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The Integration of Information and Communication Technology in the Professional Mobility of Future Electrical Engineers

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ABSTRACT: The impact of integrating information and communication technology (ICT) into engineering education on the professional mobility of future electrical engineers is examined in "The Integration of Information and Communication Technologies on the Professional Mobility of Future Electrical Engineers." This study focuses on the perspectives of younger professionals and students, with the majority of respondents (80%) being in the 21–30 age range, 73% identifying as male, and 73% as students. The majority of respondents have limited experience, with 60% having 1–5 years in the field. Students gain technical knowledge and problem-solving skills through participation in engineering projects that address current electrical challenges and problems. With circuit design tools and programming environments being the most commonly used, the results show that ICT is modestly incorporated into Electrical Engineering education and training. Nonetheless, issues like inadequate training and restricted access to essential equipment continue to be significant. The survey highlights the growing importance of ICT in the field, with respondents agreeing that it will play an increasingly significant role in the future. Although ICT skills are seen as essential for career mobility, their perceived necessity varies, with the majority of respondents considering them to be "very essential" or "somewhat essential." The report suggests better access to ICT resources, more focused training, and higher investments in technology infrastructure to boost ICT integration. The findings offer insightful information about the state of ICT integration in electrical engineering today.

KEYWORDS: Electrical Engineers; Information and Communication Technology; ICT Integration; Mobility

I. INTRODUCTION

The field of Information and Communication Technology (ICT) has a broad scope and utilization in various fields. This means that ICT plays a significant role not only in different offices but also in the day-to-day activities of all types of establishments, institutions, and both government and non-government agencies through its applications. As a result, ICT has a great impact on the success and growth of these establishments. This includes individuals, as almost everyone around the world is using the advanced technology produced by ICT.

The integration of technology has significantly transformed the professional landscape, particularly within the field of electrical engineering. As global industries continue to evolve, the demand for skilled professionals who can adapt to shifting technological environments is more critical than ever. This adaptability is essential for the development of professional mobility—the ability to move and adjust within one's professional sphere, regardless of the circumstances. Information and Communication Technologies (ICTs) have emerged as a key factor in enhancing professional mobility, providing new tools for learning, innovation, adaptation, and collaboration. While the concept of "mobility" has only recently been explored in pedagogy, it is widely studied across various scientific disciplines, including psychology, educational philosophy [1], economics [2;3], and vocational education and training [4;5].

Several studies have explored the relationship between ICTs and professional mobility in various fields, underscoring the growing importance of digital literacy and technological competencies. In the context of electronics engineering, ICTs have been identified as an essential tool for fostering continuous learning, collaboration, and adaptability among engineers.

The integration of digital tools not only enhances technical skills but also improves problemsolving abilities, critical thinking, and creativity [6]. Furthermore, the use of ICTs in engineering projects allows students to work on real-world challenges, thus preparing them for the demands of the global job market. The ability to participate in virtual teams, engage in distance learning, and use specialized software is crucial for the professional mobility of engineers in an increasingly interconnected world.

For future Electrical Engineers, ICTs have become indispensable, providing a means to keep pace with global innovations, engage in cross-disciplinary projects, and access a wealth of knowledge that was once out of reach. With the rise of online education, virtual

collaboration platforms, and advanced design software, electronics engineers are no longer bound by geographical limitations, and their ability to move professionally across borders and disciplines is significantly enhanced.

The integration of ICTs in higher education has signigicantly influenced the mobility of electrical engineers. As using or many involvement ICTs in respective field of engineers are better equipped to meet the demands of an increasingly globalized and competitive. The emphasis on ICT competence within engineering curricula is essential for preparing students to face the complex and dynamic challenges of the professional world. Consequently, a deep understanding of ICTs and their application in engineering practice has become a core competency that shapes the professional identity and mobility of future engineers.

This research paper is trying to address the role of ICTs in enhancing the professional mobility of future electrical engineers, focusing on the integration of ICT and its importance. Since, in every space in many fields the evolve of the ICT is always there. Wherein this study is proves for the significant role of ICT in the field of electrical engineers in both technical and other applications.

II. METHODOLOGY

Research Design

The research utilized a mixed-methods approach that integrates both quantitative and qualitative methods. Also, survey-based study is conducted to gather data from future electrical engineers, and professionals from Isabela State University – City of Ilagan Campus complemented by interviews and questionnaires for deeper insights and understanding in terms of the integration of ICT in any aspects that are related in the field.

