in Science, Technology, and Society were the faculty members teaching the subject at the University of Northern Philippines and employed a total enumeration sampling technique. On the other hand, the evaluators of the developed learning material were proficient research educators and experts in the field of science and developers of learning materials from the same university.

There were two research questionnaires used in the study. First is the Needs Assessment Checklist for the Availability and Adequacy of Instructional Materials adapted from the study of Selga (2013). Second, the instrument for Validation in terms of content, clarity, appeal to the target user, originality, and usefulness from Reyes and De Guia (2015); A five-point rating scale was set as norms to describe the needs assessment and validity of the developed worktext.

Before the administration of the research instrument, the research study underwent review by the Ethics Review Committee to determine the benefits that can be derived from the study and the foreseeable and expected risks and measures to mitigate them. The development and validation of the worktext consisted of two phases: 1: Development Stage and 2. Validation Stage.

For the development stage, a survey on the availability and adequacy of Instructional Materials in Science, Technology, and Society was conducted with the teachers handling the subject and the university librarians as the respondents, followed by planning and organizing the learning competencies. The researchers selected appropriate student-centered and reflective activities as agreed upon while enhancing the course syllabus and learning outcomes. It also includes designing and writing the draft of the lesson and activities.

The 5E teaching and learning methodology was utilized in creating the worktext. This approach has been proven effective in facilitating science teaching and learning. It encourages students to actively participate, construct their understanding, and utilize their prior knowledge to develop their explanations for scientific phenomena through hands-on experiences and formal investigations.

For the Validation Stage**,** evaluation of the contents of the worktext along with content, clarity, appeal to the target user, and originality by five proficient in science education in the university were done. This was followed by the revision and finalization of the developed worktext based on the suggestions and recommendations made by the validators.

The data gathered was described and analyzed using the following statistical tools; mean, to determine the needs assessment for instructional materials in terms of adequacy and availability of the worktext in STS; Flesch Formula was computed using the computer software to determine its Flesch Reading Ease and Flesch-Kincaid Grade Level for the readability of the developed worktext.

3. Results And Discussion

3.1 The Level of Availability of Instructional Materials in Science, Technology, and Society

Table 1 shows the availability of Science, Technology, and Society instructional materials. Teachers utilize textbooks, worktext, workbooks, modules, manuals, and worksheets based on the data. This demonstrates that the teachers rated teaching resources as slightly available. This also suggests that instructors may have obtained instructional materials for their personal use during the semester, as there are only a limited number of instructional materials accessible in the library for teachers to use.

According to Faize and Dahan (2011), a lack of adequate and engaging textbooks and instructional materials makes it difficult for students to improve their reading, listening, problem-solving, seeing, thinking, speaking, writing, and using media and technology. Every topic in the school curriculum requires the use of instructional resources.

Table 1. Level of Availability of instructional materials in Science, Technology, and Society

Items	Mean	Interpretation
Textbook	2.14	Slightly Available

Worktext	1.71	Slightly Available
Workbook	2.00	Slightly Available
Module	1.86	Slightly Available
Manual	1.86	Slightly Available
Worksheet	2.29	Slightly Available

3.2 The Level of Adequacy of the Instructional Materials in Science, Technology, and Society

As reflected on Table 2, the adequacy of Science, Technology, and Society instructional materials. According to the chart, the training resources given are just slightly adequate. This means that instructors desperately need appropriate teaching material for students in Science, Technology, and Society. The demands of instructors strongly indicate an existing educational material and facility deficiency. The teachers voiced their frustration with the lack of sufficient instructional materials and equipment, particularly in the Science, Technology, and Society course, as indicated in Table 4. Jalmasco (2014) confirmed these results, stating that inadequate instructional materials are present in Philippine schools, which was also validated by Ongowo and Indoshi (2013).

This was corroborated by Ramdari et al. (2019), which found that learning is seldom completed fully owing to various factors such as a lack of inventories, practical tools, practice rooms, modules, manuals and incomprehension of inadequate teaching materials in practical materials.

