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Research Article

CirKit: Development of a Low-Cost Supplementary Kit for Teaching Basic Electrical Skills

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Abstract - *This study addresses the challenge of limited access to affordable, functional, and safe instructional materials in teaching basic electrical skills in Electrical Installation and Maintenance (EIM) under Technology and Livelihood Education–Industrial Arts. The lack of hands-on learning resources hinders students' understanding of essential concepts such as circuit connections, electrical symbols, and safety procedures, resulting in insufficient development of practical competencies. To address this gap, the study developed CirKit, a low-cost supplementary instructional kit designed to support both demonstration and experiential learning. Using an exploratory sequential mixed-methods design, semi-structured interviews were conducted with Technology and Livelihood Education teachers (n = 8) to identify instructional challenges and resource gaps. The findings guided the development of the kit based on Learning Resource Management and Development System (LRMDS) standards. The prototype was validated by experts (n = 5) and evaluated by teachers (n = 18). Results showed that CirKit received high ratings across all criteria. The overall acceptability obtained a mean score of M = 4.13 (SD = 0.11), interpreted as Good, while effectiveness (M = 4.90), functionality (M = 4.83), safety (M = 4.87), and user-friendliness (M = 4.84) were rated Very Good. Instructional effectiveness recorded an overall mean of M = 4.96 (SD = 0.11), indicating improved teaching strategies and student understanding. Additional results showed high ratings in durability (M = 4.94), safety (M = 4.97), and usability (M = 4.98). The study concludes that CirKit is a practical, cost-effective, and effective instructional material that enhances hands-on learning and supports competency development in electrical skills.*

Keywords - *Low-Cost Instructional Kit, Electrical Skills, Hands-on Learning, Instructional Materials, TLE–Industrial Arts.*

I. INTRODUCTION

A well-rounded education is essential in developing the knowledge, skills, and values that learners need to function effectively in modern society and the workforce (UNESCO, 2020; World Economic Forum, 2020). In today's rapidly evolving, technology-driven environment, individuals are expected to be adaptable and capable of continuous learning. This highlights the importance of developing both technical competencies and lifelong learning skills. Experiential learning, particularly "hands-on" activities, has been identified as an effective approach in enhancing students' critical thinking, creativity, and technical abilities (Kolb, 2015). These skills are especially crucial in Technical and Vocational Education and Training (TVET), where practical experience directly contributes to learners' employability and job readiness (International Labour Organization, 2023).

Globally, TVET is recognized as a key driver of economic growth and social development (UNESCO-UNEVOC, 2020; OECD, 2019). Many education systems have adopted competency-based approaches that emphasize skills application and real-world performance. However, in developing countries such as the Philippines, the implementation of effective TVET programs is often challenged by limited access to affordable and quality instructional resources (Department of Education, 2022; UNESCO-UNEVOC, 2023). This issue directly affects the delivery of hands-on learning, which is essential in technical subjects. The importance of accessible and quality

education is further emphasized in the United Nations Sustainable Development Goal 4 (SDG 4), which promotes inclusive and equitable education and lifelong learning opportunities for all (United Nations, 2015). Recent reports highlight that achieving SDG 4 requires the provision of safe, affordable, and durable learning materials, particularly in technical and vocational education settings (UNESCO, 2024). In response, the Philippine Department of Education introduced the MATATAG Curriculum (DepEd Order No. 15, s. 2023), which focuses on strengthening foundational skills, improving teacher support, and ensuring that learning is relevant and applicable to real-life situations.

Under this curriculum, Technology and Livelihood Education (TLE), particularly Industrial Arts, plays a vital role in equipping students with practical and technical skills. One of its core areas, Electrical Installation and Maintenance (EIM), introduces learners to fundamental electrical concepts such as circuit connections, electrical symbols, and safety procedures. However, the effective teaching of these concepts remains a challenge due to the lack of functional, safe, and affordable instructional materials (Balajadia, 2023; Barcelona et al., 2023). As a result, many teachers rely heavily on theoretical instruction, limiting students' ability to apply knowledge in real-world contexts.

The Learning Resource Management and Development System (LRMDS) was established by the Department of Education (2017) to ensure the development of quality, curriculum-aligned, and accessible instructional materials. Despite this initiative, many schools still face difficulties in accessing low-cost, durable, and appropriate learning tools for technical subjects (Barrera, 2022; Manlangit, 2025). Commercially available kits are often expensive or not suitable for the learners' level, further limiting opportunities for hands-on learning.

This study addresses these gaps by developing CirKit, a low-cost supplementary instructional kit designed to support the teaching of basic electrical skills in TLE–Industrial Arts. The kit provides students with opportunities to engage in safe, structured, and meaningful hands-on activities, bridging the gap between theory and practice. The development of CirKit follows the standards of the DepEd LRMDS to ensure its quality, safety, and usability in classroom settings.

