Golden Sun-Rise
International Journal of Multidisciplinary on Science and Management
ISSN: 3048-5037/ Volume 3 Issue 2 Apr-Jun 2026 / Page No: 23-31
Paper Id: IJMSM-V3I2P104 / Doi:10.71141/30485037/V3I2P104

Research Article

Enhancing Students' Electronics Skills: Developing an Integrated Lecture-Hands-On Guidebook for Blended Learning Modalities

Aina G. Nepomuceno[1], Irish S. Pascual[2], Patrick Louie F. Barrera[3], Reygei R. Villatura[4], Daisylene G. Ocsan[5], Joseline M. Santos[6]

College of Professional Teacher Education, Bulacan State University, City of Malolos, Bulacan, Philippines.

Received: 10 April 2026 Revised: 16 April 2026 Accepted: 18 April 2026 Published: 20 April 2026

Abstract - *This study aimed to develop an Integrated Lecture–Hands-On Guidebook in Electronics for Grade 7 Technology and Livelihood Education (TLE) under Industrial Arts, designed for blended learning environments. The guidebook was aligned with the Department of Education's Learning Resources Management and Development System (LRMDS) to address the need for structured instructional materials suitable for both face-to-face and online modalities. A quantitative descriptive–developmental research design was employed, involving 57 respondents: 40 Grade 7 students for baseline skills assessment, 5 electronics experts for guidebook validation, and 12 TLE teachers to evaluate its level of acceptability using adapted and validated survey instruments. Data were analyzed using descriptive statistics, specifically the weighted mean and standard deviation. Results revealed that students demonstrated consistently low competence across learning modalities, with mean scores of 2.04 (SD = 0.30) in physical settings, 2.04 (SD = 0.33) in online settings, and 2.07 (SD = 0.28) in blended settings. These findings indicate a gap between theoretical knowledge and the application of practical skills. The developed guidebook obtained passing ratings from expert validators, with high scores in content quality (Total = 39) and instructional quality (Total = 39.8), both interpreted as Very Satisfactory. Furthermore, teachers evaluated the material as highly acceptable, with an overall mean of 4.92 (SD = 0.10) for content quality and 4.92 (SD = 0.08) for instructional quality. The study concludes that the integrated lecture–hands-on guidebook is a valid, acceptable, and effective instructional resource that can enhance students' electronics skills in blended learning environments.*

Keywords - *Blended Learning, Electronics, Industrial Arts, Integrated Lecture-Hands-On-Guidebook.*

I. INTRODUCTION

In the modern world, education has rapidly evolved due to technological advancements, globalization, and the increasing demand for skilled and adaptable individuals. As emphasized by UNESCO (2024), 21st-century education requires the development of learners' critical thinking, creativity, and ability to apply knowledge in real-life contexts. In response, many schools have shifted from traditional instruction to innovative approaches such as blended learning, which combines face-to-face and online instruction to provide flexible, accessible, and engaging learning experiences. Blended learning has been found effective in improving students' academic performance, engagement, and technical competencies, particularly in technical and vocational education (Alhashem & Alfailakawi, 2023). It supports both synchronous and asynchronous learning, allowing students to actively participate in meaningful learning experiences. Consequently, modern education now emphasizes performance-based learning, where students demonstrate practical skills rather than merely recalling information. This shift highlights the importance of integrating lecture-based and hands-on instructional materials to support both cognitive and psychomotor development.

In the Philippines, the Department of Education (DepEd) adopted blended learning during the COVID-19 pandemic to ensure continuity of education amid disruptions such as natural disasters (DepEd, 2020). However, challenges remain, particularly in Technology and Livelihood Education (TLE), specifically in Industrial Arts, where limited resources and insufficient instructional materials hinder effective teaching (Bautista et al., 2021). To address these concerns, the Learning Resources Management and Development System (LRMDS) was established to develop, evaluate, and distribute quality, standards-aligned instructional materials (DepEd, 2017). Despite these efforts, there are still gaps in the integration of theory and practice, particularly in the teaching of electronics, which requires cognitive skills and psychomotor skills. The teaching is usually skewed whereby there are those who are more of theory and those are more of procedures with little conceptual grounding and hence little practical application. To address these gaps, this study proposes the development of an integrated lecture–hands-on guidebook for teaching electronics in a blended learning context. The guidebook is aligned with DepEd's LRMDS standards and incorporates structured lectures, guided performance tasks, and reflective activities to enhance both conceptual understanding and practical skills.