Survey and Questionnaire

The research used the survey and questionnaire method in determining the needs of the respondents. So, the study formulates different questions as one of the method or ways in determining and aiming the needs of the said respondents. Wherein the different level of questions are formulated such as the essential for professional mobility in Electrical Engineering in utilizing ICT skills; the challenges faced in integrating ICT in the work of Electrical Engineers and as of the studies; the role of ICT in the next five years in the field of Electrical Engineering; and the additional tools, and recommendations that may could be improved and as to the beneficial in the said field.

Data Analysis

The dataset is subjected to statistical analysis to determine the minimum, maximum, mean, standard deviation, and range. Prior analytical description is written based on the value reflected on each of the criteria and how it is associated with the variability and dispersion of the dataset such as standard deviation. The minimum value is taken from the lowest value of a certain attribute while the maximum value refers to the highest value. The difference between the maximum and minimum values is the range and is calculated by subtracting the smallest value from the largest value. This is to determine the variability of the values of the dataset.

Standard Deviation

$$\sigma = \sqrt{\frac{\sum(x-\mu)^2}{N}}$$

Where,

- σ = standard deviation
- $\sum$ = sum of…
- x = each value
- μ = mean
- N = number of values in the population

Max = highest value of a certain attribute
Min = lowest value of a certain attribute
Range = max − min

Statistical Distribution

Values from the dataset are grouped in ranges per attribute to determine the effectiveness of the developed and designed model based on the rating values. The grouped range of values from different respondents is analyzed and interpreted.

%=f/N*100

Data Tabulation

The study used the Likert scale for the computation and tabulation of data as shown in table

1.0. There are twenty respondents in assessing the performance of the model. It comprises ten (4) faculty members or Electrical Engineering professionals, and eleven (11) under Electrical Engineering Students as indicated in table 2.0. The purpose of the tabulating of data is to determine the respondent's level of perspective view in the integration of ICT in their respective field.

Table 1.0 Respondents of the Study

Group	Frequency	Percentage
Faculty /Professional Electrical Engineers	4	27%
Electrical Engineering Students	11	73%
Total	**15**	**100**

Table 2.0 Respondents according to age level

Age group	Frequency
41-50	2
21-30	12
31-40	1

Table 3.0 Respondents according to gender

Gender	Frequency
M	11
F	4

III. RESULTS AND DISCUSSIONS

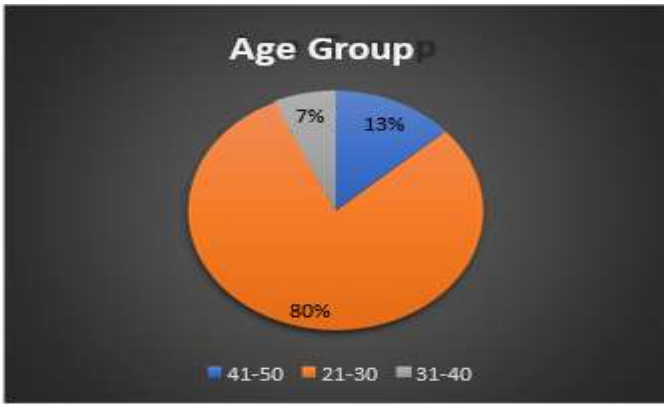

Figure 1. The respondents according to age level

Figure 1, shows that the majority of the respondents (80%) belong to the 21-30 age group, indicating that the survey primarily reflects the perspectives of younger professionals and students. The 41-50 age group accounts for 13%, while the 31-40 age group has the lowest representation at 7%. This suggests that the insights gathered are largely influenced by earlycareer individuals, with fewer contributions from more experienced professionals.

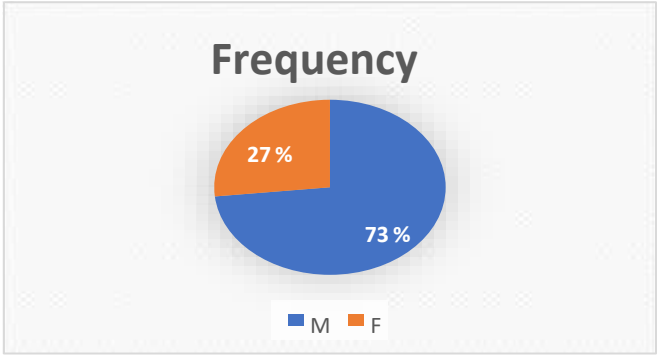

Figure 2. The respondents according to gender

In figure 2, shows that 73% of the respondents are male, while 27% are female. This gender disparity suggests that male perspectives are more dominant in the data, which may impact the overall interpretation of ICT integration in Electrical Engineering.