Specifically, this study aims to design, develop, validate, and evaluate the CirKit as an instructional material. Through this initiative, the research seeks to enhance the delivery of technical-vocational education, improve student engagement and competency development, and provide a practical and sustainable solution to resource limitations in public secondary schools. Ultimately, the study supports the broader goal of the Department of Education to produce learners who are skilled, competent, and prepared for real-life applications under the MATATAG Curriculum.

II. MATERIALS AND METHODS

A. Research Design

This study utilized an Exploratory Sequential Mixed-Methods Approach to first identify the instructional needs and challenges faced by TLE teachers in teaching Basic Electrical concepts, followed by a quantitative phase to validate the practicality, effectiveness, and classroom relevance of the developed supplementary kit, CirKit. This approach ensured that the study was grounded in actual classroom experiences while maintaining rigorous evaluation. Additionally, the research employed a Descriptive–Developmental design to systematically develop, assess, and validate the instructional kit. Through this design, the study examined existing instructional challenges and teacher needs, which guided the creation of CirKit and ensured that it effectively addressed resource gaps and was appropriate for classroom implementation.

B. Respondents ofthe Study

The study employed a purposive sampling technique in selecting respondents, ensuring that participants were chosen based on their qualifications, teaching experience, and direct involvement in teaching Basic Electrical concepts under the TLE curriculum. This non-probability sampling method was deemed appropriate because it enabled the researchers to gather data from individuals who possessed relevant expertise and firsthand experience, allowing for more reliable and meaningful insights regarding the development, validation, and acceptability of CirKit as a low-cost supplementary instructional material. The respondents of the study were composed of three groups corresponding to the three phases of the research: eight (n = 8) Grade 7 and 8 TLE

teachers for the needs assessment phase, five (n = 5) expert validators for the validation phase, and eighteen (n = 18) Grade 7 and 8 TLE teachers from selected public secondary schools in Bulacan for the acceptability evaluation phase. Each group of respondents was selected based on specific criteria to ensure the relevance of their participation and the credibility of the data gathered.

Criteria for teacher-respondents included:

1. Currently teaching Grade 7 or Grade 8 Technology and Livelihood Education under the MATATAG Curriculum;
2. Handling lessons related to Basic Electrical concepts or Electrical Installation and Maintenance competencies;
3. Possessing at least three to five years of teaching experience in the subject area; and
4. Willingness to participate voluntarily in the study.

Meanwhile, expert validators were selected based on the following qualifications:

1. professional background in TLE, Electrical Technology, or Instructional Material Development;
2. possession of advanced academic qualifications such as a master's degree or higher;
3. preferably holding relevant certifications including National Certificate (NC) in Electrical Installation and Maintenance, TESDA Trainer/Assessor credentials, or equivalent professional qualifications; and
4. experience in evaluating or developing instructional materials related to technical-vocational education.

C. Research Instruments

Data were gathered using researcher-made semi-structured interview guides, survey questionnaires, and evaluation forms designed to collect both qualitative and quantitative data throughout the study. These instruments were aligned with the objectives of the research, specifically in assessing the development, validation, and acceptability of CirKit as a low-cost supplementary instructional kit.

A semi-structured interview guide was used during the needs assessment phase to gather responses from TLE teachers regarding the challenges in teaching Basic Electrical concepts, available instructional resources, and suggested features for the development of the kit. Meanwhile, survey questionnaires and evaluation forms were utilized during the validation and acceptability phases to assess CirKit in terms of content quality, functionality, safety, usability, and instructional effectiveness. All research instruments underwent expert validation to ensure clarity, relevance, and alignment with the objectives of the study before their final use in data collection.

D. Data Gathering Procedure

Data collection followed a systematic process, beginning with the conduct of semi-structured interviews during the qualitative phase, followed by expert validation and teacher acceptability evaluation during the quantitative phase. Ethical considerations, including informed consent, voluntary participation, and confidentiality of responses, were strictly observed throughout the study to protect the rights and privacy of all participants.

Initial data were gathered through interviews with eight (n = 8) TLE teachers to identify instructional challenges, resource gaps, and recommendations relevant to the development of CirKit. The responses collected were analyzed and used as the basis for the design and development of the supplementary instructional kit.

The developed CirKit then underwent expert validation using a structured evaluation form aligned with the LRMDS evaluation criteria. Five (n = 5) experts assessed the kit based on content quality, instructional design, functionality, safety, durability, and low-cost feasibility. After revisions, the finalized kit was evaluated by eighteen (n = 18) TLE teachers using a teacher acceptability questionnaire to determine its effectiveness, usability, and overall classroom applicability.

E. Statistical Treatment ofData

After data collection, all interview responses and survey results were organized, tabulated, and encoded for analysis. The data were analyzed using appropriate qualitative and quantitative methods to ensure accuracy, reliability, and validity of the findings.

