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Enabling first-year engineering students to demonstrate technological literacy

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Abstract

Graduate attributes have been introduced at many universities around the globe, as higher educational institutions seek to make their graduates more employable. The International Engineering Alliance released a list of 12 graduate attributes that engineering students need to demonstrate through their educational career. One of these attributes is termed Modern Tool Usage which may be equated to the term "technological literacy". The purpose of this study is to highlight an activity that was used to enable first-year engineering students in South Africa to demonstrate the acquisition of this attribute. This activity may help fellow engineering educators to design and develop similar activities for their students. A descriptive case study is used focusing on quantitative data taken from 2020 to 2024. The results indicate that many students (on average, 75%) were proficient in designing and developing a 5-slide PowerPoint presentation, where they explained the operation of a logic gate using simulation software along with their own voice. It is recommended to make use of these types of presentations to enable student agency, ownership, authenticity, autonomy, and originality.

Keywords: *PPT presentation, logic gates, demonstration, graduate attributes, simulation*

INTRODUCTION

"I am not at all computer literate in real life. I haven't yet found a reason to be. Once I find a reason why I need to be on the Internet, then I will be (Brainy Quote, 2025)." A well-known actor, John Travolta, uttered these words suggesting that a reason is required to pursue computer literacy. The same can be said of "technological literacy". Why do engineering students need to demonstrate this attribute?

According to Baskette and Fantz (2013), technological literacy is critical to professional success. Graduates will undoubtedly work with several different software tools or packages when they enter the workforce, for which they will need to be prepared. One of the most common packages is Microsoft Office, which is the industry standard application for schools and organizations (Sims, 2021). It allows students to create documents, presentations, spreadsheets, and more using its popular programs. This suggests that the term "technological literacy" is closely associated with digital literacy. It has been defined as the ability of a graduate to "use information and communication technologies effectively" (Meda & Swart, 2017) and as "individual capabilities to use technology, such as digital devices and software, in various areas of life" (Ezziane, 2007).

While technological literacy is vital for the success of all STEM (Science, Technology, Engineering and Mathematics) students, enrolled students are often deficient in demonstrating its acquisition (Gertner, Xu, Porter-Morgan, & Brashears, 2023). More opportunities must therefore be awarded to students to further develop this attribute and enhance their skills in using specific digital devices or software. This is

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also vitally important from the standpoint of national councils who have the responsibility to evaluate and accredit engineering programmes within a given country.

Many countries that have subscribed to the Washington, Sydney and Dublin Accords have sought to integrate graduate attributes into their engineering curricula to ensure a quality standard of education for their students. The attributes listed by the International Engineering Alliance often forms the basis for this integration that seeks to improve the employability of engineering graduates and to reduce the gap between academic work and practice (Steenkamp & Tartibu, 2020). The successful acquisition of these attributes by engineering students is therefore critical to their professional success, which includes the attribute technological literacy.

The purpose of this study is to highlight an activity that was used to enable first-year engineering students in South Africa to demonstrate the acquisition of this attribute. This activity may help fellow engineering educators to design and develop similar activities for their students. The paper starts with a discussion on technological literacy (its different terms and context with STEM education) and then seeks to highlight the importance of enabling student agency, ownership, authenticity, autonomy, and originality. The study context is then given along with the methodology. Two key figures constitute the results, followed by the conclusions.

Research Objectives:

The following research objectives are envisioned:

1. Contrast the graduate attributes of the International Engineering Alliance (IEA), Central University of Technology (CUT) and the Engineering Council of South Africa (ECSA)
2. Substantiate the importance of student agency, ownership, authenticity, autonomy and originality and illustrate how these can be achieved using a single practical assignment
3. Determine the average percentage of students who could demonstate the graduate attribute linked to technological literacy

RESEARCH METHOD

A descriptive case study is used focusing on quantitative data taken from 2020 to 2024. Descriptive case studies are used to describe an intervention or phenomenon and the real-life context in which it occurred (Yin, 2018). The intervention is a practical assignment (called P4), and the real-life context is a module in higher education called Electronic Fundamentals 1 (ELE1). Quantitative data in the form of student grades obtained for this assignment (maximum grade of 10 possible) are presented using descriptive statistics. These statistics help to identify the number of students who were either proficient (complied with 100% of the assignment requirements and awarded a grade of 10), competent (complied with between 50 and 80% of the assignment requirements and awarded a grade of 8) and not competent (complied with less than 50% of the assignment requirements and awarded a grade of 2). These grades were obtained from the learning management system of the university, which is built on the Blackboard™ platform.

