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PREPARING CIVIL TECHNOLOGY STUDENTS FOR A FUTURE-READY WORKFORCE: A CASE STUDY OF SAFETY HAZARDS IN CONSTRUCTION AT A PUBLIC UNIVERSITY IN CEBU CITY, PHILIPPINES

Dennis Capuyan

Cebu Technological University (Philippines)

dennis.capuyan@gmail.com

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Abstract

This study explores the effectiveness of safety education in preparing civil technology students for real-world construction hazards at a public university in Cebu City. Utilizing a cross-sectional, mixed-methods approach, the study surveyed 254 students from 2nd to 4th year, aged 20 to 25, who had direct experience with construction and deconstruction activities on campus. The findings reveal significant gaps in safety training, with students reporting varied levels of severity for different hazards, including fall, equipment, and structural hazards. While the curriculum provides a foundational understanding of safety protocols, many students expressed concerns about the practical application of their training in actual construction environments. The study also highlights the need for better alignment between academic curricula and industry safety standards to equip students with the necessary skills and knowledge for future careers. The results underscore the importance of comprehensive safety education that includes hands-on experience and real-world applicability, emphasizing the role of educational institutions in preparing a future-ready workforce.

Keywords – Safety hazards, Construction and deconstruction, Civil technology education, Future-ready workforce, Safety implementation.

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1. Introduction

The construction industry, recognized as a cornerstone of global economic development, is also one of the most hazardous sectors (Almaskati, Kermanshachi, Pamidimukkala, Loganathan & Yin, 2024; Pheng & Hou, 2019). Safety concerns within construction sites remain a critical issue, with accidents often leading to severe injuries, long-term disabilities, or fatalities (Alateeq, Rajeena & Ali, 2023). These incidents highlight the urgent need for professionals who are not only skilled in construction techniques but also adept in safety management (Tao, Hu, Xue, Zhang & Xu, 2024). As civil technology students represent the future workforce of this industry, their education must encompass both the technical and safety aspects required to navigate and mitigate workplace risks effectively (De Souza & Debs, 2023).

In recent years, the push for a future-ready workforce has gained momentum, particularly in regions undergoing rapid urbanization and industrial growth, such as Cebu City in the Philippines. The construction boom in this region has underscored the necessity for graduates who are well-versed in modern construction methods and safety protocols. Public universities in Cebu City are at the forefront of this educational mission, tasked with preparing civil technology students to meet the evolving demands of the construction industry. This preparation involves not only imparting technical knowledge but also instilling a deep understanding of the critical importance of safety in all construction activities (Anastasiu, Anastasiu, Dumitran, Crizboi, Holmaghi & Roman, 2017).

The importance of safety education in civil technology cannot be overstated, especially in a field where the stakes are high, and the margin for error is minimal (Alqahtani, Abas, Alkahtani, Hayat & Farrukh, 2024). This study aims to examine the extent to which civil technology students at a public university in Cebu City are being prepared to handle safety hazards in construction environments. By investigating the curriculum, teaching methodologies, and the practical training opportunities provided, this research seeks to evaluate how effectively these students are being equipped to meet real-world challenges. This evaluation is essential to ensure that the future workforce is not only competent but also safety-conscious.

Despite the increasing emphasis on safety education in civil technology programs, significant research gaps remain in understanding how effectively these programs prepare students to manage real-world safety hazards in construction environments. Existing studies often focus on the technical skills and theoretical knowledge imparted to students, but there is limited research on the practical application of safety training in actual construction settings. Additionally, there is a lack of comprehensive evaluations that assess the alignment between academic curricula and industry safety standards, particularly in rapidly developing regions like Cebu City. This gap in research highlights the need for studies that not only assess the current state of safety education but also explore the efficacy of teaching methods, the availability of practical training opportunities, and the preparedness of students to integrate safety practices into their professional roles.

