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Research Article

Portable Extension Wire with Manual Cable Reel for Industrial Use

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Abstract: This research innovation relates to a portable extension wire with a manual cable reel mechanism. The device consists of a compact, lightweight housing that contains a spool or reel for winding and unwinding an electrical extension cord. The reel is manually operated, allowing the user to easily extend or retract the cord as needed without the use of any motors or automated mechanisms. The housing is designed to be highly portable, with a carrying handle and compact dimensions that make it easy to transport and store when not in use. The extension cord can be fully extended to provide power access over a wide area, spanning up to 26 feet. When the cord is no longer needed, it can be smoothly retracted back onto the internal reel, neatly storing the cord within the housing. The manual cable reel mechanism provides the user with precise control over the length of cord that is deployed. This helps prevent tangles, kinks, or excess slack in the cord, improving both safety and convenience compared to traditional extension cords that must be manually coiled. The study investigates user satisfaction with the device's efficiency, durability, safety, and its specific benefits for Bachelor of Industrial Technology students at Cebu Technological University.

Keywords: portable extension wire; manual cable reel; electrical safety

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1. Introduction

The Bachelor of Industrial Technology (BIT) program at Cebu Technological University Pinamungajan Campus is designed to equip students with a comprehensive understanding of industrial processes, equipment, and technologies. Today, technology is evolving by innovating the available materials even from waste and scraps (Park, 2014). As part of this curriculum, students are exposed to a wide range of tools and devices that are commonly used in various industrial settings, enabling them to develop the necessary skills and expertise to excel in their future careers.

According to Canillo and Bendanillo (2023) by learning about industrial technology, we become better at taking care of ourselves and making smart choices in our modern world. According to TAM individuals' intention to use technology determines the actual use of the application and attitudes toward technology affect the intention (Brown et al., 2012). Exploring this helps us understand how things are made and leads to a more informed and capable way of living (Maddox, 2008).

One such tool that is particularly valuable in the BIT program is the portable extension wire with a manual cable reel. According to Koren, Wang and Gu (2017), extension wire scalability is defined as the ability of a system to adjust in production capacity through reconfiguration with minimal cost, in minimal time, over a large capacity range. This versatile equipment plays a crucial role in providing temporary and flexible access to electrical power by which is essential for the successful completion of various practical assignments, laboratory exercises, and project-based learning activities.

The portable extension wire with a manual cable reel allows students to extend electrical power to areas that may not have direct access to power outlets, such as remote workstations, machinery, or equipment. This feature is particularly important in industrial settings, where the layout and configuration of the workspace can often present challenges in terms of power accessibility. By utilizing this equipment, students can overcome these obstacles and ensure

the seamless operation of their projects and experiments (Chang & Liu, 2025).

Moreover, the manual cable reel component of the extension wire offers additional benefits (Rosato, 1998). It enables students to neatly coil and retract the wire when not in use, reducing the risk of tangles, damage, or tripping hazards. This feature not only enhances the safety and organization of the workspace but also promotes efficient and effective work practices, which are essential skills for future industrial technologists (Vashishth et al., 2024).

This report aims to provide an in-depth examination of the portable extension wire with a manual cable reel, its features, and its applications within the BIT program at Cebu Technological University. By understanding the capabilities and benefits of this equipment, students can better appreciate its role in their academic and professional development as future industrial technologists.

The study will start by looking at the important parts and how the portable extension wire with a manual cable reel works. Then, it will explore how this tool can be used in different BIT courses and practical activities. Lastly, it will explain why this tool is valuable for improving learning and preparing students for jobs in the industry.

2. Materials and Methods

The portable extension wire with a manual cable reel is designed using durable materials such as copper cables for conductivity and safety, a sturdy plastic or metal reel for storage, and secure electrical connectors (Martinka, 2022). It features a wooden casing for durability, ergonomic handles for easy use, a switch for power control, and bearings for smooth operation. A smooth finish and waterproofing enhance aesthetics and longevity, while weather-resistant paint protects the housing.

The design focuses on convenience, durability, and user-friendliness, particularly for Bachelor of Industrial Technology students at Cebu Technological University Pinamungajan Campus. It ensures easy operation, secure connections, and protection from environmental factors. Construction involves precise assembly of high-quality materials, ensuring safety and functionality. Finishing processes include weather-resistant coatings for a professional look and durability.