This study is grounded in Constructivist Learning Theory (Piaget, 1972) and Experiential Learning Theory (Kolb, 1984) that focus on active involvement and experiential learning in knowledge construction. These models are used to create learner-centered teaching resources that facilitate engagement, self-evaluation, and skills acquisition. Overall, this study will enhance the quality of electronics education in the Philippine K-12 curriculum through a practical, standards-based and learner-centered guidebook. By addressing existing gaps, it contributes to the advancement of technical education and helps equip Filipino learners with essential 21st-century competencies.

II. MATERIALS AND METHODS

The study employed a quantitative descriptive-developmental research design. The quantitative part was used to assess and measure the current level of students' electronics skills within physical, online, and blended modalities, to quantify experts' evaluation, and to understand teachers' level of acceptability of the developed material. The evelopmental process is guided by the Department of Education, using the Learning Resources Management and Development System, for the creation, refinement, and evaluation of the integrated lecture-hands-on guidebook. This combination was suitable as the study was not intended to test the effect of treatment in the form of an experiment; rather it was to record the needs of learners, create a standards-based instructional resource, and establish whether the resource was of quality and acceptable to the expectations. Such a design is appropriate in developmental educational research where one seeks to produce a validated material as the desired product as opposed to a general theory of intervention effect.

III. RESULTS AND DISCUSSION

This section presents the findings aligned with the research questions of the study. The data are descriptive in nature, as the analysis utilized weighted mean and standard deviation without employing inferential statistical tests such as correlation or regression. The results focus on students' current level of skills in Industrial Arts–Electronics, the evaluation of the developed Lecture–Hands-On Guidebook by expert validators, and the level of acceptability of the material among teachers.

Table 1. Student's Current Level of Skills in Industrial Arts-Electronics across Physical, Online, and Combined Physical and Online Settings

Statement	Mean	Description
Physical Setting		
I can properly use various electronic tools and materials during workshop activities.	1.95	Disagree
I can cut and assemble materials accurately to produce an organized and presentable Electronics project.	1.95	Disagree
I can apply lessons learned in class to create an Electronics project that shows quality, creativity, and good craftsmanship.	2.08	Disagree

I can identify and troubleshoot common errors in my project to ensure circuits work correctly.	2.10	Disagree
I can perform Electronics tasks safely by following proper procedures and preventing accidents during hands-on sessions.	2.10	Disagree
Average Weighted Mean (Physical)	**2.04**	**Disagree**
Online Setting		
I can accurately perform simple circuit tasks or hands-on activities using online simulations or virtual tools.	2.05	Disagree
I can follow the correct procedures in online laboratory or simulation activities without direct supervision from my teacher.	2.00	Disagree
I can effectively apply my theoretical knowledge of Electronics in completing virtual experiments and projects.	1.98	Disagree
I can prepare and submit online project outputs, reports, or documentation that meet the required quality standards.	2.13	Disagree
I consistently show improvement in my virtual performance, accuracy, and the overall quality of my work in online learning.	2.05	Disagree
Average Weighted Mean (Online)	**2.04**	**Disagree**
Blended (Physical + Online) Learning Setting		
I can confidently apply the skills I learned from online modules when working on actual hands-on Electronics projects.	2.13	Disagree
I can effectively combine theoretical lessons from online learning with practical applications in the workshop.	2.05	Disagree
I can easily transition from virtual simulations to real-life laboratory work without difficulty.	1.95	Disagree
I can integrate online learning concepts into hands-on tasks to improve my craftsmanship and performance quality.	2.13	Disagree
I can perform blended learning projects with the same level of quality and precision as in traditional face-to-face settings.	2.08	Disagree
Average Weighted Mean (Blended)	**2.07**	**Disagree**
Scale Interpretation		
4.00 – 3.24 —Strongly Agree 3.24 – 2.50 — Agree 2.49 – 1.75 — Disagree 1.74 – 1.00 — Strongly Disagree		