2. Literature Review

2.1. Construction Safety Education and Training

Construction safety education and training are essential components of civil technology programs, as they equip students with the knowledge and skills needed to navigate the inherent risks of construction work. Previous studies have highlighted the importance of integrating safety education into civil engineering curricula, emphasizing that a well-structured safety training program can significantly reduce workplace accidents and enhance overall safety awareness among future professionals (Alhammadi, Farouk & Rahman, 2024). These programs often include a combination of theoretical instruction and practical training, such as site visits, safety simulations, and hazard identification exercises (Love & Roy, 2023). However, the effectiveness of these programs is heavily dependent on the quality of the training materials, the experience of the instructors, and the level of student engagement. For instance, a study by Love and Roy (2023) found that students who participated in hands-on safety training were more likely to retain safety concepts and apply them in real-world situations compared to those who only received classroom instruction.

Despite the recognized importance of safety education, gaps remain in how these programs are implemented across different institutions. A study by Tezel, Dobrucali, Demirkesen and Kiral (2021) revealed significant variability in the depth and breadth of safety training offered in civil technology programs, with some institutions providing comprehensive, industry-aligned safety curricula, while others only offered basic safety courses. This inconsistency can lead to disparities in students' preparedness to handle safety hazards on construction sites. Additionally, the rapid evolution of construction technologies and methodologies requires continuous updates to safety training programs to ensure that they remain relevant and effective. This highlights the need for ongoing research and development in construction safety education to ensure that future professionals are adequately equipped to manage the complexities of modern construction environments.

2.2. Industry Expectations and Competency Requirements

The construction industry places a high premium on safety competencies, expecting civil technology graduates to not only possess technical expertise but also a strong under-standing of safety protocols and hazard management. Industry standards often dictate the specific competencies required of new graduates, which include not only knowledge of safety regulations and practices but also the ability to implement these practices effectively onsite. Studies such as those by Paul (2015) have shown that employers increasingly expect graduates to be proactive in identifying potential hazards, understanding risk assessment procedures, and fostering a culture of safety within their teams. This expectation is reflected in industry competency frameworks that emphasize safety management as a core component of civil engineering education.

However, there is often a disconnect between the competencies desired by industry and those emphasized in academic programs. Research by Anastasiu et al. (2017) indicates that many academic institutions may not fully align their curricula with the latest industry standards, leading to a gap between graduate preparedness and employer expectations. This gap is particularly pronounced in regions where rapid urbanization and construction growth outpace the ability of educational institutions to update their programs. As a result, graduates may enter the workforce without the comprehensive safety management skills that are increasingly demanded by employers. Addressing this misalignment requires stronger collaboration between academic institutions and industry stakeholders to ensure that civil technology programs are continuously updated to meet the evolving needs of the construction sector.

2.3. Challenges and Barriers in Safety Implementation

Implementing safety practices in construction projects presents numerous challenges and barriers, which can hinder the effectiveness of even the most well-intentioned safety programs. One of the primary barriers identified in the literature is the lack of resources, including funding, time, and trained personnel, which can limit the ability of construction firms to provide comprehensive safety training and enforce safety protocols (Tezel et al., 2021). Additionally, cultural attitudes toward safety within the construction industry can pose significant challenges. In some cases, there may be a reluctance to prioritize safety over productivity, with safety measures being viewed as an impediment to meeting project deadlines. This is particularly evident in studies conducted in developing regions, where economic pressures often lead to compromises in safety standards (Markowski, Krasławski, A., Vairo, T., & Fabiano, 2021).

Another critical challenge is the rapid advancement of construction technologies, which can outpace the development of corresponding safety protocols. Emerging technologies such as building information modeling (BIM) and automated construction equipment introduce new safety considerations that may not be adequately covered in existing safety training programs (De Marco, Slongo & Siegele, 2024). Furthermore, regulatory frameworks may struggle to keep up with these technological changes, leading to gaps in safety oversight. These challenges underscore the importance of adaptive safety education and ongoing professional development for both students and current industry professionals. Addressing these barriers requires a multifaceted approach, including the continuous updating of safety training programs, fostering a culture of safety that permeates all levels of the construction process, and ensuring that regulatory bodies are equipped to enforce safety standards in the context of modern construction technologies.