For the qualitative phase, interview responses from eight (n = 8) TLE teachers were analyzed using thematic analysis following the framework of Braun and Clarke (2006). Recurring themes, patterns, and categories related to instructional challenges, teaching experiences, and resource needs in Basic Electrical lessons were identified and used as the basis for the development of CirKit. For the quantitative phase, data from five (n = 5) expert validators were analyzed first using descriptive statistics. The weighted mean was used to determine the level of content quality, instructional quality, usability, functionality, and safety of CirKit, while the standard deviation was computed to measure the consistency of responses.

For the expert validation of CirKit as a manipulative instructional material, evaluation was based on the Learning Resource Management and Development System (LRMDS) criteria with the following passing requirements: For Factor A (Content), the material must obtain at least 30 points out of 40 to be rated Passed, indicating that the content is accurate, relevant, and aligned with learning competencies. For Factor B (Other Findings), the material must obtain a perfect score of 16 out of 16 points to be rated Passed, indicating the absence of major conceptual, factual, grammatical, or technical errors. For Factor C (Instructional and Technical Design for Manipulatives), the material must obtain at least 18 points out of 24 to be rated Passed, ensuring that the manipulative is safe, appropriate, and suitable for learner use. Only materials that met all required threshold scores were considered Passed and acceptable for classroom implementation; otherwise, revision was required.

For the Level of Acceptability of CirKit as evaluated by eighteen (n = 18) TLE teachers, the data were encoded and processed using Google Sheets for systematic organization and computation of the weighted mean and standard deviation. The results were interpreted using a five-point Likert scale ranging from Not Acceptable to Highly Acceptable. Overall, the combined qualitative and quantitative findings provided a comprehensive basis for evaluating and refining CirKit as a low-cost supplementary instructional material for teaching Basic Electrical concepts.

III. RESULTS AND DISCUSSION

The results of the study are presented in three phases, corresponding to the sequential procedures undertaken in the development, validation, and evaluation of CirKit. Phase I results revealed the key themes from the qualitative data gathered through interviews with TLE teachers, analyzed using thematic analysis following Braun and Clarke (2006). The most prominent challenge identified was the lack of instructional materials, particularly insufficient tools and learning kits needed for teaching Basic Electrical concepts. Teachers also highlighted limited hands-on practice as a major concern, as students had fewer opportunities to apply theoretical knowledge in actual circuit activities. In addition, time constraints in delivering practical lessons and safety concerns in handling electrical components were also commonly experienced in the classroom.

In terms of least-learned competencies, teachers identified difficulties among students in understanding electrical symbols, performing circuit connections, and following proper safety procedures. These gaps suggest that learners struggle most in applying concepts in actual tasks rather than in theoretical discussion.
Based on the themes generated, teachers recommended that a supplementary instructional kit should prioritize hands-on learning components, safety-focused design, user-friendly features, and durable materials. These recommendations served as the foundational basis for the development of CirKit, ensuring that the instructional material directly responds to the identified classroom needs and learning gaps.

Following Phase I, the development of CirKit was guided by the DepEd Learning Resource Management and Development System (LRMDS) to ensure alignment with curriculum standards, safety, affordability, and suitability for Grade 7 and 8 TLE–EIM competencies. The process followed a systematic flow including planning, design specification, prototyping, and refinement until the final beta version. The initial stage involved identifying essential learning competencies based on Grade 7 and 8 EIM modules, focusing on basic circuit assembly, safe handling of electrical tools, and understanding electrical symbols. This phase was informed by teachers' identified needs, particularly the lack of hands-on materials and difficulty in applying theoretical concepts. The instructional design followed a simple-to-complex progression to support skill development.

An instructional and technical design specification was then created, supported by a 3D model to visualize the kit layout before fabrication. A prototype (alpha version) was developed for early testing of usability, safety, and

functionality, followed by a teacher manual to guide proper use and classroom implementation. After expert validation, a revised beta version was produced with improved structure, clearer instructions, and enhanced safety features such as circuit protection devices, emergency readiness components, and added mechanical safety mechanisms. Overall, the final version of CirKit was refined to be safe, durable, low-cost, and learner-friendly, ensuring its effectiveness as a supplementary instructional material for hands-on electrical learning in TLE.

Then the affordability of the developed CirKit was determined through a detailed analysis of its bill of materials, covering both structural and electrical components. This analysis was conducted to establish the total production cost of the kit and to evaluate its feasibility as a low-cost supplementary instructional material for teaching Basic Electrical concepts in TLE. The results highlight the breakdown of expenses and demonstrate the overall cost-effectiveness of the developed instructional kit.

