



## IT-SIBOL: Thematic Station-Based Learning, Unplugged

Jomerson R. Tolentino

Master of Arts in Teaching (Major in Biology) Graduate School, Quirino State University, Philippines

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\*Corresponding Author: Jomerson R. Tolentino

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### Abstract

### Review Article

This study aimed to develop and validate “IT-SIBOL” (Interactive Thematic Station-Based Instruction for Biology Offline Learning), a PowerPoint-based instructional technology designed to enhance the delivery and comprehension of Grade 7 Biology topics under the K–12 Science Curriculum. The study utilized a Research and Development (R&D) design guided by the modified 4D Model of Thiagarajan et al. (1974), covering only the Define, Design, and Develop phases. A descriptive-quantitative approach was used to evaluate the content, instructional quality, and technical quality of the IT-SIBOL through expert validation. There are 17 IT-SIBOL lessons developed that consistently follow the same section format and instructional structure, using thematic, inquiry-based, station-based, and 5E instructional frameworks. Twenty (20) qualified validators, consisting of ten (10) Biology Validators and ten (10) IT validators. They hold Master’s or Doctorate degrees and possess extensive expertise in their respective fields, with at least five years of professional experience. This ensured a reliable and comprehensive validation. Content and instructional quality were assessed in terms of learning outcomes, face validity, lesson presentation, usefulness, and novelty, while technical quality covered multimedia design, interface, customizability, system controls, and hyperlinks. The findings revealed that validators confirmed that the initial version of the IT-SIBOL demonstrated strong approval on content and instructional quality, which indicates clear objectives, accurate content, relevant and well-organized lessons, innovative and strong usefulness. Moreover, the technical quality met excellent technical standards in design, interface, controls, and multimedia features. Therefore, the IT-SIBOL instructional technology is suitable, usable, and ready for pilot-testing in the classroom.

**Keywords:** IT-Sibol, Interactive, Thematic, Station-Based Instruction, Inquiry-based learning, Instructional technology, K–12 Science curriculum

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### Introduction

In the 21<sup>st</sup> century, creating a more dynamic, collaborative, and inclusive learning environment is driven by innovation through emerging technologies

because of a global change that is essential in transforming education (Mena-Guacas et al., 2025). The Philippine Education System is undergoing a significant transformation in science education by adopting new instructional methods and technology



aimed at cultivating and fostering scientifically literate citizens motivated by a national commitment to nurture, engage, inform, and innovate citizens ready to advance in science. (Saro et al., 2025).

According to OECD (2023), a recent study consistently shows that the learning outcomes in science education in the Philippines remain critically low based on the PISA 2022. Also, several studies highlight several factors that contributed to the poor performance of students in science, such as low science skills, weak understanding and reading abilities, low metacognitive strategies, limited access to resources, disparities in support of their learning (Silang, 2026; Sadera et al., 2020; Calleja et al., 2023). Moreover, issues on pedagogical barriers arises that affects the academic performance and engagement of students in science, includes consistent issues with the curriculum alignment and assessment practices (Langit, 2024), limited teacher instructional preparation of materials (Calo & De Vera, 2025), insufficient integration of technology in the classroom even if there is available training (Arellano & Lumogdang, 2025), limited integration of technology, difficulty simplifying complex ideas to diverse learners, heavy workload, lack of laboratory facilities and learning resources, limited professional development, minimal institutional support, and non-specialized teaching assignments (Arellano & Lumogdang, 2025; Garcia et al., 2025; Bumagat et al., 2023; Magtulis & Brunio, 2025).

Although there is an increased adoption of technology during the pandemic (Espinosa et al., 2023), persistent barriers and challenges occur in infrastructure, such as inadequate internet access, limited resources, and teacher support. (Celeste & Nimfa, 2024; Mangarin & Climaco, 2024; Atilano-Tang & Cirilo, 2023; Bondoc et al., 2022; Colegado, 2025; Mauricio-Garcia, 2024). These factors mentioned limit the effectiveness of digital instruction in science education (Colegado, 2025; Endona & Buquia, 2024; Paran et al., 2024).