2.4. The Current Study

The purpose of this study is to evaluate the effectiveness of safety education in civil technology programs at a public university in Cebu City, focusing on how well these programs prepare students to manage real-world safety hazards in construction environments. Specifically, this study aims to (1) identify the primary health and safety hazards encountered in construction and deconstruction projects within the university, (2) examine how these hazards impact student learning experiences, and (3) determine the essential skills and knowledge that civil technology students need to address these challenges in their future careers. The study also evaluates the alignment between academic curricula and industry safety standards, along with the practical application of safety training, to provide comprehensive insights into the current state of safety education.

3. Methodology

3.1. Research Design

This study employed a cross-sectional, mixed-methods research design using a convergent parallel approach to evaluate the effectiveness of safety education within civil technology programs at a public university in Cebu City. The cross-sectional design was chosen to capture a comprehensive snapshot of the current state of safety training, allowing for the collection of both quantitative and qualitative data from students at a single point in time (Wang & Cheng, 2020). The mixed-methods approach integrates descriptive-quantitative and qualitative data, enabling a more nuanced understanding of the variables under study (Creswell, 2014). The quantitative component systematically measured and analyzed variables such as the types of safety hazards encountered, their impact on student learning, and the level of student preparedness to address these challenges, using structured surveys. Simultaneously, the qualitative component gathered in-depth insights through open-ended survey questions, exploring students' experiences with safety protocols and their perceptions of curriculum alignment with industry standards. The convergent parallel design allowed for the simultaneous collection and analysis of both data types, providing a comprehensive understanding of the effectiveness of safety education by comparing and integrating the results from both quantitative and qualitative data.

3.2. Participants and Data Collection

The study utilized a purposive sampling technique to select 254 participants who could provide relevant and informed responses regarding the safety hazards encountered during construction and deconstruction activities on campus. The participants were 2nd to 4th-year students enrolled in the civil technology program at a public university in Cebu City, with a gender distribution of 54% male and 46% female. These students were chosen because they had completed the prerequisite subjects on civil technology works and had direct experience with construction activities on campus for a duration ranging from 1 to 3 years. The age range of the participants was between 20 and 25 years. Informed consent was obtained from all participants before the study commenced, ensuring that they were aware of the study's purpose and their rights as participants.

Data were collected using a researcher-made instrument, developed based on existing literature on construction hazards. The survey included a combination of closed and open-ended questions designed to gather comprehensive data on the participants' experiences and perceptions. The closed-ended questions focused on identifying the specific safety hazards encountered during construction activities, assessing the severity of each hazard, and determining how these hazards impacted the students' learning experiences. Participants were also asked to rate the impact of each selected hazard. Additionally, the survey explored the skills and knowledge that the students deemed essential for addressing these hazards in their future careers, with participants rating the importance of each skill. Open-ended questions were included to capture the students' perspectives on which skill they believed to be the most essential and how effectively the curriculum equipped them with the necessary safety skills.

To ensure the validity and reliability of the instrument, content validity was established through a review by two safety professionals and two civil technology professors. The content validity index (CVI) was calculated, with an acceptable value of 0.78, ensuring that the instrument was appropriately aligned with the study's objectives. Reliability testing was conducted with a sample of 30 students who were not part of the actual study respondents, yielding a Cronbach's alpha of 0.73, indicating an acceptable level of internal consistency.

3.3. Data Analysis

The data analysis for this study involved both quantitative and qualitative approaches, reflecting the mixed-methods research design employed. Quantitative data were derived from structured survey responses, which were statistically analyzed using descriptive statistics to determine the frequency, percentage, and severity of the various construction and deconstruction hazards reported by the students. The analysis focused on identifying patterns and trends related to the students' experiences with hazards such as falls, equipment failures, structural issues, and others. Data were presented using stacked bar charts and Sankey

diagrams to illustrate the distribution of hazard severity and its perceived impact on student learning and safety preparedness.