Table 2. Level of Adequacy of the instructional materials in Science, Technology, and Society

Items	Mean	Interpretation
Textbook	2.17	Slightly Adequate
Worktext	2.43	Slightly Adequate
Workbook	2.14	Slightly Adequate
Module	2.57	Slightly Adequate
Manual	2.14	Slightly Adequate
Worksheet	2.43	Slightly Adequate

3.3 Description of the developed worktext in Science, Technology, and Society

Science, Technology, and Society (STS) is an interdisciplinary field of study that tries to investigate and comprehend how modern science and technology shape modern culture, values, and institutions and how current values shape science and technology. STS investigates how science and technology arise, enter society, evolve due to social processes, and how society reacts to science and technology.

STS is a New General Education Course in the CHED Memorandum Order No. 20 Series 2013. This is one of the reasons why the needs analysis results in this study revealed slight adequacy and availability of instructional materials in Science, Technology, and Society, given that the course is in its infancy. These circumstances and the unexpected emergence of the COVID-19 pandemic demanded that instructional materials in the course be developed. The Worktext in this study was conceptualized to address the call of the present times.

The development of the worktext was guided by appropriate theories of learning and the 5-e model, a constructivist approach to course design offering substantial advantages over other approaches. The STS course syllabus served as an outline of the topics that need to be tackled, the learning outcomes and the competencies that need to be achieved, and the appropriate assessment to be assigned.

The Worktext comprises four chapters that contain several lessons. Chapter 1 is Introduction to Science, Technology, and Society. Chapter 2 is The Human Person Flourishing in Terms of Science and Technology. Chapter III is Specific Issues in Science, Technology, and Society. And Chapter III is Indigenizing Sustainable Development and Inclusive Growth through Appropriate Science and Technology in the Grassroots.

The flow of presentation of the Worktext starts with the basic parts such as the main cover page, foreword, table of contents, the general objectives, and the series of chapters. Each chapter commences with a cover page containing the Title, the Chapter Number, and a figure representing the covered topic. The lessons with the lesson number, title, objectives, main body of the lesson, and the Lesson Activities follow this. The main body of the Lesson includes the Introduction and a discussion of concepts. The Lesson Activities provide diverse exercises that enrich the student's learning. At the end of each Chapter

is the Chapter test that will serve as a formative assessment tool to gauge the student's mastery of concepts. The Worktext ends with the References to give due credit to sources used in the Development of the material. Lastly, the Backpage presents the authors and a brief description of each.

The Worktext is designed to guide the students to develop the 21st Century Skills necessary and crucial to succeed in the globally competitive workplace. Likewise, it will help broaden the practical and theoretical understanding of the students to augment their research, conceptual knowledge, and understanding of Science, Technology, and Society to adapt to the fast-evolving challenges of the times.

On a specific note, the following are the features of the developed worktext:

Figure a - Title Page


Table of Contents

Figure b- Table of Contents

a. Title Page- The worktext dives into the subtle connection between human progress, scientific discoveries, and the modern world's shifting ethical landscapes. The cover image is an enthralling combination of classic scientific symbols, technical gears, and connecting human silhouettes, representing the synergy between knowledge, development, and human contact. The authors, experts in their respective professions who have collaborated to create comprehensive and engaging instructional material, are identified.
b. Table of Contents is a list of the worktext's chapters, sections, and other major divisions, presented in the order in which they appear. The purpose of a table of contents is to provide readers with a structured overview of the

content within the document. It serves as a roadmap, helping readers quickly locate specific topics, chapters, or sections of interest without reading through the entire document.