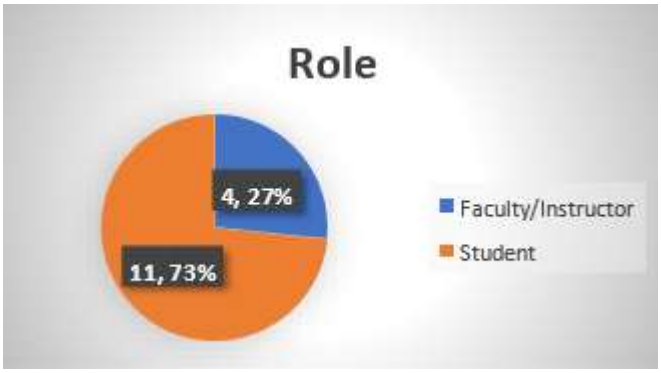

Figure 3. The respondents according to the level of professions

The survey results indicate that the majority of respondents are **students**, accounting for **73%** (**11 individuals**), while **faculty/instructors** make up **27%** (**4 individuals**) as shows in figure
3. This suggests that the survey primarily reflects the perspectives of students.

Figure 4. The respondents according to the year level of experience

Figure 4, shows most of the respondents (60%) have 1-5 years of experience, with 27% having less than a year of experience. Only 13% of respondents have over 11 years of experience. This distribution indicates that the survey insights are largely influenced by those in the early stages of their careers. While this provides valuable information on how ICT is shaping new professionals, the perspectives of highly experienced individuals may be underrepresented.

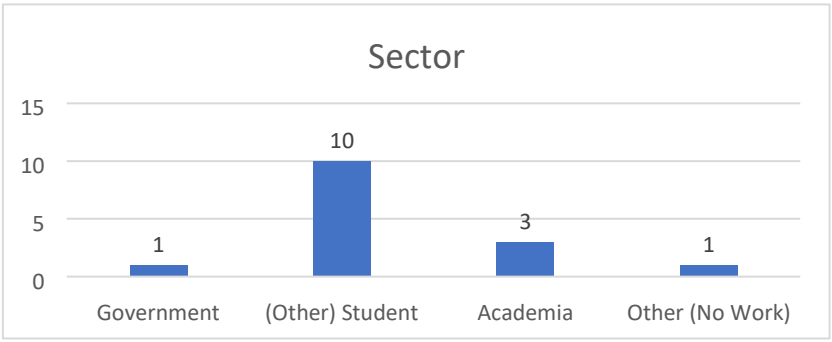

Figure 5. The respondents according to Sector

Figure 5, shows that the survey results highlight a vibrant composition of respondents, with a significant 67% identifying as students. This trend underscores the engagement of younger participants, bringing fresh perspectives to the findings. Academia also contributes meaningfully at 20%, adding valuable insights from educational professionals, while 7% represent the government sector. An additional 7% of respondents categorized themselves under "Other (No Work)," showcasing a diverse range of

experiences. This distribution suggests that the findings will predominantly reflect student viewpoints, which may energize discussions on ICT's impact among the youth