For the qualitative component, open-ended responses were analyzed using thematic analysis (Braun & Clarke, 2022). Responses related to skills, knowledge, and practical application of safety training were coded and categorized into themes, such as safety protocols, risk management, and emergency response. The analysis aimed to capture students' perceptions and experiences in their own words, providing deeper insights into the effectiveness of the curriculum. Direct quotations were selected to illustrate key points and to support the quantitative findings, offering a comprehensive view of how well the civil technology program prepares students for real-world safety challenges.

4. Results and Discussion

4.1. Health and Safety Hazards

Figure 1 presents the severity levels of various hazards encountered in construction and deconstruction activities, with the severity categories ranging from "Very Low" to "Very High." Fall hazards exhibit a significant level of severity, with 154 instances categorized as "High" and 37 as "Very High," suggesting that falls are one of the most critical safety concerns in construction environments. The moderate severity category also has a substantial count of 53, indicating that falls are a persistent and serious issue. This aligns with previous studies that identify falls as a leading cause of injury and fatality in the construction industry, emphasizing the need for robust fall protection measures and training programs (Chan, Guan, Choi, Yang, Wu & Lam, 2023).

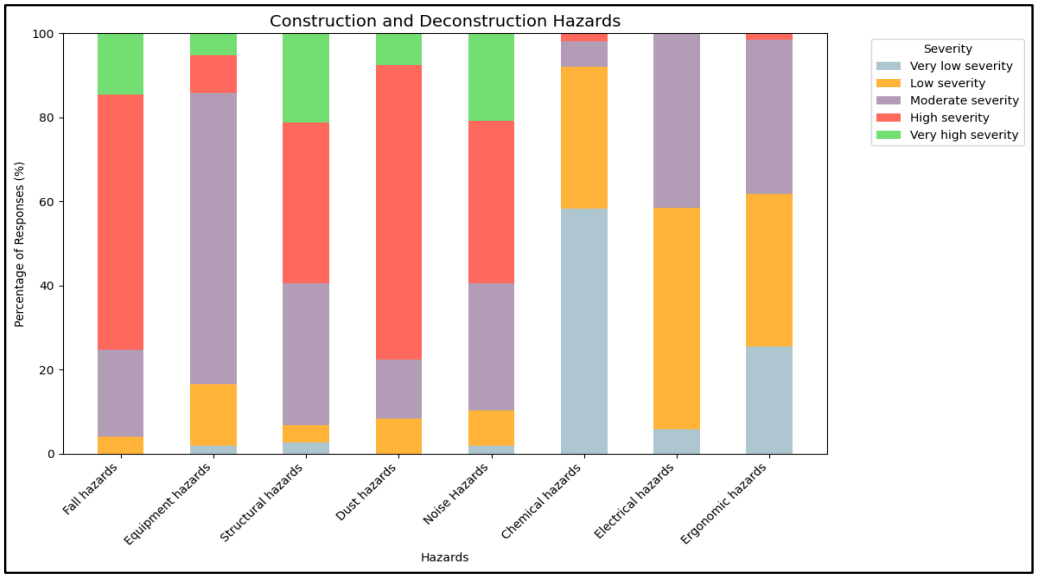

Figure 1. Construction and deconstruction hazards identified

Additionally, Equipment hazards show a different distribution, with the majority of occurrences in the "Moderate" severity category (176), followed by "Low" (37) and "High" (23). The lower counts in the "Very High" severity category (13) suggest that while equipment-related incidents are common, they are less likely to result in the most severe outcomes compared to fall hazards. However, the relatively high number of moderate severity incidents underscores the importance of proper equipment handling and maintenance training, consistent with findings from Almaskati et al. (2024) who highlighted the risks associated with machinery and equipment in construction. Structural hazards are notably severe, with high numbers in both the "High" (97) and "Very High" (54) categories. This suggests that structural integrity issues pose significant risks, potentially leading to catastrophic failures. The moderate severity category (86) also indicates frequent occurrences of less severe, yet still concerning, structural hazards. These findings are in line with research by Benson, Obasi, Akinwande and Ile (2024), which discusses the critical

nature of structural hazards and the importance of thorough inspections and safety protocols in mitigating these risks.