In the physical setting, the computed average weighted mean was 2.04, interpreted as Disagree. This indicated that students generally lacked confidence in their skills and competencies in Industrial Arts–Electronics during face-to-face activities. This was evident in items such as the proper use of electronic tools and materials (M = 1.95) and the ability to cut and assemble materials accurately (M = 1.95), which both received low ratings. These results suggested that students experienced difficulties in performing hands-on tasks and applying theoretical knowledge in actual workshop settings. This finding supports the study of Deepthi and Exley (2023), who emphasized that insufficient hands-on experiences significantly hinder skill development in technical and vocational education. Similarly, Olowe (2024) noted that learners must first develop a solid understanding of foundational concepts before effectively performing practical tasks. In the online setting, the average weighted mean was also 2.04, interpreted as Disagree, indicating low perceived competence in virtual learning environments. Students reported challenges in performing circuit tasks using simulations, following procedures independently, and applying theoretical knowledge in virtual activities. Notably, the mean was the lowest in the application of theoretical knowledge to virtual experiments (M = 1.98) indicating a disconnect between conceptual knowledge and its use in digital platforms. These findings implied that while online tools were available, students struggled to effectively utilize them for meaningful learning. This aligns with Gumasing et al. (2025), who found that although online learning platforms provide access to instructional content, students often encounter difficulties in translating theoretical knowledge into practical skills. Moreover, Gregori et al. (2023) highlighted that blended learning space must possess a powerful pedagogical framework to be able to tie online and offline components.

In the combined physical and online learning settings, the average weighted mean was 2.07, still interpreted as Disagree. This indicated that students encountered difficulties in integrating knowledge and skills acquired from both learning modalities. The highest-rated item, where the emphasis was put on the online learning implementation into practical assignments (M = 2.13), did not go beyond the Disagree range, whereas the lowest-rated one included the shift between virtual simulations and the real laboratory work (M = 1.95). These results suggested that students faced challenges in transferring learning from virtual environments to real-world applications, highlighting a gap in blended learning effectiveness. This finding is consistent with Yeo (2021) described, who stated that hybrid learning environments need to be carefully integrated in terms of instructional strategies to achieve smooth transitions between modalities. Equally, Mahande et al. (2024) pointed out that in the absence of a well-organized support, students can find it difficult to reap the full advantages of blended learning approaches.

Overall, the findings revealed consistently low levels of competence across physical, online, and blended learning settings. This pointed to the need for more structured and integrated instructional materials that effectively bridge theoretical knowledge and practical application in Electronics. This supports the findings of Tindan and Anaba (2024), who emphasized that the combination of lecture-based education and practical tasks can notably enhance the level of conceptual knowledge and the development of technical skills in the learner.

Table 2. Descriptive Measures of How Can the Lecture-Hands-On Guidebook Be Evaluated in Terms of Content Quality, Instructional Quality and Other Findings

Statement	Total	Descriptive Interpretation
Content Quality		
Content is consistent with topics/skills found in the DepED Learning Competencies for the subject and grade/year level it was intended	4.00	Very Satisfactory
Concepts developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives	4.00	Very Satisfactory
Content is accurate	4.00	Very Satisfactory
Content is up-to-date	3.80	Very Satisfactory

Content is logically developed and organized	4.00	Very Satisfactory
Content is free from cultural, gender, racial, or ethnic bias	4.00	Very Satisfactory
Content stimulates and promotes critical thinking	3.80	Very Satisfactory
Content is relevant to real-life situations	3.60	Very Satisfactory
Language (including vocabulary) is appropriate to the target user level	4.00	Very Satisfactory
Content promotes positive values that support formative growth	3.80	Very Satisfactory
Total Score (Content Quality)	**39.00**	**Passed**
Instructional Quality		
Purpose of the material is well defined	4.00	Very Satisfactory
Material achieves its defined purpose	4.00	Very Satisfactory
Learning objectives are clearly stated and measurable	4.00	Very Satisfactory
Level of difficulty is appropriate for the intended target user	4.00	Very Satisfactory
Graphics / colors / sounds are used for appropriate instructional reasons	4.00	Very Satisfactory
Material is enjoyable, stimulating, challenging, and engaging	3.80	Very Satisfactory
Material effectively stimulates creativity of the target user	4.00	Very Satisfactory
Feedback on target user's responses is effectively employed	4.00	Very Satisfactory
Target user can control the rate and sequence of presentation and review	4.00	Very Satisfactory
Instruction is integrated with the target user's previous experience	4.00	Very Satisfactory
Total Score (Instructional Quality)	**39.80**	**Passed**
Other Findings		
Conceptual errors	4.00	Very Satisfactory
Factual errors	4.00	Very Satisfactory
Grammatical and/or typographical errors	4.00	Very Satisfactory
Other errors (computational, obsolete information, visuals, etc.)	4.00	Very Satisfactory
Overall (Other Findings)	**16.00**	**Passed**
Scale Interpretation		