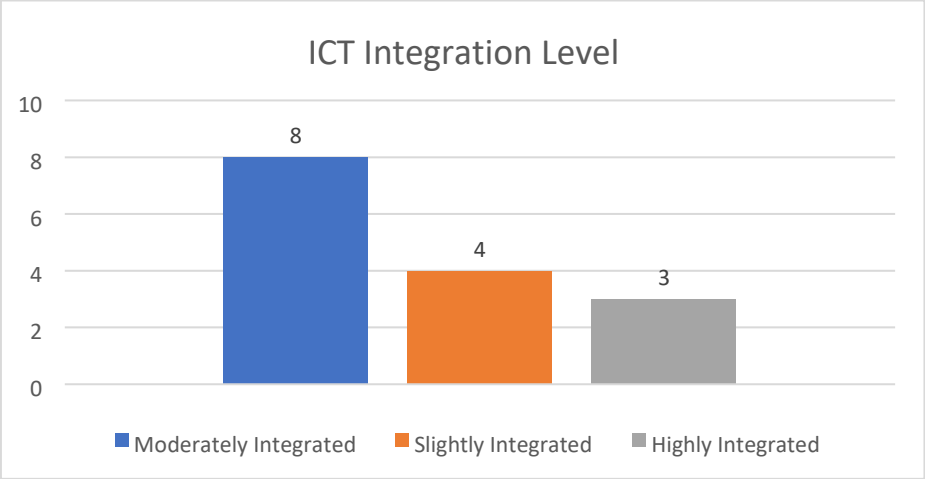

Figure 6. The respondents according to the level of the ICT integration

Figure 6, shows the survey results indicate that ICT is moderately integrated into Electrical Engineering education and training, with 53% of respondents identifying it as "Moderately Integrated." Additionally, 27% of respondents believe it is only "Slightly Integrated," while 20% report that it is "Highly Integrated." These findings suggest that while ICT is present in education and training, there is still room for improvement in its adoption and effectiveness. The relatively low percentage of respondents who consider ICT to be highly integrated highlights the potential need for enhanced implementation strategies, improved access to digital resources, and more training opportunities for both students and professionals.

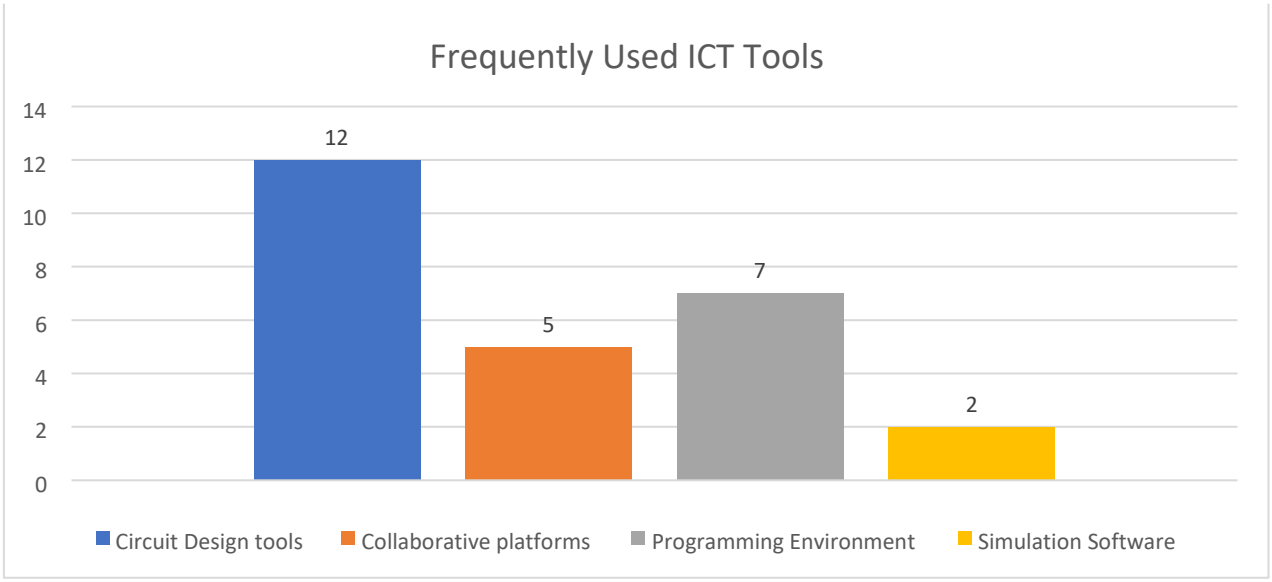

Figure 7. The respondents how frequently used ICT tools

Figure 7, shows the respondents how frequently used ICT tools, the data indicates that Circuit Design tools are the most frequently used ICT tools, with 12 respondents reporting their use. Programming Environments are also widely utilized, with 7 respondents indicating their frequent usage. Collaborative platforms are used by 5 respondents, highlighting the role of communication and teamwork in the field. Simulation Software, however, is the least frequently used tool, with only 2 respondents reporting its use. These findings suggest that practical design and coding tools are essential components of Electrical Engineering tasks and studies, whereas simulation-based applications may be less commonly integrated into daily work or academic activities. Further exploration could assess whether access, training, or perceived effectiveness influences the utilization of these tools.