Figure c- Different Parts of Each Chapter

c. Different Chapters – The worktext is divided into chapters, each concentrating on a different element of the interaction of science, technology, and society. Each chapter takes a different approach, diving into historical developments, ethical considerations, environmental effects, and cultural influences. Each chapter takes students on an enthralling journey through the deep relationships between scientific development, technological advances, and the cultural fabric of nations worldwide. Understanding the relationship of science and technology with cultural values, beliefs, and traditions is becoming increasingly important as research and technology continue to influence the modern world. Each chapter invites learners to navigate the dynamic interplay between knowledge and culture through diverse lessons, thought-provoking activities, and carefully crafted learning outcomes. It also includes a chapter test, an important assessment technique used to measure students' comprehension, retention, and mastery of the knowledge taught in a single chapter. The chapter test in the worktext is a multifaceted tool that assesses knowledge, promotes active learning, provides feedback, and contributes to the overall educational experience. It supports the learning process by gauging understanding, encouraging critical thinking, and helping students and educators adapt their strategies for effective learning outcomes.

Figure d- References Figure e- About the Authors

d. References- The worktext includes a carefully chosen list of references, further readings, and other resources. These resources provide opportunities for further investigation and inquiry, allowing readers to dive deeper into specific themes of interest.
e. About the authors- Information about the authors, their expertise, and their qualifications is provided, establishing credibility and expertise in the subject matter.

According to Casiano (2012), using instructional materials assists in achieving a more effective teaching and learning process. Teachers can give services to students more professionally and efficiently, while students may acquire insight and learn more effectively and efficiently. As a result, the objectives of any educational process dictate the materials, methodologies, and resources necessary to attain those aims.

The learning assessment aspects comprised instructor evaluation, collaborative assessment, self-assessment, and the instructor's role associated with coaching, directing, mentoring, recognizing, offering feedback, and measuring student learning. The assessment consists of exercises that are sequential and consistent with one another. Each topic begins with an opening paragraph that informs students about the subject under discussion. The learning outcomes define the objectives that must be accomplished after completing every stage indicated in the learning assignments. The worktext is just one educational material available to teachers and students. Students might use this to augment their research, conceptual knowledge, and

understanding of Science, Technology, and Society. It is recommended that students supplement the worktext with an additional learning resource to better understand the essential concepts of STS. Today, textbooks serve as the primary tool and tutor of teaching and learning in most classrooms, and they have a huge effect on what is taught in science classes and how the curriculum is presented (McDonald, 2016; Pingel, 2010; Roseman et al., 2001). It was thought that well-designed inquiry-based assignments in science textbooks are significant in helping students' experiences with scientific inquiry and building an understanding of scientific ideas (Yang & Liu, 2016).

3.4 Overall Level of Validity of the Developed Worktext

Table 3. Overall Level of Validity of the Developed Worktext

Indicators	Mean	Interpretation
Content	4.67	Very Highly Valid
Clarity	4.80	Very Highly Valid
Appeal to the target user	4.60	Very Highly Valid
Originality	4.57	Very Highly Valid
Usefulness	4.78	Very Highly Valid
Overall	4.67	Very High

Statistical Range	Descriptive Rating	Statistical Range	Descriptive Rating
4.50 - 5.00	Very High Validity	4.50 - 5.00	Strongly Agree
3.50 - 4.49	High Validity	3.50 - 4.49	Agree
2.50 - 3.49	Moderate Validity	2.50 - 3.49	Neutral
1.50 - 2.49	Poor Validity	1.50 - 2.49	Disagree
1.00 - 1.49	Not Valid	1.00 - 1.49	Strongly disagree

Table 3 summarizes the findings of the validity of the developed worktext. Regarding the worktext's validity, the validators gave it an overall mean rating of 4.67, indicating that the validity is "Very High Validity." This signifies that in the developed worktext in Science, Technology, and Society, the validators strongly agreed that its many components in terms of content, clarity, appeal to the target user, originality, and usefulness are helpful, suitable, and closely connected to the various subjects covered in the course Science, Technology, and Society. This demonstrates that the validators' rating determines the

students' knowledge, abilities, and qualities. The result also shows that among the five indicators, clarity got the highest mean rating of 4.80, with a descriptive rating of very high validity. This is supported by the comments of the validators that the topics were well arranged, providing a precise sequence of each lesson.
Meanwhile, originality got the lowest evaluation of 4.57, described as very high validity. Based on the suggestion of one of the evaluators, the photo sources must be given proper credit. Furthermore, topics such as Industry 4.0, Education 4.0, and 5.0 must be included to make the worktext unique. Overall, the expert validators gave favorable feedback on the developed worktext and expressed optimism about the benefits it would bring to students' learning.