4.00 — Very Satisfactory 3.99 – 3.00 — Satisfactory 2.99 – 2.00 — Poor 1.99 – 1.00 — Not Satisfactory

Concerning instructional quality, the guidebook also demonstrated a high level of effectiveness, with all indicators rated as Very Satisfactory. The material was found to have clearly defined objectives, an appropriate level of difficulty, engaging features, and effective feedback mechanisms. The majority of indicators had the mean 4.00, and engagement and stimulation had a slightly smaller mean 3.80, which also belong to the same category. The total score of 39.8 (Passed) confirmed that the material was instructionally sound and aligned with DepEd standards. These results indicate that the guidebook effectively supports teaching and learning processes.

This is consistent with Bredow et al. (2021), who found that instructional materials that combine structured content with interactive elements significantly enhance learner engagement in blended learning environments. Similarly, Klein et al. (2023) emphasized that engagement is a key factor that must be strengthened in instructional design, particularly in technical-vocational subjects. In terms of other findings, the guidebook received perfect ratings across all indicators, including conceptual accuracy, factual correctness, and absence of grammatical or typographical errors, each with a mean of 4.00. This indicates that evaluators did not identify any issues in the material. The total score of 16 (Passed) further confirms that the guidebook met quality assurance standards and demonstrated a high level of accuracy and reliability.

These results align with Mayer (2021), who highlighted that cognitive load decreases with error-free instructional materials and improves understanding. Similarly, Branch and Dousay (2020) affirmed that accuracy and clarity are part and parcel of quality instructional design. Overall, these results indicate that the Lecture–Hands-On Guidebook was developed with careful attention to content accuracy, instructional design, and technical quality, making it a credible and effective instructional resource for both teachers and learners.

Table 3. Descriptive Measures of How the Lecture-Hands-On Guidebook's Level of Acceptability Can Be Evaluated in Terms of Content Quality and Instructional Quality

Statement	Mean	Description
Content Quality		
The guidebook content is aligned with DepEd curriculum standards and supports competency-based instruction	5.00	Highly Acceptable
The guidebook presents accurate, relevant, and up-to-date content aligned with practical learning goals	4.92	Highly Acceptable
The information and illustrations are clear, accurate, and easy to understand	5.00	Highly Acceptable
The guidebook integrates illustrations and tasks that are appropriate, engaging, and suitable for blended learning environments	5.00	Highly Acceptable
Content is organized logically, progressing from basic to complex	4.92	Highly Acceptable
The examples, activities, and materials are relevant and applicable to real-life situations	4.92	Highly Acceptable
Safety practices and work ethics are clearly emphasized throughout the lessons	4.83	Highly Acceptable
The guidebook encourages students to produce actual or simulated outputs relevant to the field	4.75	Highly Acceptable
Overall Weighted Mean (Content Quality)	**4.92**	**Highly Acceptable**

Instructional Quality		
The guidebook supports face-to-face and online/blended learning delivery	5.00	Highly Acceptable
The learning objectives are clearly stated and measurable	5.00	Highly Acceptable
Instructions and procedures are easy to follow and suitable for the learner's level	4.83	Highly Acceptable
Activities in the guidebook are relevant to real-world teaching contexts and support practical skill development	4.92	Highly Acceptable
The guidebook clearly presents procedures and concepts that support knowledge acquisition and practical application	4.92	Highly Acceptable
The guidebook provides opportunities for assessment and self-evaluation	4.92	Highly Acceptable
Visual aids, diagrams, and photos enhance learning and understanding	4.83	Highly Acceptable
The layout, design, and format are appealing and appropriate for the learners	4.92	Highly Acceptable
Overall Weighted Mean (Instructional Quality)	**4.92**	**Highly Acceptable**
Scale Interpretation		
5.00 – 4.49 — Highly Acceptable 4.48 – 3.50 — Acceptable 3.49 – 2.50 — Moderately Acceptable 2.49 – 1.50 — Slightly Acceptable 1.49 – 1.00 — Not Acceptable		