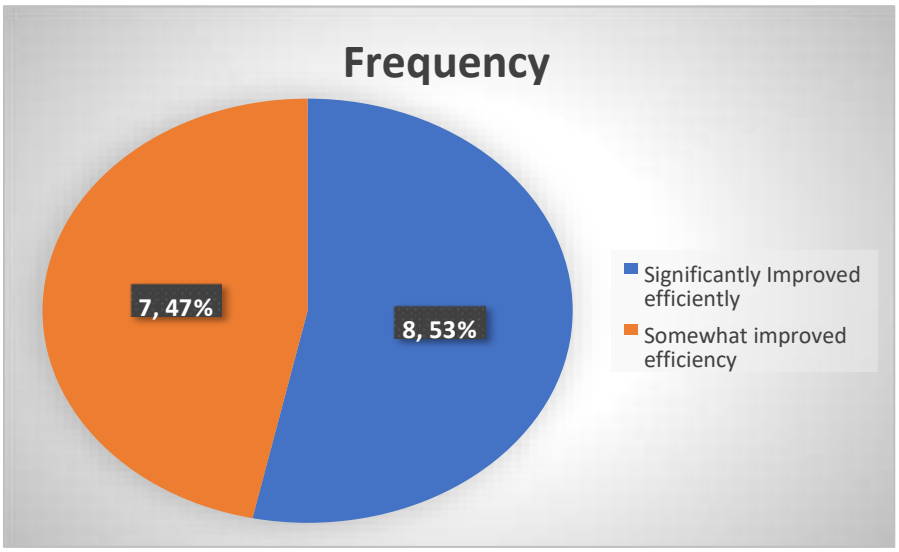

Figure 8. The respondents how frequently used ICT tools to improved activities

Figure 8, shows that the data indicates that Circuit Design tools are the most frequently used ICT tools, with 12 respondents reporting their use. Programming Environments are also widely utilized, with 7 respondents indicating their frequent usage. Collaborative platforms are used by 5 respondents, highlighting the role of communication and teamwork in the field. Simulation Software, however, is the least frequently used tool, with only 2 respondents reporting its use. These findings suggest that practical design and coding tools are essential components of Electrical Engineering tasks and studies, whereas simulation-based applications may be less commonly integrated into daily work or academic activities. Further exploration could assess whether access, training, or perceived effectiveness influences the utilization of these tools.