The findings of the study are also consistent with the findings of Flores (2008), who noted that it is not essential to change teaching techniques but rather to develop activities that improve educational outcomes and student happiness. Similarly, using instructional materials in the classroom enhances student performance and allows teachers to explain their courses (Leonen, 2016). It is also proper to recognize that the findings of this study are consistent with the findings of other investigations (Evangelista et al., 2014; Ocampo, 2015; Pastor et al., 2015). According to Tomlinson (1998), the impact of instructional materials is accomplished when resources have a perceptible influence on learners, which is when the learners' curiosity, interest, and attention are drawn.

In terms of content, the developed worktext received a Very High Validity rating (M = 4.67), suggesting that all of the indicators were highly agreed upon by the validators. The developed worktext has valuable information that can assist learners in developing the necessary abilities. This suggests that the lessons offered in the worktext contain adequate knowledge, exercises and examples, and background information on the topics.

The worktext's clarity was rated Very High Validity by the evaluators, with a rating mean of 4.80. The table reveals that the respondents' evaluations of practically every statement differed slightly. This means that the worktext developed is clear and simple to understand. The

result demonstrates that the developed worktext is practical and that the sequential arrangement of ideas and the straightforwardness of concept presentation are adequately explained to support the worktext's numerous objectives. Both students and instructors who use the worktext benefit from the clarity of ideas and concepts and the understandability of teaching. This also indicates that respondents find it plain and uncomplicated since they are more familiar with the course's contents, and the worktext is appropriate for its users' level.

In terms of appeal to the target user, the developed worktext got a Very High Validity rating (M = 4.60). This shows that the worktext is interesting and could arouse students' attention. The results indicate that the worktext piques the learners' attention, an essential element of the instructional material that assists in developing the target skills. Furthermore, the results demonstrate that by using simulation and additional activities linked to it, the worktext stimulates thought and gives rise to learners' positive attitudes toward learning. It means that learners can prove their communication skills in situations of actual life where they are confident and unafraid to communicate what they have learned fearlessly and confidently with the use of the worktext.

Regarding originality, the developed worktext got a Very High Validity rating (M = 4.57), meaning the validators strongly agreed on all the indicators. The result suggests that the worktext has distinct qualities that distinguish it from others. The outcome also shows that the worktext gives new strategies for improving abilities, which leads to lifelong learning.

For the worktext's usefulness, the evaluators assessed the worktext's Very High Validity with an evaluation mean of 4.78. This signifies that the worktext has Very High Validity. This means that the validators agreed that the worktext provides actions that relate the new ideas to the previous ones, as shown in the table. Furthermore, this demonstrates that the validators agree on the usefulness of the worktext.

Similar findings were found in studies conducted by Belecina (1999), Menor & Limjap (2011), Nwike & Catherine (2013), and Torrefranca

(2017), in which students taught with learning materials performed significantly better than those taught without materials.