Table 1. Bill of Materials for the Structural Fabrication of the CirKit

Quantity	Unit	Tools or Materials	Price (₱)	Total Price (₱)
Assorted	pcs	Scrap wood (3/4 & 1/4 plyboard)	450	450
250	grams	Stikwel Wood Glue	50	50
1/4	kg	1½ Finishing Nails	35	35
2	pcs (set)	Heavy Duty Hinges	88	88
2	pcs	Full Extension Steel Drawer Slide Guide Ball Bearing #16	130	260
4	pcs	Chrome Plated Cabinet Drawer Handle (4–5 inch)	19	76
1	pc	Keyed Hasp Lock (3 inch)	55	55
4	pcs	Caster Wheels (2 with lock, 2 without lock)	127	127
1/4	liter	Mocha Paint	85	85
1/4	liter	Dark Brown Paint	85	85
2	yards	2-inch Black Garter	15	30
2	yards	1-inch Black Garter	10	20
GRAND TOTAL				**₱1,361**

As shown in the table, the total cost of materials used for the structural fabrication of CirKit amounted to ₱1,361.00. The prototype was completed within two weeks, with materials such as scrap wood, hinges, drawer slides, caster wheels, and paint carefully selected to balance affordability, durability, and functionality. The low total cost indicates that the kit can be produced economically, making it suitable for schools with limited resources while still maintaining structural integrity and usability for instructional purposes.

Table 2. Bill of Materials for the Electrical Components of the CirKit

Quantity	Unit	Tools or Materials	Price (₱)	Total Price (₱)
1	pc	RCBO 10A with IP65 Waterproof Electrical Distribution Box HT-2P Outdoor	539	539
1	pc	Circuit Breaker	350	350
1	pc	2 Gang Duplex Outlet Universal Socket	75	75
2	pcs	2 Gang Surface Type Universal Outlet	55	110

4	pcs	Ceiling Receptacle 2¼" Diameter with Screw (4A-250V)	25	100
4	pcs	Surface Mounted Snap Switch 1 Gang 250V 10A	29	116
4	pcs	LED Bulb	45	180
4	yards	#14 Stranded Wire – Black	21	84
4	yards	#14 Stranded Wire – Red	21	84
4	yards	#14 Stranded Wire – Blue	21	84
4	yards	#14 Stranded Wire – Green	21	84
2	yards	2-core #14 AWG Flat Cord	30	60
1	meter	3/4 inch Flexible Hose	15	15
3	pcs	Regular Rubber Male Plug	15	45
1/4	kg	Phillips Screw	25	25
1	pack	Cable Clip	30	30
2	pcs	Electrical Tape	40	40
2	pcs	Phillips Screwdriver (small)	11	22
1	pc	Lineman Pliers (small)	47	47
1	pc	Long Nose Pliers (small)	48	48
1	pc	Side Cutting Pliers (small)	48	48
1	pc	Small First Aid Kit	53	53
GRAND TOTAL				**₱2,239**

As presented in the following table, the total cost of the electrical components and tools required for the CirKit amounted to ₱2,239.00. Similar to the structural components, the prototype version of the electrical section was completed within two (2) weeks, and several refinements were made based on expert suggestions to improve functionality, safety, and ease of use. The items such as the RCBO distribution box, circuit breaker, outlets, wiring, switches, LED bulbs, and various hand tools were selected for their balance of affordability and practicality. Each component was carefully counted and priced to provide a comprehensive view of the expenses necessary to make the CirKit operational. The relatively low total cost for the electrical section shows that the CirKit can be assembled at a minimal expense without sacrificing the essential features needed for hands-on learning activities. This further supports the idea that the developed kit is an accessible, cost-effective instructional tool that schools can adopt even with limited budgets. By minimizing the cost of electrical components while ensuring the kit remains functional and safe, the CirKit promotes a practical approach to technical education that can enhance students' skills through experiential learning (Ugot & Pasion, 2023).

Combining both structural and electrical components, the overall bill of materials for the complete CirKit amounts to ₱3,600.00 (₱1,361.00 for the base materials + ₱2,239.00 for the electrical components). When compared to the cost reported in the study Design and Development of AC-DC Electrical Installation and Maintenance (EIM) Trainer, which indicated that the EIM trainer required an estimated ₱6,935.00 for its bill of materials to complete a functional instructional trainer (Ugot & Pasion, 2023), the developed CirKit is significantly more economical.

This comparison suggests that the CirKit provides a more cost-effective alternative to traditional instructional trainers without compromising its instructional capability. The EIM trainer study highlighted the benefits of providing learners with hands-on experience through practical devices, but its higher cost may limit adoption by schools with tighter budgets. In contrast, the lower total cost of the CirKit demonstrates that it can be produced and replicated at a fraction of the expense, making it a viable option for enhancing technical and vocational education. Such affordability can help schools implement inclusive instructional materials that support learners' skills development more sustainably and accessibly (Ugot & Pasion, 2023).

This section presents the summary of the expert validation results of CirKit. The evaluation was conducted by five (n = 5) experts using three factors: content quality, other findings, and additional requirements for manipulatives. The results were analyzed using the weighted mean to determine the overall quality and validity of the developed instructional kit.