Implementation includes thorough testing, quality assurance, and user training to ensure proper use and maintenance. The research uses a quantitative design with a structured survey to measure workspace efficiency, user comfort, and productivity among 80 BIT students and instructors. Data is collected anonymously via an online survey and stored securely to protect privacy. Ethical guidelines are strictly followed, with informed consent and anonymized data ensuring participants' confidentiality and rights.

3. Results

This study investigates the beneficial of Portable Extension Wire with Manual Cable Reel as a series of profitable and ergonomic assessment. Following the comprehensive analysis of findings and discussion on the usability and effectiveness of the portable extension wire with a manual cable reel, it is pivotal to outline strategic recommendations aimed at optimizing its design, safety features, and educational integration within the Building and Industrial Technology curriculum. These recommendations are poised to enhance user experience, mitigate operational risks, and foster a more robust educational framework for future industrial professionals.

3.1. Statistics and Data Analysis

Table 1 presents the User's appeasement for the application of Portable Extension Wire with Manual Cable Reel. The data reflects the respondents' perceptions based on four key dimensions: efficiency, durability, safety and reliability, and safety features and mechanisms. The responses were gathered to assess the device's impact on workshop management, equipment use, and educational utility.

Table 1. User's appeasement for the application of Portable Extension Wire with Manual Cable Reel.

What is the user's appeasement with the application of the Portable Extension Wire with Manual Cable Reel in terms of the following:

Questions	Answer	Frequency	Percentage
1.1. Efficiency (Purposeful application of the device & ability to save energy over an extended period)			
Q1. Does the Portable Extension Wire with Manual Cable Reel made easier to manage the work shop / electricity needs?	yes	79	96.7%
	no	1	3.3%
Q2. Does the Portable Extension Wire with Manual Cable Reel enhance the work efficiency and flexibility of BIT students in electronics projects by providing a reliable power source for electronic devices and circuits?	yes	80	100%
	no	0	0%
Q3. How effective is the manual cable reel mechanism in preventing cable tangling?	yes	79	96.6%
	no	1	3.4%
1.2. Durability (Ability of an object or material to withstand where damage or deterioration overtime)			
Q1. How do the preferences and requirements for using portable extension wires in practical activities vary for BIT students specializing in Civil Technology, EIM, SMAW, IDT, and Electronics based on durability considerations?	yes	78	95.6%
	no	2	4.4%
Q2. How effective is the Portable Extension Wire with Manual Cable Reel innovation?	yes	80	100%
	no	0	0%
Q3. How does regular equipment maintenance, including the portable ex-tension wire, impact the longevity and effectiveness of the tools in design-related fields?	yes	79	97%
	no	1	3.0%
1.3. Safety and Reliability (ability to operate safely over an extended period)			
Q1. Is the current innovation of the Portable Extension Wire with Manual Cable Reel beneficial for BIT students in CTU by supporting seamless connectivity for various design tools and equipment?	yes	80	100%
	no	0	0%
Q2. How does user experience with the portable extension wire influence their overall satisfaction and efficiency in completing tasks?	yes	76	95.7%
	no	4	5.3%
1.4. Safety Features and Mechanism (it is added for user safety and designed system)			
Q1. How does the manual cable reel mechanism play in enhancing workspace organization and efficiency in de-sign-related tasks?	yes	77	94%
	no	3	6%
Q2. How do the design features of the portable extension wire align with the specific needs and challenges faced by BIT students and instructors in design-related fields at Cebu Technological University Pinamungajan Campus?	yes	79	99%
	no	1	1%

The data from Table 1 provides a comprehensive view of BIT students' satisfaction and perceptions regarding the application of the Portable Extension Wire with Manual Cable Reel. across various dimensions, the findings indicate overwhelmingly positive feedback. In terms of efficiency, 96.7% of respondents find that the device significantly eases workshop management and electricity needs, highlighting its role in enhancing work efficiency and flexibility for electronics projects (100%). The manual cable reel mechanism is also highly effective in preventing cable tangling (96.6%). Regarding durability, 95.6% of students acknowledge the importance of durability in practical activities, underscoring the device's effectiveness (100%) and its impact on tool longevity through regular maintenance (97%). Safety and reliability receive unanimous approval (100%), emphasizing the Portable Extension Wire with Manual Cable Reel's crucial support in seamless connectivity and satisfaction in task completion (95.7%). Safety features, including workspace organization and alignment with specific needs, are similarly recognized (94-99%), demonstrating the device's robust design and its integration into instructional settings at Cebu Technological University Pinamungajan Campus. Overall, these findings illustrate strong user satisfaction and operational benefits across efficiency, durability, safety, and specific design-related challenges, affirming the device's positive impact within educational contexts.