Notably, dust hazards are primarily categorized under "High" severity (178), with a considerable number in the "Moderate" (36) and "Low" (21) categories. The high prevalence of dust-related issues highlights the ongoing challenge of managing airborne particulates in construction sites, which can lead to respiratory issues and other health concerns. Studies such as those by Luo, Huang, Xue, Chen, Zhou, Wei et al. (2021) have documented the significant health risks posed by dust in construction, reinforcing the need for effective dust control measures and personal protective equipment (PPE). Noise hazards have a significant presence in the "High" (98) and "Very High" (53) severity categories, indicating that excessive noise levels are a major concern. With a moderate severity count of 77, it's clear that noise pollution is not only pervasive but also harmful, affecting workers' health and productivity. This finding is supported by research from Mir, Nasirzadeh, Bereznicki, Enticott Lee and Mills (2023), which emphasizes the detrimental impact of prolonged exposure to high noise levels in construction environments and the necessity for effective hearing conservation programs.

In contrast, chemical hazards are predominantly categorized as "Very Low" (148) or "Low" (86) severity, with very few incidents in the higher severity categories. This suggests that while chemical hazards are present, they are generally well-controlled, resulting in less severe outcomes. The effective management of chemical hazards is likely due to strict adherence to safety regulations and proper use of protective gear, as discussed in studies by Shin and Byeon (2021). Electrical hazards exhibit a concentration in the "Low" (137) and "Moderate" (108) severity categories, with no incidents in the "High" or "Very High" categories. This distribution indicates that while electrical hazards are common, they are generally managed to avoid severe consequences. This aligns with the findings of Kulor, Apprey, Agbevanu, Gasper and Akorta (2024), who highlighted the importance of rigorous electrical safety protocols and ongoing safety training to prevent serious incidents.

Lastly, ergonomic hazards primarily fall into the "Moderate" (93) and "Low" (92) severity categories, with a significant number also classified as "Very Low" (65). The absence of incidents in the "Very High" severity category suggests that while ergonomic issues are widespread, they rarely result in the most severe outcomes. This pattern is consistent with research by Jaffar, Abdul-Tharim, Mohd-Kamar and Lop (2011), which discusses the chronic but manageable nature of ergonomic risks in construction.

4.2. Impact of Hazards

Figure 2 illustrates the varying impacts of construction and deconstruction hazards on multiple aspects of worker health, productivity, and overall well-being, as visualized in a Sankey diagram. In the construction category, the most significant impacts are "Learning disruption" (38%) and "Reduced productivity" (27%), both categorized as very significant on the impact scale. These findings highlight how construction activities can severely disrupt educational environments, possibly due to noise, dust, or other hazards that interfere with students' ability to focus and learn. Previous studies, such as those by Jung, Kang, Choi, Hong, Park and Lee (2020), have shown that noise and environmental disruptions in construction zones significantly affect cognitive performance and productivity, underscoring the importance of mitigating such hazards in educational settings.

Health issues and increased stress/anxiety also emerge as moderately significant impacts, with 15% and 18% of the impact, respectively. These findings align with the research by Wang, Yao, Sun, Yang and Deng (2023), which documented the health risks associated with prolonged exposure to hazardous environments in construction, leading to chronic stress and health problems. The slight significance of minor injuries (2%) and the non-significance of major injuries and fatalities (0%) suggest that while injuries occur, they are relatively infrequent or well-managed, reducing their overall impact.