Table 3. Summary of Experts' Evaluation of the CirKit Instructional Material

Indicators	**Evaluator 1**	**Evaluator 2**	**Evaluator 3**	**Evaluator 4**	**Evaluator 5**	**Overall**
Factor A. Content Quality	40	40	38	40	40	39.6
Factor B. Other Findings (Conceptual Errors, Factual Errors, Grammatical/Typographical Errors, etc.)	16	16	16	16	16	16
Factor C. Additional Requirements for Manipulative	24	22	22	24	23	23
Interpretation	Passed	Passed	Passed	Passed	Passed	**Passed**

As shown in the expert validation results, CirKit received consistently high ratings across all factors from five (n = 5) evaluators, indicating strong agreement on its quality and suitability as an instructional material. Factor A (Content Quality) obtained a very high mean of 39.6, showing strong alignment with curriculum standards and accurate, well-presented content. Factor B (Other Findings) consistently scored a perfect 16, indicating that the material is free from conceptual, factual, and grammatical errors. Factor C (Additional Requirements for Manipulative) recorded an overall mean of 23, with slight variations but still interpreted as Passed, confirming adequacy in instructional design, safety, and usability. Overall, the results show that CirKit is highly acceptable and compliant with DepEd LRMDS standards, with minor variations only suggesting areas for improvement but not affecting its overall validity.

The following table presents the teachers' evaluation of the CirKit in terms of its overall effectiveness, workmanship, functionality, safety, and user-friendliness as a supplementary instructional material in supporting the development of students' competencies in basic electrical concepts. An adapted research instrument is used by the respondents using the point scale on its effectiveness, workmanship, functionality, safety, and user-friendlyness.

Table 4. Rating Scale and Interpretation Guide

Indicators	**Scale**	**Range**
Very Good	5	4.60 – 5.00
Good	4	3.70 – 4.59
Average	3	2.80 – 3.69
Poor	2	1.90 – 2.79
Very Poor	1	1.00 – 1.89

Table 5. Teachers' Evaluation of the CirKit in Terms of Overall Effectiveness, Workmanship, Functionality, Safety, and User-Friendliness

Statements	Mean	SD	Description	Interpretation
1. Effectiveness	4.90	0.17	Very Good	Highly Acceptable
2. Workmanship	4.78	0.30	Very Good	Highly Acceptable
3. Functionality	4.83	0.28	Very Good	Highly Acceptable
4. Safety	4.87	0.19	Very Good	Highly Acceptable
5. User-Friendly	4.84	0.23	Very Good	Highly Acceptable
Overall	**4.13**	**0.11**	**Good**	**Acceptable**

Table 5 demonstrates that each of the five evaluation criteria of the CirKit scored high, ranging between 4.78 to 4.90 that can be interpreted as, Very Good. Effectiveness scored highest (M = 4.90, SD = 0.17), followed by safety (M = 4.87, SD = 0.19), ease of use (M = 4.84, SD = 0.23), and functionality (M = 4.83, SD = 0.28). The lowest score (M = 4.78, SD = 0.30) was workmanship, (but also considered Very Good) with an average of 4.13 (SD = 0.11) indicating that there was solid consensus on the functionality of the kit.

The results support the idea that the CirKit is a high-quality and useful resource of teaching the principles of the basics of electricity. The effectiveness and safety ratings are rated high which means that it is practical and student centered. Lines of less importance in workmanship make no difference in the general approval. These findings are consistent with the Experiential Learning Theory (1984) suggested by Kolb and a study by Syam, Ada, & Poerwanto (2024) about the relevance of safe and practical materials in shaping skills and engagement. The following table indicates the ratings by the teachers on CirKit in facilitating the achievement of electrical competencies in the students.

Table 6. The Level of Effectiveness of the CirKit in Improving Students' Understanding and Practical Skills in Basic Electricity as Perceived by Teachers

Statements	Mean	SD	Description	Interpretation
1. Effectively supports the teaching of basic electrical skills	4.94	0.24	Very Good	Highly Acceptable
2. Helps simplify lessons about basic electrical concepts	5.00	0.00	Very Good	Highly Acceptable
3. Enhances teachers' instructional strategies in TLE	5.00	0.00	Very Good	Highly Acceptable
4. Promotes a better understanding of electrical lessons	4.94	0.24	Very Good	Highly Acceptable
5. Can be an effective aid in teaching-learning discussions	4.89	0.32	Very Good	Highly Acceptable
Overall	**4.96**	**0.11**	**Very Good**	**Highly Acceptable**

Table 6 indicates that the CirKit got highly rated in terms of instructional effectiveness whereby the mean scores were between 4.89 and 5.00 which are all understood to be very good. Perfect score (M = 5.00, SD = 0.00) in the simplification of lessons and improvement of teaching strategies, which reflects the unanimity of participants. Other indicators included supporting basic electrical skills (M = 4.94, SD = 0.24), promoting content understanding (M = 4.94, SD = 0.24), and discussing (M = 4.89, SD = 0.32) also indicated highly with little variation. The mean value of 4.96 (SD = 0.11) shows that there is a high agreement on the effectiveness of the CirKit. Such findings indicate that the kit enhances learning, engagement, and in-classroom interaction, which includes Bruner Discovery Learning Theory (1961) and the studies on hands-on circuit kits (Hanapi et al., 2021).