In terms of content quality, the guidebook obtained an overall weighted mean of 4.92, interpreted as Highly Acceptable. The highest ratings (M = 5.00) were observed in curriculum alignment, clarity of information, and integration of blended learning tasks. Other indicators such as relevance, organization, and safety practices also received high ratings (M = 4.75–4.92). These findings indicate that the guidebook is well-structured and aligned with competency-based instruction. This supports Salmorin (2021), who emphasized that strong curriculum alignment is essential for effective blended learning materials.

In terms of instructional quality, the guidebook also obtained an overall mean of 4.92, interpreted as Highly Acceptable. The highest ratings (M = 5.00) were given to clarity of objectives and support for blended learning delivery. Other indicators, such as instructions, visuals, and assessment support, ranged from 4.83 to 4.92. These results indicate strong instructional effectiveness. Marciniak and Cáliz Rivera (2021) noted that clarity, structure, and adaptability are key factors in effective blended learning materials.

Overall, the overall high ratings indicate that there is a high level of agreement between teacher evaluators concerning the effectiveness, relevancy, and usability of the guidebook as an instructional resource. This further supports Alqahtani and Alyami (2024), who stated that learner-centered instructional materials enhance engagement, understanding, and skill development in technical education.

IV. CONCLUSION

The study concluded that Grade 7 students' electronics skills across physical, online, and blended learning settings were consistently rated at a low competent level, indicating challenges in applying theoretical knowledge to tasks. To address these gaps, the researchers developed an integrated lecture–hands-on guidebook aligned with DepEd LRMDS standards, ensuring curricular relevance, coherence, and originality.

The guidebook included an introduction and objectives, lecture and hands-on sections, and assessment and reflection, supported by activities that integrate instruction, performance tasks, and practical applications adaptable across modalities. Evaluation results revealed satisfactory content quality and very satisfactory instructional quality, highlighting clarity, accuracy, appropriateness, and engagement. The guidebook proved to be a productive tool in improving electronics skills among students in blended learning set-ups as confirmed by teacher assessments that showed high levels of acceptability.

The findings supported Constructivist Learning Theory, which assumes that learners build knowledge by being active and engaged in interaction (Piaget, 1970; Vygotsky, 1978), and Experiential Learning Theory, which asserts that learning occurs through experience and reflection (Kolb, 1984). These theories guided the design of the guidebook, particularly in integrating lecture and hands-on activities that promote active participation, concept application, and skills development, making learning more meaningful and relevant.

As a developmental research, the study focused on the design and evaluation of the integrated lecture–hands-on guidebook rather than its implementation. The material provided structured and comprehensive activities aligned with DepEd standards, ensuring responsiveness to learners' needs. The involvement of experts and evaluators strengthened its credibility, confirming its pedagogical soundness and practical applicability. The study emphasized the importance of integrating lecture and hands-on approaches in instructional materials, establishing the guidebook as a sustainable and adaptable model for supporting the development of students' electronics skills in blended learning contexts.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Acknowledgements

The authors extend their warmest gratitude to Dr. Joseline M. Santos for her invaluable thesis supervision, and to the validators and electronics experts who generously participated in and reviewed the researchers' thesis instruments and the integrated lecture-hands-on guidebook.

Sincere appreciation is likewise extended to the public secondary schools that allowed and supported the data gathering process. The researchers acknowledge the teachers who evaluated the level of acceptability of the developed product, as well as the Grade 7 students who honestly participated in assessing their baseline skills in electronics, which significantly contributed to the development of the instructional material. Recognition is also given to the panel members for their insightful comments and recommendations during the thesis defense. Most especially, the researchers express profound appreciation to their families and friends, whose unconditional love, unwavering support, patience, and constant encouragement served as their greatest source of strength and inspiration throughout the completion of this study.

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