Deconstruction activities also exhibit similar patterns, with "Learning disruption" (33%) and "Reduced productivity" (23%) being the most significant impacts, reflecting the disruptive nature of deconstruction

in both educational and work environments. The moderately significant impact of health issues (17%) and increased stress/anxiety (24%) indicates that, like construction, deconstruction also poses health and psychological risks, although these might vary depending on the specific activities involved. Interestingly, minor injuries are slightly more significant in deconstruction (3%) compared to construction (2%), possibly due to the inherently unpredictable nature of deconstructing existing structures. However, as with construction, major injuries and fatalities remain non-significant (0%), suggesting effective safety protocols and risk management strategies are in place to prevent severe incidents.

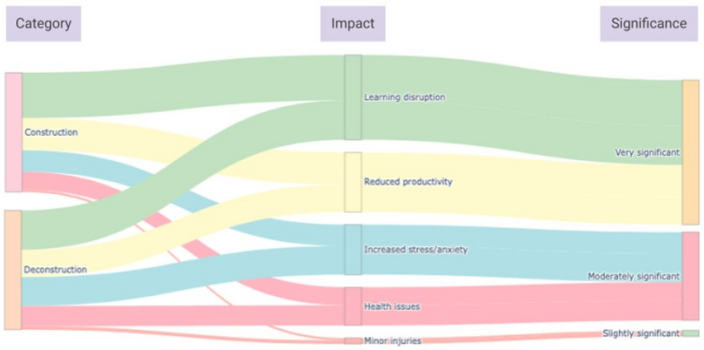

Figure 2. Impact of construction and deconstruction hazards

To sum up, the findings reveal that while construction and deconstruction activities pose several risks, their most profound impacts are on productivity, stress levels, and learning environments, rather than on physical injuries or fatalities. This finding is consistent with studies like those by Szafranko (2019), which emphasize the im-portance of addressing the indirect effects of construction hazards—such as stress, anxiety, and cognitive disruptions—on workers and students. Furthermore, the high significance of learning disruption and reduced productivity in both categories underscores the need for targeted interventions that minimize these impacts. This could involve scheduling construction and deconstruction activities during off-peak times, implementing noise and dust control measures, and enhancing communication between project managers and educational institutions to better align activities with students' needs.

4.3. Skills and Knowledge to Address Hazards

The sub themes included in this section collectively underscore the diverse range of skills and knowledge that civil technology students must acquire to effectively address hazards in construction environments. Integrating these competencies into the curriculum not only enhances students' safety awareness but also prepares them for the dynamic and challenging nature of the construction industry.

Safety protocols and procedures. Understanding and adherence to safety protocols and procedures form the foundation of hazard prevention in construction environments. Students emphasized the importance of this knowledge, with one noting, "Knowing the proper safety procedures helps us avoid mistakes that could lead to serious accidents." This emphasis on protocols aligns with previous studies that highlight the necessity of ingraining safety procedures into the daily practices of civil technology students (Sidani, Martins & Soeiro, 2023). Comprehensive training in safety protocols ensures that students not only learn the rules but also internalize the importance of these procedures in preventing accidents and promoting a culture of safety (Adzivor, Emuze, Ahiabu & Kusedzi, 2024).

Risk assessment and management. Risk assessment is a critical skill that allows students to identify potential hazards before they cause harm. One student remarked, "We need to be able to spot risks early and manage them effectively to keep everyone safe." This sentiment reflects the findings of previous research, which underscore the importance of integrating risk management strategies into construction education (Tóth & Sebestyén, 2014). Effective risk management requires not only theoretical knowledge

but also practical skills that students can apply in real-world situations (Bhattacharjee, Bugalia & Mahalingam, 2024). Training in this area equips students with the tools necessary to anticipate and mitigate risks, ensuring safer construction practices.

Emergency response training. Emergency response training is crucial for preparing students to act swiftly and effectively in the event of an accident. A student highlighted the importance of this training, saying, "Knowing how to respond in an emergency can be the difference between life and death." Previous studies support this view, emphasizing that timely and well-coordinated responses are essential in minimizing the impact of construction accidents (Lozano-Díez, López-Zaldívar, Del Cura & Verdú-Vázquez, 2019). Training in emergency response not only covers the technical aspects of handling emergencies but also focuses on the psychological readiness of students to act under pressure (Patel, Pamidimukkala, Kermanshachi & Etminani-Ghasrodashti, 2023).