To address these challenges, thematic learning and learning station approaches have been identified as effective instructional strategies. Thematic learning improves understanding, engagement, and retention by organizing instruction around meaningful real-

world topics (Nurmawati, 2022), while learning stations enhance academic performance, critical thinking, collaboration, and learner motivation through rotational task-based activities (Azaman et al., 2020; Rogayan, 2019; Guerrero & Benavides, 2024). Their successful implementation, however, depends on accessible and well-designed instructional materials.

Moreover, recent studies confirm that multimedia-based and offline digital materials, such as Microsoft PowerPoint, effectively improve student engagement, usability, and academic performance in science classrooms (Emralino & Nartea, 2020; Levitasari et al., 2024; Argones & Sabasales, 2025). Because internet limitations remain a major concern, offline instructional tools must undergo validation for content quality, instructional soundness, and technical feasibility before classroom use (Lim, 2024; Cano, 2022).

Therefore, the study focused on the development and validation of "IT-SIBOL," an offline interface for thematic station-based instruction designed in a PowerPoint format. The system aims to enhance the delivery and comprehension of Biology concepts by providing a structured, interactive, and accessible offline learning experience. Moreover, the study aims to evaluate its content quality, instructional usability, and technical acceptability to support effective science learning despite existing digital constraints.

## Methods

This study employed a Research and Development (R&D) design guided by the 4D Model of Thiagarajan et al. (1974). The original model consisted of four phases, namely: (1) Define, (2) Design, (3) Develop, and (4) Disseminate. Moreover, the descriptive-quantitative design was used to assess the quality and acceptability of the developed IT-SIBOL instructional technology.

The participants of this study were ten (10) Biology Validators and ten (10) IT Validators who validated the developed "IT-SIBOL" instructional technology.

They were selected based on their specialized knowledge and experience relevant to the material's content, instructional, and technical aspects. The researcher used two validation tools to evaluate the validity and quality of the IT-SIBOL instructional technology. For the content and instructional quality tool, adapted from Guray (2025), assessed learning outcomes, content, face validity, lesson presentation, usefulness, and novelty, while the technical validation tool, adopted from the Department of Education (2009), evaluated multimedia design, overall interface, user support, system controls, and hyperlinks. Data analysis involved frequency counts, means, standard deviations, and weighted means. This tool is used to evaluate the content, instructional, and technical quality of the IT-SIBOL.

Ethical considerations, including informed consent and confidentiality, were observed throughout the research process.

**Results and Discussions**

**I. Demographic Profile of the Validators**

The panel of validators for the validation of the developed IT-SIBOL instructional technology consisted of Biology validators who evaluated the content and instructional quality, and IT validators for the technical quality.

Table 1: Demographic profile of the biology validators

Profile	Particulars	Frequency	Percentage
Age	26-30	4	40
	31-35	6	60
Sex	Male	3	30
	Female	7	70
Field of Specialization	Biology	7	70
	General Science	2	20
	Other Field	1	10
Educational Attainment	Master's Graduate	8	80
	Doctorate Graduate	2	20
Years of Service	5-10 years	5	50
	11-15 years	5	50

n=10

Table 2: Demographic profile of the IT validators

Profile	Particulars	Frequency	Percentage
Age	26-30	1	10
	31-35	6	60
	36-above	3	30
Sex	Male	6	60
	Female	4	40
Field of Specialization	IT	9	90

	Other Field	1	10
Educational Attainment	Master’s Graduate	8	80
	Doctorate Graduate	2	20
Years of Service	5-10 years	6	60
	11-15 years	2	20
	16-20 years	2	20

n=10

Table 1 and 2 shows the twenty (20) qualified validators who evaluated the developed IT-SIBOL Instructional technology, consisting of ten (10) Biology Validators who validated the content and instructional quality, and ten (10) IT validators who assessed the technical quality. Most of the validators in Biology and IT are female, aged 31-35. All validators hold Master’s or Doctorate degrees and possess extensive expertise in their respective fields, with at least five years of professional experience. This ensured a reliable and comprehensive validation of the developed IT-SIBOL instructional technology.