CONTRASTING THE GRADUATE ATTRIBUTES FROM THREE ORGANIZATIONS

Organizations and institutions use different terms to describe the abilities they want their graduates to possess, such as competencies, skills, or capabilities. Although they use different words, the meanings and concepts behind these abilities are often similar. For instance, the IEA has a "Problem Analysis" attribute that links to the "Innovation and problem-solving" attribute of CUT and the "Problem-solving" attribute of ECSA. This similarity highlights a shared understanding of the essential abilities' students should possess upon graduation, emphasizing a common goal of preparing individuals to succeed in different professional and societal contexts. Therefore, despite the different terms used, the fundamental principles and desired outcomes across different organizations can be seen as connected and complementary in defining the complete skill set of a well-prepared graduate. Table 1 contrasts the IEA, CUT, and ECSA graduate attributes while providing a single sentence definition. Technological literacy may therefore be equated to Modern Tool Usage and Engineering methods, skills, tools, including information technology.

Table 1. Linking the graduate attributes prescribed by the IEA, CUT and ECSA

IEA Graduate Attributes	CUT Graduate Attributes	ECSA Graduate Attributes	Basic definition linking the attributes from the IEA, CUT and ECSA
Engineering Knowledge	Numerate (N)	Application of scientific and engineering knowledge	Graduates should be able to apply engineering knowledge to perform basic mathematical, budgeting, and financial calculations.
Problem Analysis	Innovation and problem solving	Problem solving	Graduates should be able to critically analyze a real-world problem by determining the underlying factors that contribute to it.
Design / development of solutions	Innovation and problem solving	Engineering design	Graduates should be able to develop a range of innovative solutions for a real-work problem using their newly acquired engineering knowledge.
Investigation	Technical and conceptual competence	Investigations, experiments, and data analysis	Graduates should be able to gather relevant data for a real-world problem by using specific equipment or scientific procedures.
Modern Tool Usage	Technologically literate	Engineering methods, skills, tools, including information technology	Graduates should be able to use information and communication technologies in an efficient and effective manner.
The Engineer and Society	Community engagement	Sustainability and impact of engineering activity	Graduates should be able to actively engage with society in using their engineering knowledge to advance the socio-economic development of communities.
Environment and sustainability	Sustainable development	Sustainability and impact of engineering activity	Graduates should be able to incorporate sustainability into their innovative solutions that contribute to preserving the environment for the good of humanity.
Ethics	Citizenship and global leadership	Engineering professionalism	Graduates should be able to act ethically and professionally by advancing engineering for the good of humanity.
Individual and teamwork	Teamwork	Individual, team, and multi-disciplinary work	Graduates should be able to collaborate in teams and contribute individually to solving real-world problems.
Communication	Communication	Professional and technical communication	Graduates should be able to communicate their engineering knowledge effectively, both verbally and in text.

IEA Graduate Attributes	CUT Graduate Attributes	ECSA Graduate Attributes	Basic definition linking the attributes from the IEA, CUT and ECSA
Project Management and Finance	Citizenship and global leadership	Engineering professionalism	Graduates should be able to manage a project effectively, demonstrating leadership and financial management skills.
Lifelong learning	Entrepreneurship	Independent learning	Graduates should be able to engage in self-directed learning by staying abreast of knowledge generation within their specific fields of expertise.

TECHNOLOGICAL LITERACY WITHIN THE BORDERS OF STEM EDUCATION

Technological literacy is a fundamental component of STEM education, bridging the gap between theoretical knowledge and practical application (Reeve & Barbato, 2023). Since STEM disciplines depend heavily on modern tools, software, and emerging technologies, it is essential for students to develop the skills necessary to effectively interact with digital resources. In this context, technological literacy goes beyond simply using digital tools; it involves the ability to critically evaluate, adapt, and apply technology to solve complex problems. This preparation ensures that students are ready to meet the evolving demands of the workforce and can contribute meaningfully to advancements in their respective fields.