Table 2. The current innovation Portable Extension Wire with Manual Cable Reel help the BIT students with their task or projects.

How do the current innovation Portable Extension Wire with Manual Cable Reel help the BIT students with their task or projects?	Identified respondent groups					
	Civil & Electrical Technology (10)		Welding & Fabrication and Interior Design Technology (10)		Electronics & Drafting Technology (60)	
	WM	VD	WM	VD	WM	VD
The Portable Extension Wire with Manual Cable Reel has improved work setup efficiency.	4.54	VHS	4.56	VHS	4.56	VHS
The Portable Extension Wire with Manual Cable Reel helps students work in various campus locations.	4.56	VHS	4.59	VHS	4.56	VHS
The Portable Extension Wire with Manual Cable Reel enhances safety and organization in workspaces.	4.56	VHS	4.54	VHS	4.56	VHS
The Portable Extension Wire with Manual Cable Reel makes tasks easier and more accessible.	4.54	VHS	4.56	VHS	4.54	VHS
Overall weighted mean:	4.55		4.56		4.55	
Standard deviation:	0.01		0.0180		0.01	
Interpretation:	Very highly satisfied					

Table 2 presents data on how the current innovation of the Portable Extension Wire with Manual Cable Reel benefits BIT students in their tasks or projects, segmented by different respondent groups: Civil & Electrical Technology (10 respondents), Welding & Fabrication and Interior Design Technology (10 respondents), and Electronics & Drafting Technology (60 respondents). The table evaluates various aspects of the Portable Extension Wire with Manual Cable Reel's impact, represented by weighted means (WM) and interpreted through verbal descriptions (VD).

Across all identified respondent groups, the Portable Extension Wire with Manual Cable Reel consistently scores very high satisfaction ratings, with weighted means ranging from 4.54 to 4.59, signifying that students are "Very highly satisfied" with its performance. Specifically, the device significantly improves work setup efficiency, facilitates work in different campus locations, enhances safety and organization in workspaces, and makes tasks easier and more accessible. Overall, the data from Table 2 underscores that the Portable Extension Wire with Manual Cable Reel is highly effective and well-received among BIT students across various disciplines. Its ability to enhance efficiency, safety, and accessibility in project environments highlights its value as a beneficial tool in educational settings, contributing positively to student outcomes and project execution.

Table 3. The safety of Portable Extension Wire with Manual Cable Reel innovation towards the BIT students.

How safe is the Portable Extension Wire with Manual Cable Reel innovation to the BIT students?	Identified Respondent Groups					
	Civil & Electrical Technology (10)		Welding & Fabrication and Interior Design Technology (10)		Electronics & Drafting Technology (60)	
	WM	VD	WM	VD	WM	VD
The Portable Extension Wire with Manual Cable Reel is designed with strong insulation and durable materials to prevent electrical hazards, like shocks and short circuits.	4.53	VSA	4.55	VSA	4.54	VSA
It includes easy-to-hold handles and organized cable management, reducing strain and physical risks while using it.	4.59	VSA	4.54	VSA	4.52	VSA

It meets safety standards required for electrical devices, ensuring it's safe and reliable for educational use.	4.51	VSA	4.53	VSA	4.55	VSA
BIT students are taught how to use it safely, promoting responsible handling and minimizing accidents.	4.52	VSA	4.52	VSA	4.54	VSA
Overall weighted mean:	4.53		4.53		4.53	
Standard deviation:	0.0311		0.0112		0.0132	
Interpretation:	Very strongly agree					

Table 3 provides an analysis of the safety of the Portable Extension Wire with Manual Cable Reel innovation among BIT students, segmented by respondent groups: Civil & Electrical Technology (10 respondents), Welding & Fabrication and Interior Design Technology (10 respondents), and Electronics & Drafting Technology (60 respondents). The table evaluates the device's safety aspects using weighted mean (WM).

Overall, the Portable Extension Wire with Manual Cable Reel receives very high safety ratings across all respondent groups, indicating a consensus that students "Very strongly agree" with its safety features. Specific aspects contributing to this high rating include its design with strong insulation and durable materials to prevent electrical hazards like shocks and short circuits, ergonomic features such as easy-to-hold handles and organized cable management that reduce strain and physical risks, and adherence to safety standards required for educational use.