Table 7. The Extent to which the CirKit Demonstrates Durability, Proper Assembly, and Quality Construction as Evaluated by Teachers

Statements	Mean	SD	Description	Interpretation
1. Is made of quality and durable materials	5.00	0.00	Very Good	Highly Acceptable
2. Is neat, well-built, and presentable in appearance	4.83	0.38	Very Good	Highly Acceptable
3. Meets the standards and learning competencies for basic electrical lessons	4.94	0.24	Very Good	Highly Acceptable
4. Demonstrates originality and quality comparable to other teaching kits for electricity	4.94	0.24	Very Good	Highly Acceptable
5. Devices, components, and accessories are properly arranged	5.00	0.00	Very Good	Highly Acceptable
Overall	**4.94**	**0.09**	**Very Good**	**Highly Acceptable**

Table 7 results indicate that the teachers rated the CirKit with high scores in the area of durability with average scores of 4.83 to 5.00 with all scores being very good. Perfect scores (5.00) on the use of quality materials and arrangement of components means unanimous agreement. Other aspects, such as quality and originality, scored M = 4.94 (SD = 0.24), while neatness scored M = 4.83 (SD = 0.38). The mean rating was M = 4.94 (SD = 0.09) with a high level of agreement.

These results suggest that the CirKit is composed of quality enduring materials and it is well packaged to be used in the classroom. Trivial differences in appearance made no difference in the general evaluation. They find relevance with the Appropriate Technology Theory (1973) developed by Schumacher, focusing on simple, low-cost, durable tools, and conform to Suyod (2024), who observes a high student interest in circuit kits and their role as a source of creativity, problem-solving, and reliability. In general, the CirKit can be seen as efficient and sustainable in terms of creating the fundamental electrical skills in students. The following table will include the assessment of the CirKit by teachers as an add-on tool to build basic currents-work skills in students.

Table 8. The Degree to which the CirKit Operates Properly and Performs its Intended Instructional Purpose as Assessed by Teachers

Statements	Mean	SD	Description	Interpretation
1. Is practical, helpful, and multifunctional in performing its intended purpose for teaching basic electrical concepts	5.00	0.00	Very Good	Highly Acceptable
2. Allows users to perform hands-on simulation and troubleshooting of basic electrical circuits	4.94	0.24	Very Good	Highly Acceptable
3. Operation procedures clearly demonstrate and explain the required competencies in basic electrical installation and maintenance	4.89	0.32	Very Good	Highly Acceptable
4. Provides learners with training opportunities that reinforce fundamental concepts and principles of basic electricity	4.94	0.24	Very Good	Highly Acceptable
5. Aligns with the desired learning outcomes and competency standards set for basic electricity instruction	5.00	0.00	Very Good	Highly Acceptable
Overall	**4.96**	**0.09**	**Very Good**	**Highly Acceptable**

Table 8 demonstrates that the CirKit was rated in the category of very high in all five criteria with averages of between 4.89 and 5.00 and all scored as very good. In the total mean of 4.96 (SD = 0.09) there is a high level of agreement. The score of statement 1 and statement number 5 was 5.00, which reflects agreement by all

respondents about the suitability of the kit and its correspondence to the learning outcomes. High scores with low differences were also achieved on other statements indicating consistency in the perceptions of the statements.

The results of these tests are that the CirKit is quite acceptable and can be used to teach the fundamental electrical theory. Its practical, student based design supports competencies development, interaction and involvement. Delays in rating of simulation and demonstration were a trifle. These outcomes match the existing study that revealed that technical-vocational education gains more in hands-on kits than in other assessment methods (Hanapi et al., 2021).

Altogether, the CirKit is a resource which is reliable, cost-effective, practical and user-friendly, which takes care of the gaps in the TLE classrooms and improves the overall effectiveness of teaching, as well as student learning. The following table will include the assessment of the CirKit by teachers as an add-on tool to build basic currents-work skills in students.

Table 9. The Extent to which the CirKit Ensures Safe Usage during Classroom Instruction as Perceived by Teachers

Statements	Mean	SD	Description	Interpretation
1. Has built-in safety features and proper protection for users	5.00	0.00	Very Good	Highly Acceptable
2. Electrical connections are correctly installed and well-insulated	4.94	0.24	Very Good	Highly Acceptable
3. Includes appropriate labels and symbols for electrical parts and circuits	4.94	0.24	Very Good	Highly Acceptable
4. Wiring and setup ensure safe use and prevent electrical hazards	5.00	0.00	Very Good	Highly Acceptable
5. Does not pose any serious risk of injury to users	4.94	0.24	Very Good	Highly Acceptable
Overall	**4.97**	**0.08**	**Very Good**	**Highly Acceptable**

Table 9 indicates that electrical set up and safety features of the CirKit have been rated very highly by the respondents with a mean rating of between 4.94 and 5.00 with an overall mean of 4.97 and SD of 0.08 indicating that there was strong agreement. The perfect scores (5.00) and the lack of disagreements were noted in the Safety features and protection, and inSafe Wiring and Hazard Prevention. There are other factors which are rated M = 4.94 (SD = 0.24) with extremely positive rates and a low rate of variance.