## II. Development of the Interactive Thematic Station-Based Learning as an Instructional Technology in Biology

The main objective of the study was to develop and

design an interactive, thematic, and station-based instructional technology that can enhance the delivery and comprehension of Biology concepts by providing a structured, engaging, interactive, and offline learning experience. There are 17 lessons of IT-SIBOL developed that consistently follow the same section format and instructional structure, with differences only in the theme applied to each lesson to match the specific topic being presented, as shown in Table 3. The developed IT-SIBOL in every lesson consisted of the following sections: (a) title of the game, (b) learning competency, (c) main mission of the game, (d) game map with the 5 Station that represents the 5E’s Learning Model such as Engage, Explore, Explain, Elaborate and Evaluate, (e) question quests, (f) values integration, (g) mission rewards, (h) summary and (i) references.

Table 3. Complete List of the Lessons and Topics with their Corresponding Game Theme Titles

Lesson	Topics	Theme of the Game for each Lesson
1	Parts and Functions of the Microscope	Micro Forensics
2	Focusing the Microscope	Lens Legends
3	Levels of Biological Organization	Bio Stack
4	Cell: Basic Structural and Functional Unit of Life	Inside Cell City
5	Parts and Functions of the Cell	Battle of the Organelles
6	Difference between an Animal and a Plant Cell	The Ultimate Cell News
7	Microorganisms	Germ Patrol
8	Asexual Reproduction	Asexual Arena
9	Sexual Reproduction	Repro Rangers
10	External and Internal Fertilization	Fertilization Battle Cards

11	<i>Biotic and Abiotic Components of the Ecosystem</i>	<i>Ecosystem Builders</i>
12	<i>Types of Ecosystems</i>	<i>Diego's Barko Voyage: Ecosystem Expedition</i>
13	<i>Food Chain</i>	<i>Rise and Fall of Civilization</i>
14	<i>Food Web</i>	<i>The Sang'gres: Food Web Quest</i>
15	<i>Energy Pyramid</i>	<i>The Pharaoh's Food Pyramid</i>
16	<i>Ecological relationship</i>	<i>The Hunger Games</i>
17	<i>Prey and Predator</i>	<i>Apex Hunter</i>

### III. Validation of the IT-SIBOL Instructional Technology

The developed instructional technology underwent expert validation. A panel of experts in biology/science education, instructional material development, and information technology evaluated the material with respect to content quality, instructional quality, and technical quality. This validation process ensured that the IT-SIBOL instructional technology is usable, effective, and interactive for instructional purposes.

### A. Content and Instructional Quality

Recent studies have shown that well-structured learning outcomes and content accuracy enhance learners' comprehension and facilitate effective learning, which, in turn, leads to improved academic performance and student engagement (Ongor & Uslusoy, 2023; Li et al., 2022; Vinuya & Alquizar, 2025). Moreover, an instructional technology should demonstrate clarity, alignment, clear language, design, format, and presentation. (Basilio & Sigua, 2021; Niño & Lomibao, 2026). In the context of IT-SIBOL instructional technology, each criterion should be met to ensure it is clear, usable, acceptable, and pedagogically sound.

Table 4. Mean Evaluation in Content and Instructional Quality of the IT-SIBOL instructional technology

Criteria	Mean	SD	Description
1. Alignment of Learning Outcomes	3.86	.135	Strongly Agree
2. Content Accuracy	3.80	.163	Strongly Agree
3. Face Validity	3.72	.235	Strongly Agree
4. Presentation of the Lessons	3.80	.163	Strongly Agree
5. Usefulness	3.88	.215	Strongly Agree
6. Novelty	3.70	.271	Strongly Agree

Table 4 presents the mean evaluation of the content and instructional quality of the developed IT-SIBOL. Each criterion obtained consistently strong approval, with mean scores ranging from 3.70 to 3.88. Moreover, among the criteria, Usefulness obtained the highest mean of 3.88 (SD = 0.215), showing that

the validators considered IT-SIBOL highly beneficial and effective in supporting teaching and learning. Recent studies indicate that gamified and multimedia instructional designs further enhance the attractiveness, originality, and alignment of activities with learners' interests, making lessons more

interactive and motivating for students (Uriawan, 2025; González-Fernández et al., 2022). This indicates that the instructional technology is perceived as a practical and valuable tool for improving student engagement and lesson delivery.