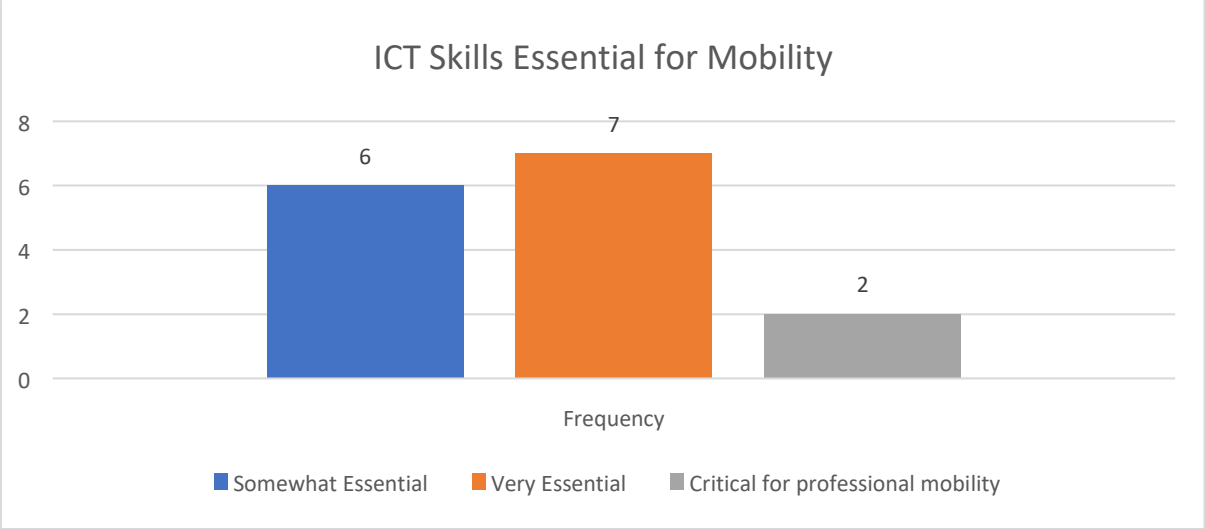

Figure 9. The respondents how frequently used ICT skills essential for mobility

Figure 9, shows that the data suggest that ICT skills play a significant role in professional mobility within Electrical Engineering. A majority of respondents (7) consider ICT skills "Very Essential," while 6 respondents classify them as "Somewhat Essential." Only a small fraction (2 respondents) believes ICT skills are "Critical for Professional Mobility."

This indicates that while most participants recognize the importance of ICT skills in career progression, there is some variation in the perceived necessity of these skills. The results suggest that ICT competencies facilitate job transitions and career growth, but they may not always be viewed as absolute prerequisites.

Given the increasing reliance on digital tools, simulation software, and programming environments in Electrical Engineering, developing strong ICT skills is likely to provide a competitive advantage in both academic and professional settings.

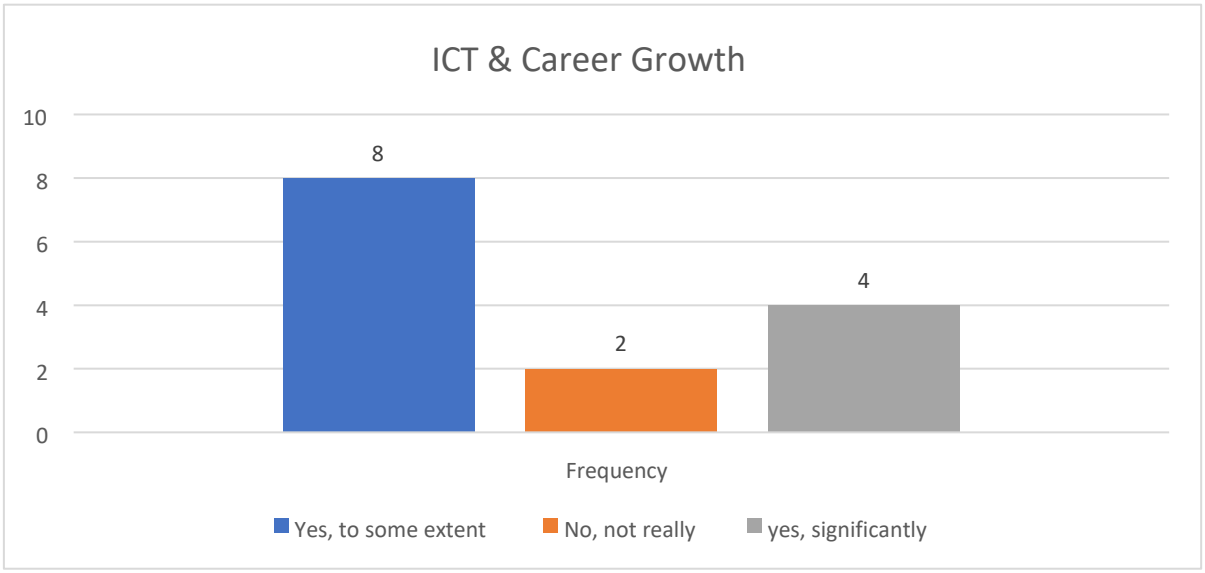

Figure 10. The respondents how frequently used ICT skills essential for Career Mobility

Figure 10, indicate that the data suggest that ICT skills play a significant role in professional mobility within the field of Electrical Engineering. A majority of respondents (7) consider ICT skills "Very Essential," while 6 respondents classify them as "Somewhat Essential." Only a small fraction (2 respondents) believes ICT skills are "Critical for Professional Mobility."