A key aspect of technological literacy within STEM education is its focus on problem-solving and innovation (Hebebci & Usta, 2022). For instance, engineering students use simulation software to design circuits, while mathematics students employ computational tools for data analysis. Similarly, environmental science students rely on technology to model climate change scenarios, and those in medical fields utilize digital simulations for anatomical studies. By incorporating technological literacy across STEM disciplines, educators can create a learning environment that fosters interdisciplinary problem-solving skills, preparing students for careers that require adaptability and technological proficiency (Eugenijus, 2023).

Moreover, technological literacy enhances student engagement and agency by promoting hands-on learning experiences (Nkomo, Daniel, & Butson, 2021). Interactive simulations, coding exercises, and digital design projects empower students to take ownership of their learning, thereby stimulating their critical thinking abilities that may lead to a deeper conceptual understanding and skill development. This approach aligns with global educational frameworks that emphasize active learning and student-centered pedagogies. Future research should investigate how technological literacy can be assessed across different STEM disciplines and how variations in technology exposure influence student outcomes. By advancing this understanding, STEM education can continue to evolve, ensuring that graduates possess the competencies they need to succeed in an increasingly digital world.

As noted previously, technological literacy is closely associated with digital literacy. There are four frameworks in digital literacy, namely digital skills, digital security (digital safety), digital ethics, and digital culture (Novanana, 2022). Digital skills are a person's ability to operate, utilize, and understand technology to obtain, process, and manage information. Digital safety is the ability to protect yourself and personal data when in a digital space. Digital ethics is the ability to be aware of, understand, and apply a digital code of ethics and rules when using digital media. Digital culture is a concept that contains the idea that technology and the internet can have a real influence in the formation of a person's personality, including behavior and how to interact with others, think, and communicate. Digital skills and culture are closely associated with this study, as students need to demonstrate the ability to use software tools to effectively communicate their understanding of a given concept. This further links to student agency and originality.

STUDENT AGENCY, OWNERSHIP, AUTHENTICITY, AUTONOMY AND ORIGINALITY

Student agency refers to the ability of students to take charge of their learning process, make informed choices about their education, and effectively advocate for their needs and interests. It emphasizes the active participation of students in directing their learning experiences rather than receiving instructions passively (Klemenčič, 2015). In a classroom with a strong emphasis on student agency, learners are encouraged to set goals, track their progress, reflect on their learning, and make decisions that align with their interests and aspirations. This approach empowers students to develop critical thinking skills, creativity, self-efficacy, and a sense of responsibility for their own learning journey. It also promotes a more collaborative and engaging learning environment where students and teachers work together as partners in the learning process. Table 2 provides definitions for each of the five concepts discussed in this section, along with potential methods for evaluating them, which can be adapted based on specific learning contexts and objectives.

Student ownership in education refers to the level of responsibility and accountability that students have over their own learning experiences (Klemenčič, 2020). It involves empowering students to participate actively in their educational journey, take initiative in setting goals, make decisions about their learning path, and reflect on their progress. Overall, student ownership fosters a sense of motivation, engagement, and ownership, leading to deeper learning and better preparation for lifelong learning and success. Some key aspects of student ownership in education include:

- Goal Setting: Students take an active role in setting academic and personal learning goals that align with their interests, strengths, and aspirations (Walkington & Bernacki, 2020).
- Decision Making: Students are given the autonomy to choose how they approach learning tasks, including selecting topics of study, choosing resources, and deciding on methods of assessment (Berendt, Littlejohn, & Blakemore, 2020).
- Self-Regulation: Students develop skills for self-monitoring, self-assessment, and self-reflection (Blau, Shamir-Inbal, & Avdiel, 2020). They learn to identify their strengths and areas for improvement and take steps to address them.
- Autonomy: Students are encouraged to explore topics beyond the curriculum, pursue independent projects, and engage in experiential learning opportunities (Lysne et al., 2023).
- Collaboration: While students take ownership of their learning, they also collaborate with peers, teachers, and other stakeholders to enhance their learning experience and achieve shared goals(Lysne et al., 2023).
- Feedback and Reflection: Students actively seek feedback from peers and teachers, reflect on their learning experiences, and adjust their approach based on this feedback (Carless, 2022).