Moreover, the inclusion of safety education for BIT students, promoting responsible handling and accident prevention, further supports the device's high safety use. To sum up, Table 3 illustrates that the Portable Extension Wire with Manual Cable Reel is widely perceived as very safe among BIT students across various disciplines. Its robust design, ergonomic considerations, compliance with safety standards, and emphasis on user education collectively contribute to its effectiveness and reliability in educational environments, ensuring a secure and conducive workspace for student projects and tasks.

4. Discussion and Conclusions

The results manifested that the students in the BIT program at CTU Pinamungajan Campus expressed high satisfaction with the Portable Extension Wire with Manual Cable Reel.

The device was praised for its practicality, functionality, and safety, meeting their needs effectively at a reasonable cost. Participants appreciated its enhanced convenience and portability, aligning with ergonomic principles, which facilitated easy movement and use across various campus locations. While some suggestions for improvement were noted, overall feedback highlighted the extension wire's utility in workspace settings.

These findings resonate with previous research, such as studies by J. Rotimi, Moshood, and F. Rotimi (2024), which underscore the importance of ergonomic design in cable management systems. Similarly, Ravanbakhsh (2024) emphasized the critical role of temporary power solutions in enhancing safety and productivity on job sites. The positive reception of the portable extension wire with a manual cable reel among BIT students aligns with these broader insights into the practical benefits and ergonomic considerations of such devices in industrial and educational contexts.

Thus, this study not only confirms the device's effectiveness in meeting user expectations but also contributes to the growing body of knowledge on ergonomic tools that support efficient and safe work environments (Ronario Jr, 2023). The study's findings carry important implications for workplace safety, particularly in terms of electrical safety and health considerations. By incorporating portable extension wires with manual cable reels, organizations have the potential to lower costs linked to specialized electrical equipment while offering users a flexible and ergonomic workspace solution. The versatility of utilizing portable extension wires with manual cable reels creates possibilities for innovative workspace layouts and adjustable workstations that accommodate a range of user requirements. Addressing noted limitations, such as cord management and ergonomic support, can further improve the usability and effectiveness of repurposed extension wires in various settings, including sites, workshops, and field environments. In conclusion, this research highlights the portable extension wire with a manual cable reel as a versatile and convenient tool suitable

for various applications. Its ease of extension and retraction makes it ideal for workshops, construction sites, outdoor events, and more. The manual reel mechanism ensures controlled and tidy cable management, reducing the risk of accidents. Overall, this extension cord offers a practical solution for extending power where needed, promoting organization and safety.

For further enhancements in the development of a high-quality, durable portable extension wire with a manual cable reel can be achieved by implementing specific recommendations. Firstly, enhancing the ergonomics of the manual cable reel mechanism should be prioritized to optimize user comfort and reduce fatigue during prolonged use. This could involve refining handle shapes, improving rotation mechanisms, and simplifying cable retraction based on ergonomic evaluations which were conducted previously (Patel et al., 2022).

Secondly, safety features should be continuously upgraded to meet current standards and regulations (Soliman et al., 2011). This includes ensuring robust insulation to prevent electrical hazards, implementing secure cable management systems to mitigate tripping risks, and potentially integrating smart technologies for overload protection.

Thirdly, exploring durable and sustainable materials and construction methods is crucial (Abera, 2024). This approach could include using recyclable materials, enhancing energy efficiency during operation, and ensuring product longevity through rigorous testing and quality assurance measures.

Furthermore, developing comprehensive training programs for both students and instructors in the Building and Industrial Technology field is essential (Davis, 1993). These programs should emphasize safe handling practices, proper maintenance procedures, and situational awareness to minimize accidents and extend the product's lifespan.

Establishing a robust feedback mechanism where users, particularly BIT students and faculty, can provide ongoing input and suggestions for improvement is also recommended. This could involve regular surveys, focus groups, or direct feedback channels to capture user experiences and implement iterative enhancements (Neitzel, 2016).

Moreover, integrating the portable extension wire with a manual cable reel more deeply into the BIT curriculum would enhance its educational value. Practical exercises, case studies, and real-world applications across different disciplines (e.g., Civil Technology, Electrical, Welding and Fabrication) should be incorporated to better prepare students for industrial challenges.

Lastly, fostering collaborations with industry partners, researchers, and stakeholders to advance the technology and applications of portable extension wires is crucial. Joint research initiatives, knowledge-sharing efforts, and participation in industry conferences can facilitate continuous improvement and innovation (Lacaba, 2025).

By implementing these recommendations, manufacturers, educators, and stakeholders can significantly enhance the utility, safety, and educational impact of portable extension wires with manual cable reels, ensuring they remain indispensable tools in both educational settings and various industries.

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