Technical skills for equipment operation. Operating equipment safely is a key aspect of preventing accidents in construction. As one student put it, "If we don't know how to use the equipment properly, we can easily cause accidents." This observation is consistent with studies that emphasize the need for hands-on training in equipment operation (Albert & Routh, 2021). Proper training ensures that students are proficient in using various tools and machinery, thereby reducing the likelihood of equipment-related accidents (Del Giudice, Sharafkhani, Di Nardo, Murino & Leva, 2024).

Knowledge of safety regulations and standards. Understanding and applying safety regulations and standards is essential for compliance and safety on construction sites. A student explained, "We need to know the rules and standards to make sure we're working safely and legally." This awareness is crucial, as studies have shown that knowledge of safety regulations significantly reduces the occurrence of safety violations (Ajmal, Isha, Nordin & Al-Mekhlafi, 2022). Furthermore, familiarity with both local and international standards helps students prepare for diverse work environments, ensuring they can adapt their practices to meet required safety guidelines (Almaskati et al., 2024).

Communication and teamwork skills. Effective communication and teamwork are vital in maintaining a safe construction site. A student commented, "Good communication helps us work together to keep the site safe." Research supports the idea that clear communication and strong teamwork are critical in ensuring that safety protocols are followed and that potential hazards are promptly addressed (Leonard, Graham & Bonacum, 2004). These skills enable students to coordinate with their peers, supervisors, and other stakeholders, fostering a collaborative approach to safety management (Cheng, Huang, Jiang, Chen, Chen & He, 2023).

Problem-solving and critical thinking. Problem-solving and critical thinking skills are essential for students to navigate complex safety challenges in construction. One student noted, "We need to be able to think on our feet and solve problems quickly to keep everyone safe." This perspective aligns with research that highlights the importance of developing students' ability to analyze situations and make informed decisions under pressure (Sinakou, Donche, Pauw & Van Petegem, 2019). Cultivating these skills prepares students to respond to unexpected hazards and adapt their safety strategies as needed.

4.4. Curriculum Effectiveness in Equipping Future-Ready Workforce

This section highlights the multifaceted nature of curriculum effectiveness in preparing civil technology students for a future-ready workforce. A curriculum that integrates relevant content, practical experience, industry collaboration, emerging technologies, soft skills development, and continuous improvement is more likely to equip students with the competencies needed to excel in their professional careers.

Relevance of course content. Students often emphasized the importance of having course content that is directly applicable to real-world construction scenarios. One student remarked, "The topics we study in class should reflect the challenges we'll face on actual construction sites." This sentiment aligns with research suggesting that the effectiveness of a curriculum is closely tied to how well it prepares students for industry-specific challenges (O'Neill & Short, 2023). A curriculum that is continuously updated to

include the latest industry practices and technologies ensures that students are not only well-informed but also well-prepared for their future roles (Turnbull, 2020).

Integration of practical experience. Practical experience is crucial for bridging the gap between theoretical knowledge and real-world application. As one student noted, "The hands-on projects we do help us understand how to apply what we've learned in class." Previous studies support this view, highlighting that students who engage in practical, hands-on activities during their studies are better equipped to handle the complexities of the construction industry (Seifan, Dada & Berenjian, 2020). The integration of internships, lab work, and field exercises into the curriculum enhances students' ability to transfer classroom knowledge to the job site (Fantinelli, Cortini, Di Fiore, Iervese & Galanti, 2024).

Industry collaboration and networking. Collaboration with industry professionals provides students with valuable insights and networking opportunities. A student shared, "Working with industry experts gives us a clearer picture of what to expect when we graduate." This collaboration is essential in ensuring that the curriculum remains relevant and aligned with industry needs, as noted in research that emphasizes the role of industry partnerships in curriculum development (Hsu, Chen, Shiau, Liu & Chern, 2019). Networking with professionals also offers students a head starts in their careers by exposing them to potential employers and mentors (Yan, Yang, Chong & Feng, 2023).