Table 2. Definitions for student agency, ownership, authenticity, autonomy, and originality, along with potential methods for achieving eachone

Concept	Definition	Methods to achieve the concept
Agency	The capacity of students to take initiative, make choices, and have control over their learning journey.	• Discovering how to complete a task. • Student decision-making in learning tasks • Initiative in seeking additional resources or assistance

Concept	Definition	Methods to achieve the concept
Ownership	The sense of responsibility and accountability that students have for their learning process and outcomes.	• Completion of assigned tasks • Personal reflections on learning goals and progress • Students are given freedom to provide additional inputs on a task
Authenticity	The extent to which learning tasks and assessments reflect real-world contexts and challenges.	• Alignment of learning objectives with real-world problems • Use of authentic resources and materials • Application of learning in practical situations
Autonomy	The level of independence and self-direction students exhibit in their learning activities.	• Management of time and resources effectively • Demonstration of self-regulation and self-assessment skills • Fault-finding in a circuit or an incomplete task
Originality	The ability of students to generate new ideas, perspectives, or solutions in their learning endeavours.	• Creativity in project work or assignments • Novel approaches to problem-solving • Independent learning is visible as the student's own work is presented

Student authenticity in education means that students genuinely engage, express, and own their learning. It involves being true to oneself, interests, and values while actively participating in the learning process (Han & Resta, 2020). Authenticity can take different forms, such as personalized learning, critical thinking, creativity and innovation, ownership of learning, real-world connections, and ethical and moral development (Corriveau, 2020). Fostering student authenticity promotes deeper engagement, meaningful learning experiences, and the development of well-rounded individuals prepared for the complexities of the world beyond the classroom.

Student autonomy in education refers to the independence, self-governance, and self-direction students have in their learning journey. It includes the ability of students to choose what and how they learn, take responsibility for their education, and actively participate in decision-making processes (Alrabai, 2021). In a classroom setting, this can take various forms, such as allowing students to choose from a range of learning activities, providing opportunities for self-paced learning, encouraging goal setting, offering problem-solving and critical thinking tasks, and empowering students to reflect on their learning experiences and seek feedback (Cheon, Reeve, & Vansteenkiste, 2020).

In education, student originality refers to thinking creatively and independently. It encourages new ideas, critical thinking, and adaptability. Educators play a vital role in nurturing originality by offering guidance and feedback to students as they develop their unique voices and ideas (Rahimi & Shute, 2021).

STUDY CONTEXT

The context of this study focuses on a compulsory first-year electrical engineering module offered at the Central University of Technology (CUT) in South Africa. It forms part of a 2-year Diploma programme where students need to spend a minimum of 2,400 notional hours to obtain 240 credits. This programme is an NQF (National Qualifications Framework) Level 6 qualification accredited with ECSA.

The module is called Electronic Fundamentals 1 (ELE1) which has 14 credits attached to it. Approximately 400 students register for this module at the start of the calendar year, as it is only offered during the first semester of the programme (February to May). Theory and practical instruction are offered which covers the oscilloscope, resistors, diodes, transistors, the design of a power supply and an amplifier and basic digital logic.

The theory contributes 65% to the course mark, comprising six online self-assessments (called Test 1) and a main test (called Test 2). The practical (called Test 3) contributes 35% to the course mark and requires students to submit four practical assignments online via eThuto (the learning management system of the university built on Blackboard™). Students need to obtain more than 50% for Test 3 and more than 40% for their course mark to gain access to the main summative examination at the end of the semester. The final grade is calculated using 50% of the course mark and 50% of the main examination, which must tally more than 50% for the student to successfully complete the module.

The results of this study focus on the last practical assignment which students need to submit on eThuto, called P4 (Practical 4). The learning outcome for this assignment requires students to explain the operation of a specific logic gate by using a Microsoft Power Point (PPT) presentation with their own voice included on each slide. A minimum of 5 slides is required. The student must introduce himself, or herself, on the first slide and state which logic gate will be explained. The next four slides each cover one row of the truth table, showing the input and output states of the gate using an online simulation tool. The input states are visually represented by a switch and LED, while the output state is shown by a single LED. The last slide requires students to show a noteworthy picture of themselves, where they explain its significance.