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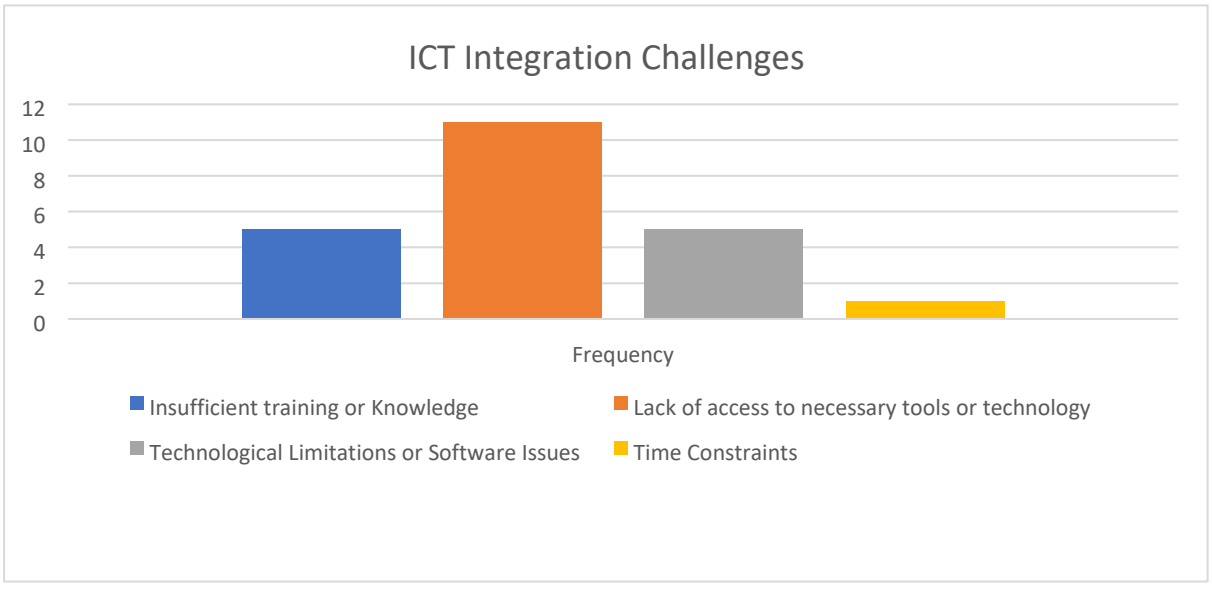

Figure 11. The respondents how frequently used ICT Integration Challenges

Figure 11, shows that the chart illustrates key challenges in ICT integration. The most significant issue is the lack of access to necessary tools or technology, followed by insufficient training and knowledge [7]. Technological limitations and software issues also pose challenges, though to a lesser extent. Time constraints are the least reported problem. This suggests that improving access to ICT resources and providing better training could significantly enhance integration efforts [8].

Also, the results show that all respondents (15 in total) agree that ICT will become more important and integrated in the future [10]. This highlights the growing role of technology in various industries, especially in Electrical Engineering, and the need to keep up with these changes.