3.5 The Readability of the Developed Worktext in Science, Technology, and Society

Table 4. The Readability of the Worktext

Chapter	Reading Ease Score	Verbal Description	Grade/Year Level in the Philippine Educational System
Introduction to Science, Technology, and Society	34.6	Difficult	13th - 16th Grade (College Level)
The Human Person Flourishing in terms of Science and Technology	43.2	Difficult	13th - 16th Grade (College Level)
Specific Issues in Science, Technology, and Society	35.1	Difficult	13th - 16th Grade (College Level)
Indigenizing Sustainable Development and Inclusive Growth Through Appropriate Science and Technology in the Grassroot	16.5	Very Difficult	College Graduate
OVERALL	**36.7**	**Difficult**	**13th - 16th Grade (College Level)**

Flesch Reading Ease	Flesch-Kincaid Grade Level Score	Interpretation
0-30	College Graduate	Very Difficult
31-50	13th - 16th Grade (College Level)	Difficult
51-60	a10th - 12th Grade (High School)	Fairly Difficult
61-70	8th - 9th Grade	Standard
71-80	7th Grade	Fairly Easy
81-90	6th Grade	Easy
91-100	5th Grade	Very Easy

Finally, the worktext was validated along with readability, which assures how comprehensible it is to the reader, such as regulating the document's vocabulary to increase its readability.

Table 4 shows the result of the readability of the worktext. As reflected in the table, Chapter 2 (The Human Person Flourishing in Terms of Science and Technology) has the highest readability with a verbal description of Difficult. The grade level is equivalent to college. Likewise, Chapter 4 (Indigenizing Sustainable Development and Inclusive Growth Through Appropriate Science and Technology in the Grassroot) has the lowest readability score with a verbal description of Very Difficult. This signifies that the concepts mentioned above are understandable to learners using the developed worktext. According to Hidayatillah, N. and Zainil, Y (2020), several students received low marks and complained of dissatisfaction with the textbook's readability. Additionally, it was found that an appropriate degree of readability level must be considered for them to comprehend the concepts. Hence, it is crucial to take readability level while developing educational materials like worktext.

A comprehensive study by Dubay (2004) shows that in addition to vocabulary and sentence structure, the reader's reading skills, prior knowledge, and motivation are also essential factors in text readability. This research also indicated that when reader engagement is strong, understanding doesn't benefit from composing the content below the readers' grade level; instead, it's more effective to maintain the material at their grade level.

4. Conclusions And Recommendations

Based on the analysis of the data gathered in this study, it is concluded that (1) the teachers have limited learning resources, particularly on the different instructional materials like textbooks, worktext, workbooks, modules, manuals, and worksheets. (2) the instructional materials mentioned are only slightly adequate; hence, the teachers need instructional materials in STS to aid in teaching-learning. (3) the worktext developed was guided by the constructivist theory of learning and the 5E model. It is considered substantial, clear, simple to understand, stimulating, and loaded with activities. (4) The STS

worktext was rated as Very Highly Valid (5) In terms of its readability, it is rated to be suitable for 13th to 16th Grade Level in the Philippine Educational system (6) Hence, it can be utilized as one of the instructional materials that could aid in delivering the STS course.

The validated worktext is thereby recommended for use in teaching the STS course. Similar studies may be carried out with other courses or topic areas of the many degrees available in the university to foster a culture of instructional innovation and academic research. The worktext shall be considered as teaching materials and tools used during the teaching-learning process to evaluate their effectiveness and practicability. Teachers and lecturers should develop worktexts, modules, and instructional resources. The university administrators are encouraged to support teachers in the preparation of instructional materials by coming up with training in the development of learning materials related to their fields or specialization. Because the worktext was validated solely in the University, the study's conclusions are only definitive for the University.

References

1. Adams, N. E. (2015). Bloom's taxonomy of cognitive learning objectives. Journal of the Medical Library Association: JMLA, 103(3), 152.
2. Hackling, M. W., Peers, S., & Prain, V. (2007). Primary Connections: reforming science teaching in Australian primary schools. Teaching Science, 53(3), 12-16.
3. Adebule & Ayoola, (2015). Impact of Instructional Materials on Students Academic Performance in Mathematics in Secondary Schools in Ekiti, Nigeria. Research Journal of Educational Studies and Review, Vol.2 (1), 20016.
4. Alicar-cadorna, E. & Cadorna, E. F. (2009). Development and Validation of a Worktext in Statistics for Nursing Students. JPAIR Multidisciplinary Research Journal, 2(1).
5. Almazan, J. G. I., Jacob, D. A., Saniatan, C. J. S., & Galangco, J. (2020). STEM Curriculum Implementation and Academic Performance of Senior High School Students. UNP Research Journal, 29(1).
6. Aninag, R. S., Cajindos, R. P., & Torres, J. B. (2021). Predictors of Science Performance of Senior High School Students. Asian Journal of

Education and Human Development, 2(1).