Focus on emerging technologies. The inclusion of emerging technologies in the curriculum is critical for preparing students for the future demands of the construction industry. "Learning about new technologies like BIM and sustainable construction practices makes us more competitive," one student pointed out. This focus on innovation is supported by research that indicates a growing demand for professionals who are proficient in the latest construction technologies (De Souza & Debs, 2023). Incorporating these topics into the curriculum not only enhances students' technical skills but also positions them as leaders in the adoption of cutting-edge practices (Siddiqui, Thaheem & Abdekhodaee, 2023).

Development of soft skills. In addition to technical skills, the development of soft skills such as communication, teamwork, and leadership is essential for a well-rounded education. A student mentioned, "It's not just about knowing how to build; we also need to know how to work with others and lead a team." Studies have shown that soft skills are increasingly valued by employers, as they are critical for effective collaboration and project management in construction (Shah, Bhatti & Ahmed, 2023). A curriculum that balances technical training with soft skill development ensures that graduates are fully prepared to meet the demands of the workforce (Acut, Cururaton, Latonio & Latonio, 2021; Moradi, Kähkönen & Aaltonen, 2020).

Continuous curriculum improvement. The effectiveness of a curriculum depends on its ability to evolve and adapt to changing industry trends. One student emphasized, "Our curriculum should be reviewed regularly to keep up with what's happening in the industry." Research supports the need for continuous curriculum improvement, suggesting that regular feedback from industry stakeholders and alumni can help ensure that educational programs remain relevant and effective (Bal, Bryde, Fearon & Ochieng, 2013). Continuous improvement processes, such as curriculum reviews and updates, are essential for maintaining the alignment between academic training and industry requirements (Ab-Rahman, Hwang, Yusoff, Mohamad, Ihsan, Rahman et al., 2022).

5. Limitations of the Study and Future Works

While this study provides valuable insights into the effectiveness of safety education in preparing civil technology students for real-world construction hazards, several limitations must be acknowledged. First, the study's cross-sectional design captures data at a single point in time, which limits the ability to assess changes in students' preparedness or the long-term impact of safety education. Additionally, the study was conducted at a single public university in Cebu City, which may limit the generalizability of the findings to other institutions or regions. The reliance on self-reported data from students introduces the potential for response bias, as participants may have overestimated or underestimated their experiences and

competencies. Moreover, the study focused primarily on the students' perspectives, without incorporating feedback from faculty members, industry professionals, or alumni, which could have provided a more comprehensive understanding of the curriculum's effectiveness.

To address these limitations, future research could adopt a longitudinal design to track students' development of safety skills and knowledge over time, offering a clearer picture of how safety education impacts their professional readiness. Expanding the study to include multiple institutions across different regions would enhance the generalizability of the findings and allow for comparisons between various educational contexts. Additionally, incorporating mixed-methods approaches that include qualitative interviews with faculty members, industry professionals, and alumni could enrich the understanding of the curriculum's strengths and weaknesses. Future studies could also explore the integration of advanced technologies such as virtual reality (VR) simulations and augmented reality (AR) tools in safety training, evaluating their effectiveness in enhancing students' practical skills and engagement. Lastly, examining the long-term career outcomes of graduates who have undergone this safety education could provide valuable insights into the real-world applicability and impact of the curriculum.

6. Conclusion

The study concludes that while the current safety education in civil technology programs provides essential theoretical knowledge, it falls short in practical application, leaving students underprepared for real-world construction hazards. Enhancing the curriculum to better align with industry standards and incorporating more hands-on training could significantly improve students' readiness to manage safety risks in their future careers. The findings advocate for a more integrated approach to safety education, ensuring that graduates are not only knowledgeable but also capable of effectively applying safety practices in dynamic construction environments. Further research should explore innovative methods to bridge the gap between classroom learning and real-world application, ensuring that civil technology students are fully equipped to navigate the complex safety challenges in the construction industry.

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