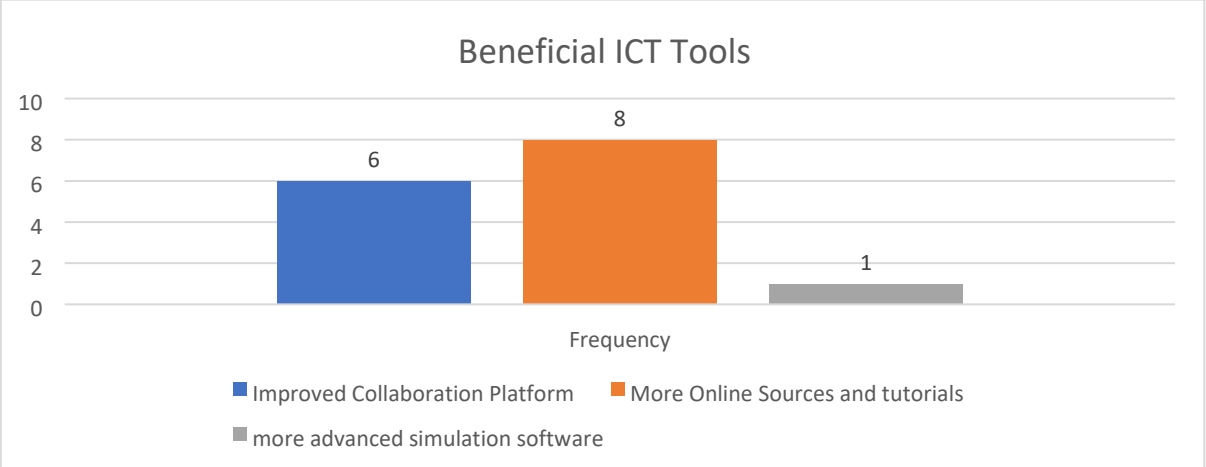

Figure 12. The respondents how frequently used as ICT is Beneficial Tools

Figure 12, shows that the results indicate that the most beneficial ICT tools for Electrical Engineering professionals and students are online sources and tutorials, as reported by 8 respondents. Improved collaboration platforms were also highly regarded, with 6 respondents identifying them as essential. However, more advanced simulation software was the least favored, with only 1 respondent considering it a beneficial resource. These findings suggest that access to educational materials and enhanced communication tools are prioritized over simulation-based tools, possibly due to the growing need for knowledge-sharing and teamwork in both academic and professional settings.

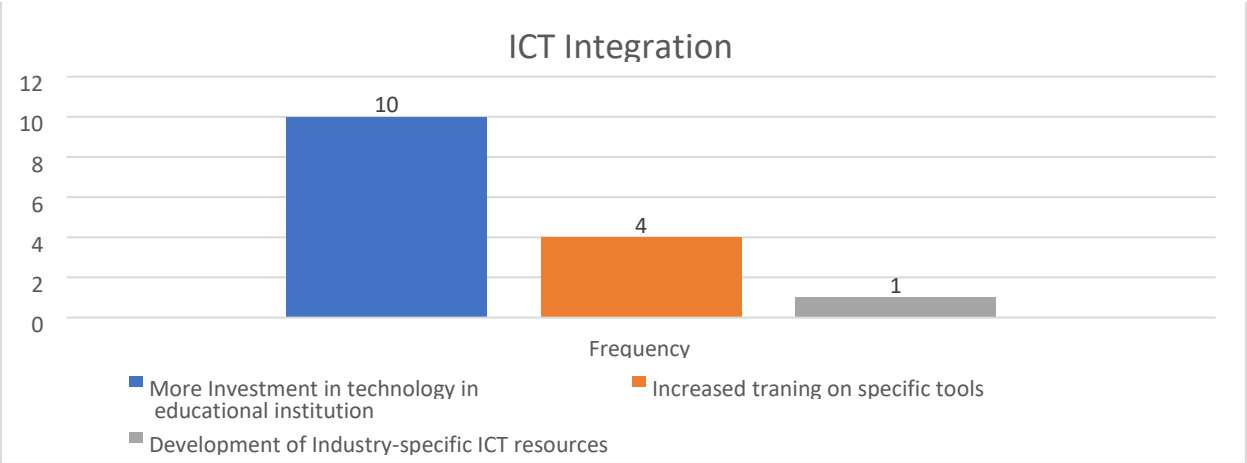

Figure 13. ICT Integration

Figure 13, suggest that the key recommendation for enhancing ICT integration in Electrical Engineering education is increased investment in technology within institutions (10 responses). This highlights the need for better infrastructure and resources. The second priority is more training on specific tools (4 responses), emphasizing hands-on learning. Lastly, developing industry-specific ICT resources (1 response) is seen as less critical. Overall, the focus should be on improving access to technology and skill development.

IV. CONCLUSION

According to the study's findings, electrical engineering has a moderate level of ICT integration, but there is still much space for growth in terms of tool accessibility, training, and overall integration. The answers show a young, student-centered perspective, emphasizing useful resources like circuit design and programming environments. The majority of respondents acknowledge the growing significance of ICT in influencing the future of the profession, notwithstanding certain obstacles in obtaining resources and training. Better training and more investment in technology are the main suggestions for improving ICT integration, which should boost the use and efficacy of ICT in Electrical Engineering practice and education [9].

V. SUMMARY

The study's findings, which mostly represent the opinions of younger professionals and students, shed light on how information and communication technology (ICT) is incorporated into electrical engineering. Male students between the ages of 21 and 30 make up the bulk of responders. A significant percentage of responses are from the academic sector, and the majority have 1–5 years of experience in the topic. According to the study, the most commonly utilized ICT tools are circuit design tools and programming environments, indicating a modest level of integration between ICT and Electrical Engineering education and training. Despite various disagreements on their perceived importance, ICT skills are thought to be crucial for job mobility. The main issues noted are inadequate training and restricted access to essential instruments. The expanding significance of ICT in the future was also emphasized by the respondents.

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