7. Araza, F. (2023). Development and Validation of Most Essential Learning Competency-Based Workbook in General Physics 1 for Senior High School. SEAQIS Journal of Science Education, 3(01), 1-13.
8. Aureada, J. J. U. (2017). The Effectiveness of a Work-text in Logic for College Students. Asia Pacific Higher Education Research Journal (APHERJ), 4(1).
9. Bodner, G. (1986). Constructivism: A theory of knowledge. Journal of Chemical Education, 63(10), 873-877.
10. Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E instructional model: Origins and effectiveness. Colorado Springs, Co: BSCS, 5(88-98).
11. Cadorna, E. A., Riboroso, R. A., Llagas Jr, R. M., & Taban, J. G. (2023). Development of Worktext in Mathematics in the Modern World. Journal of Namibian Studies: History Politics Culture, 33, 3855-3871.
12. Clark, R. (2002). Six principles of effective e-Learning: What works and why. The e-learning developer's Journal, 6(2), 1-10.
13. Defiño, F. Q., Ducay, J. C., & Soberano, K. T. (2022). Modular Learning Approach: A Glimpse at Students' Self-efficacy and Academic Performance in Challenging Times. Globus Journal of Progressive Education, 12(2).
14. DuBay, W. H. (2004). The principles of readability. Online Submission.
15. Evangelista, E., Ayuste, T.O.D., Belmi, R.M., Butron, B.R., Cortez, L.A.S.,Evangelista, L.T., Tondo, J.E. (2014). Development and evaluation of grade 7 and grade 8 biokit. The Normal Lights, 8(2), 152-171.
16. De Leon, N. G. (2023). Localized Traditional Learning Modules in the History of Mathematics its Effect to the Learning Competency of Students.
17. Ergin, I ̇ ., Kanli, U., & Ünsal, Y. (2008). An example for the effect of the 5E model on the academic success and attitude levels of students' "Inclined projectile motion." Journal of Turkish Science Education, 5(3), 47-59.
18. Flores, C.D. (2008). Teaching Styles of Social Studies Teachers of Tarlac National High School and their Students' Learning Styles (Master's thesis, Tarlac State University, Tarlac).
19. Garcia, G. A. (2020). Development and Validation of a Worktext in Electromagnetism. Liceo Journal of Higher Education Research, 16(1).
20. Gibbon, M. Individualized Instruction. (2004). New York: Teacher's Columbia University Press
21. Hidayatillah, N., & Zainil, Y. (2020). The readability of students'

textbooks used in semantic and pragmatic course in english language education program of UNP. Journal of English Language Teaching, 9(1), 144-159.