The results affirm the CirKit to be safe, reliable, and even surpass expectations in defending users. Wiring, insulating, labeling and protection of components meet national electrical standards. There are slight differences in certain criteria but this does not mean that there are deficiencies. The findings are consistent with those of Turqueza & Angangan (2025) and Vallar (2025) who observed that kits that were well insulated and safely designed had the best safety rating. On balance, the CirKit offers a safe practical learning platform that can be utilized to deliver effective and safe education on the basics of electrical knowledge.

Table 10. The Level to which the CirKit is Easy to Use, Understand, and Manage during Instruction According to Teachers' Evaluation

Statements	Mean	SD	Description	Interpretation
1. Is easy to use, operate, and carry to different learning areas	5.00	0.00	Very Good	Highly Acceptable
2. Provides realistic and practical tasks related to basic electrical work	5.00	0.00	Very Good	Highly Acceptable
3. Is convenient and helpful within a limited learning time	4.89	0.32	Very Good	Highly Acceptable
4. Matches the user's ability to understand and perform electrical tasks	5.00	0.00	Very Good	Highly Acceptable
5. Is suitable for various users and adaptable to different group sizes	5.00	0.00	Very Good	Highly Acceptable
Overall	**4.98**	**0.06**	**Very Good**	**Highly Acceptable**

According to Table 46, the CirKit was rated highly on usability, practicality, adaptability, and alignment with the abilities of learners with 4.89 to 5.00 mean scores with an overall mean of 4.98, and a low standard deviation of 0.06. The four statements had a scores of 5.00, 5.00, 5.00, 5.00 and the third score fell below 5.00 at 4.89 with SD = 0.32 meaning there was unanimous agreement, however, there was a slight deviation of the other score.

These findings suggest that the CirKit is easy to use, convenient, and flexible to learners of different levels of skills including a large number of learners. The small variations in the ratings of convenience are probably a straight reflection of personal experiences without impacting the general positivity. These results confirm previous studies (Rosales, 2022; Malunes & Narcilla, 2025) that low cost, easy to use instruction kits are effective, inclusive and reliable learning tools that can improve teaching and learning in Technology and Livelihood Education.

IV. CONCLUSION

Based on the results of the study, the following conclusions were drawn. The development and validation of CirKit demonstrated that teachers face persistent challenges in delivering hands-on electrical lessons due to limited instructional resources. CirKit provided an affordable, safe, and user-friendly solution aligned with DepEd's LRMDS standards, addressing gaps in teaching basic electrical competencies in TLE–Industrial Arts (Department of Education, 2017; Barrera, 2022).

Teachers emphasized the need for durable, learner-centered kits that simplify complex concepts and promote active learning. CirKit responded to these needs by offering functional and practical activities that strengthened both theoretical understanding and psychomotor skills, consistent with findings by Hanapi, Abd Rahman, and Mohd Zuki (2021). Validation results confirmed that CirKit met standards of content quality, functionality, safety, and usability, making it acceptable to teachers as a supplementary instructional material. This supports previous studies showing that teacher-made kits improve curiosity and problem-solving among learners (Suyod, 2024).