Overall, the findings indicate that the IT-SIBOL instructional technology demonstrates quality features such as clear alignment of objectives, organized presentation and format, usefulness, and novelty. Overall, the results suggest that the developed IT-SIBOL instructional technology is suitable for classroom implementation.

**B. Technical Quality**

A well-designed overall interface of instructional

technology plays a crucial role in supporting clear presentation, easy navigation, and engaging learning experiences for learners. (Tepe,2022; Peng, 2021; Mat Yusoff et al, 2025). Research shows that clear visual cues, adaptive interfaces, responsive controls, and consistent design in instructional material development significantly enhance user customizability, engagement, and learning outcomes (Olimverio et al., 2026; Faudzi et al., 2023; Jamali et al., 2025; Yusoff et al.,2025). In the context of IT-SIBOL instructional technology, technical quality enhances learner engagement and supports active learning by fostering interactive navigation, consistent multimedia elements that are visually appealing, and a user-friendly interface to improve instructional effectiveness and student achievement in educational contexts.

*Table 5. Table of the Mean Evaluation in Technical Quality of IT-SIBOL Instructional Technology*

<b>Criteria</b>	<b>Mean</b>	<b>SD</b>	<b>Description</b>
1. Multimedia Design	3.46	.162	Excellent
2. Overall Interface	3.53	.137	Excellent
3. Customizability/Support for Users	3.38	.144	Excellent
4. Behavior of Controls and System of Information	3.43	.285	Excellent
5. Hyperlinks	3.50	.287	Excellent

Based on the given summary table 17 of the mean evaluation of technical quality of the developed IT-SIBOL, the technical validators rated all the criteria excellent with a range mean of 3.38 to 3.53. Moreover, among the criteria, Overall Interface obtained the highest mean of 3.53 (SD = 0.137), indicating that the validators highly appreciated the visual organization, layout, and user-friendly appearance of IT-SIBOL. Studies show that well-designed multimedia environments improve students’ motivation, cognitive processing, and overall learning performance when instructional content is presented through visually organized and interactive formats (Mayer, 2009; Hadiyanti et al., 2025; Agustin et al., 2024). Furthermore, Systems

with user-centered controls also support learners with varying digital literacy by providing accessible and adaptable interfaces (Al-Azawei et al., 2016; Issa & El-Sabagh, 2026). This suggests that the instructional technology provides an effective and appealing interface that supports smooth user interaction. Overall, these results indicated that the developed IT-SIBOL met strong technical standards in multimedia design, clear interface structure, user support, reliable system support, and hyperlinks. Overall, the technical quality of the IT-SIBOL was ready for pilot testing.

From the highlights of the findings, validators confirmed that the initial version of the IT-SIBOL, with 17 lessons developed that consistently follow

the same section format and instructional structure, following thematic, inquiry-based, station-based, and 5E instructional frameworks, demonstrated very high content and instructional quality, which indicated clear objectives, relevant and well-organized lessons, and strong usefulness. Moreover, the technical quality met excellent technical standards in design, interface, controls, and multimedia features. Therefore, the IT-SIBOL instructional technology is suitable, usable, and ready for pilot-testing in the classroom.

Based on the results and conclusions of the study, it is recommended that future researchers conduct pilot testing of the initial version of the IT-SIBOL to further assess its practicality and usability in the classroom. Furthermore, teachers may adopt it as a supplementary and instructional material in the Grade 7 Biology Class to enhance student comprehension and engagement. To ensure smooth delivery of the lesson and appropriate use of the IT-SIBOL, training and seminars may also be conducted for the effective use of the instructional technology. Lastly, future researchers may also conduct quasi-experimental studies to evaluate its effectiveness on the learning experience of the learners and may explore the adaptation of it to other science topics at different grade levels to expand its applicability and contribution to the transformative science education.

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