22. Herr, N. (2007). Theories and Perspectives in Science Education. Internet Resources to Accompany. http://www.csun.edu/science/ref/theory-research/theories-science-education.html
23. Jalmasco, N. M. (2014). Science education realities. The Manila Times.
24. Kapur, R. (2019). Development of teaching-learning materials. Unpublished manuscript.
25. Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2014). Experiential learning theory: Previous research and new directions. In Perspectives on thinking, learning, and cognitive styles (pp. 227-247). Routledge.
26. Llewellyn, D. (2007). Inquire within: Implementing inquiry-based science standards in grades 3-8. Thousand Oaks, CA: Corwin Press.
27. Leonen, R.B. (2016). Development and Validation of Worktext in Chemistry. Unpublished Research: Don Mariano Marcos Memorial State University.
28. McDonald, C.V. (2016). Evaluating junior secondary science textbook usage in Australian schools. Research in Science Education, 46(4), 481-509.
29. Menor, N. & Limjap A. (2011). Evaluation of the Design and Implementation of a Learning Package on Ratio and Proportion Using the Understanding by Design Framework. Conference Proceedings, International Conference on Mathematics Education, Olongapo City.
30. Mohzana, Agus Rofi'i, Antonia Junianty Laratmase, Susatyo Adhi Pramono, Enny Diah AstutiAstuti (2023). The Development Of E-Module Based on Science Writing Heuristic (SWH) To Improve the Effectiveness of Teaching and LearningActivities.Journal for Educators, Teachers and Trainers. 14(3).533-538
31. Moradi, M., Liu, L., Luchies, C., Patterson, M. M., & Darban, B. (2018). Enhancing teaching-learning effectiveness by creating online interactive instructional modules for fundamental concepts of physics and mathematics. Education Sciences, 8(3), 109.
32. Nwike, M. C. & Catherine, O. (2013). Effects of Use of Instructional Materials on Students Cognitive Achievement in Agriculture Science. Journal of Educational and Social Research, 3(5), 103-107.
33. Nola, Robert; Irzik, Gürol (2006). Philosophy, Science, Education and Culture. Springer Science & Business Media. p. 175. ISBN 978-1-4020-3770-2.

34. Ongowo, Richard & Indoshi, Francis. (2013). Science Process Skills in the Kenya Certificate of Secondary Education Biology Practical Examinations. Creative Education. 04. 713-717. doi:10.4236/ce.2013.411101.
35. Piaget, Jean. (1950). The Psychology of Intelligence. New York: Routledge.
36. Pingel, F. (2010). Guidebook on Textbook Research and Textbook Revision. 2nd ed. Pairs: United Nations Educational, Scientific and Cultural Organization.
37. Reyes, Y. D., & De Guia, R. G. (2017). Development of English worktext in English 101. International Journal of Science and Research (IJSR), 6(10).
38. Reyes, John Christian delos, (2015). Preparation and Evaluation of Instructional Materials. https://www.slideshare.net/mobile.eng.115
39. Roseman, J. E., Kulm, G., & Shuttleworth, S. (2001). Putting textbooks to the test. ENC Focus, 8(3), 56-59.
40. Selga, M. C. R. (2013). Instructional materials development: A worktext in science, technology and society. LCCB Development Education Journal of Multidisciplinary Research, 2(1), 1-1.
41. Sudirtha, I. G., Widiana, I. W., & Adijaya, M. A. (2022). The Effectiveness of Using Revised Bloom's Taxonomy-Oriented Learning Activities to Improve Students' Metacognitive Abilities. Journal of Education and e-Learning Research, 9(2), 55-62.
42. Tan-Espinar, M. J. F., & Ballado, R. S. (2017). Content validity and acceptability of a developed worktext in Basic Mathematics 2. Asia Pacific Journal of Multidisciplinary Research, 5(1), 72-84.
43. Tomlinson, B. (1998). Materials Development in Language Teaching. Cambridge: Cambridge University Press.
44. Torrefranca, E. (2017). Development and validation of instructional modules on rational expressions and variations. The Normal Lights, 11(1), 43 – 73
45. TETY, JL, The Role of instructional materials in academic performance in community secondary
46. Wallace, E.D. & Jefferson, R.N. (2013) Developing critical thinking skills: assessing the effectiveness of workbook exercises. New Review of Academic Librarianship 19(3), 246-25
47. Wang, E. L., Tuma, A. P., Doan, S., Henry, D., Lawrence, R. A., Woo, A., & Kaufman, J. H. (2021). Teachers' Perceptions of What Makes Instructional Materials Engaging, Appropriately Challenging, and Usable.
48. Yang, W., & Liu, E. (2016). Development and validation of an instrument for evaluating inquiry-based tasks in science textbooks.

International Journal of Science Education, 38(18), 2688-2711.