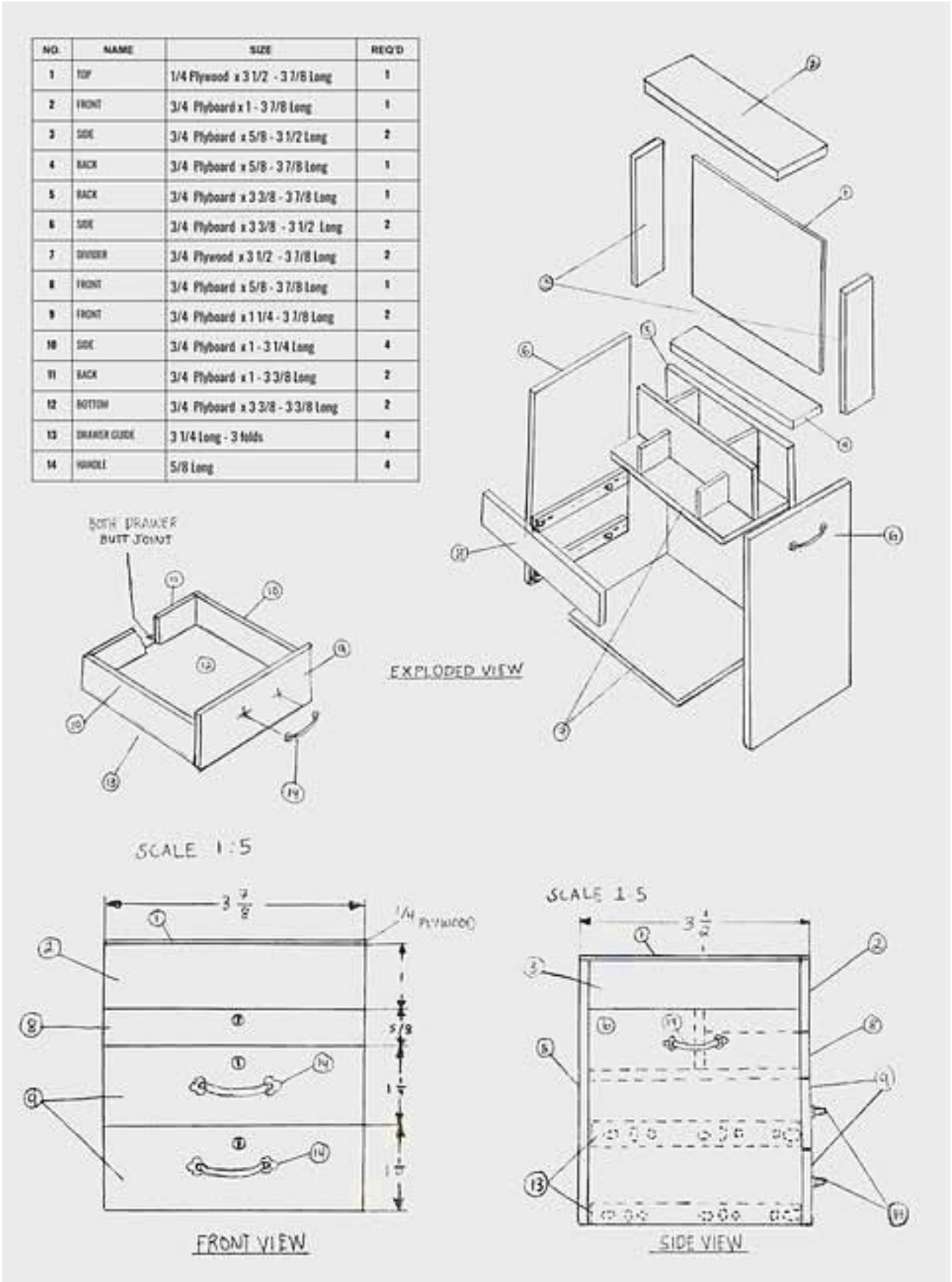
Resource limitations such as inadequate tools, limited funding, and lack of access to commercial kits remain significant challenges in teaching electrical competencies. CirKit provided a cost-effective alternative, but broader institutional support is necessary for sustainability, echoing Barcelona et al.'s (2023) findings on resource shortages in public schools.

CirKit serves as a model for innovation in technical-vocational education. Anchored in Kolb's Experiential Learning Theory (1984), the kit fosters meaningful learning by allowing students to perform tasks, reflect on outcomes, and apply knowledge in new contexts. At the same time, guided by Appropriate Technology Theory (Schumacher, 1973), CirKit demonstrates that simple, low-cost, and locally available materials can effectively support skill development without requiring expensive or complex systems.

Appendix 1

Picture of Assembly Drawing of CirKit

NO.	NAME	SIZE	REQ'D
1	TOP	1/4 Plywood x 3 1/2 - 3 7/8 Long	1
2	FRONT	3/4 Plyboard x 1 - 3 7/8 Long	1
3	SIDE	3/4 Plyboard x 5/8 - 3 1/2 Long	2
4	BACK	3/4 Plyboard x 5/8 - 3 7/8 Long	1
5	BACK	3/4 Plyboard x 3 3/8 - 3 7/8 Long	1
6	SIDE	3/4 Plyboard x 3 3/8 - 3 1/2 Long	2
7	DIVIDER	3/4 Plywood x 3 1/2 - 3 7/8 Long	2
8	FRONT	3/4 Plyboard x 5/8 - 3 7/8 Long	1
9	FRONT	3/4 Plyboard x 1 1/4 - 3 7/8 Long	2
10	SIDE	3/4 Plyboard x 1 - 3 1/4 Long	4
11	BACK	3/4 Plyboard x 1 - 3 3/8 Long	2
12	BOTTOM	3/4 Plyboard x 3 3/8 - 3 3/8 Long	2
13	DRAWER GUIDE	3 1/4 Long - 3 folds	4
14	HANDLE	5/8 Long	4



Appendix 2

Pictures of 3D Design of CirKit

Appendix 2

Pictures of the Prototype Version of CirKit




Appendix 2

Pictures of the Final Version of CirKit


Conflicts of Interest

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

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