This assignment enables student agency, ownership, authenticity, autonomy, and originality. Firstly, students become agents of their own learning as they need to discover how to create a PPT presentation with their voice included on each slide. Using Google or ChatGPT enables students to achieve this. Secondly, students take ownership of their learning as they need to complete the assignment themselves, recording their own voice as they explain the operation of the logic gate. They also need to select a unique picture of themselves for the last slide, explaining its significance to the lecturer. Using a notebook or computer available on the campus of the university enables students to achieve this. Thirdly, authenticity is promoted as students are exposed to a well-known software package that is used to design presentations which are required in the workplace. Students are thus exposed to an authentic learning experience which may help them to prepare a better presentation in the future. Fourthly, autonomy is promoted as students are given four weeks in which to complete the assignment. Many complete the assignment ahead of time showing that they have good time management skills. Self-assessment of the assignment is also promoted, as many students review their presentation before submitting it. They check if the truth table has been followed sequentially, if their voice is audible on each slide, and if the circuit is working correctly in the simulation. Fault-finding is often required in circuit analysis which calls for critical thinking, logical reasoning, and problem-solving skills. Lastly, originality is promoted as students need to submit a presentation with their own voice. The student can maybe copy a PPT presentation from another student, but the student cannot copy the voice.

The student is therefore required to use PPT and an online simulation tool to demonstrate the acquisition of technological literacy. The student may enhance the presentation by using GIFS, but no other software tools are required. It must be noted that these are first-year African engineering students who may be using these software tools for the first time. Exposing them to a variety of software tools at this early stage of their academic career may prove overwhelming. Furthermore, research indicates that learners in South Africa struggle with digital literacy due to a lack of necessary resources, such as digital tools and infrastructure (Mbalo, Jiyane, & Evans, 2024). Assisting these students to demonstrate a basic understanding of PPT and the use of a single simulation package can enable them to develop this skill set to use additional software tools in the future.

FINDINGS

Figure 1 presents the student profile from 2020 to 2024. The dominant gender among enrolled students is male (62%), which is consistent with enrollment trends in Engineering disciplines, as reported by Jeroh (2018). Additionally, 84% are 24 years or younger, supporting their classification as first-year engineering students. The dominant home language is Sesotho, reflecting the demographic composition of the Free State Province in South Africa, where CUT is located (Khetoa, 2019; Kusmawan, U. 2015) .

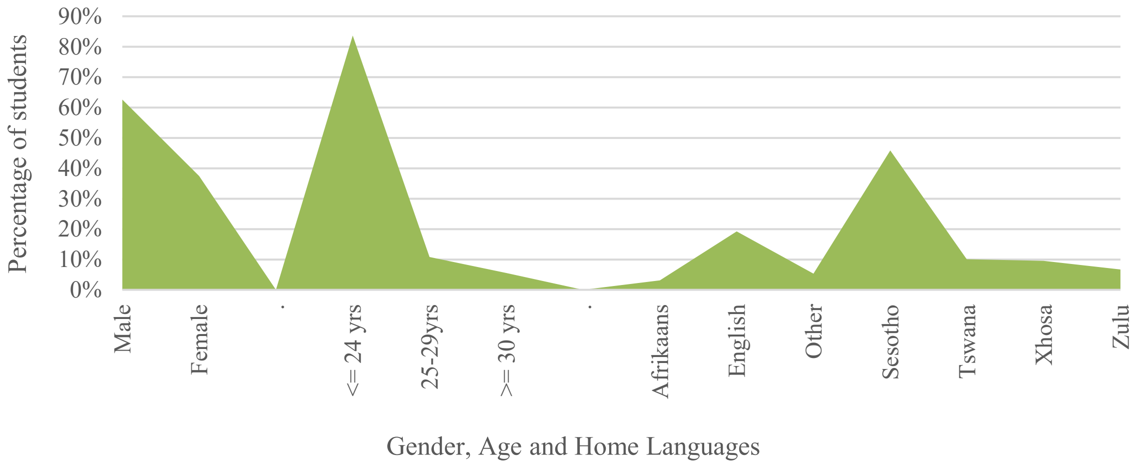

Figure 1. Student profile from 2020-2024

Figure 2 provides a breakdown of student performance on the P4 practical assignment. The data indicates a significant improvement in proficiency over the study period. In 2020, only 46% of students demonstrated competency or proficiency. This figure rose dramatically in 2021, when 90% of students were proficient, with a similar trend in subsequent years. The change from the AND gate (used from 2020 to 2022) to the NAND gate in 2023 to the XOR gate in 2024 aimed to mitigate academic dishonesty.

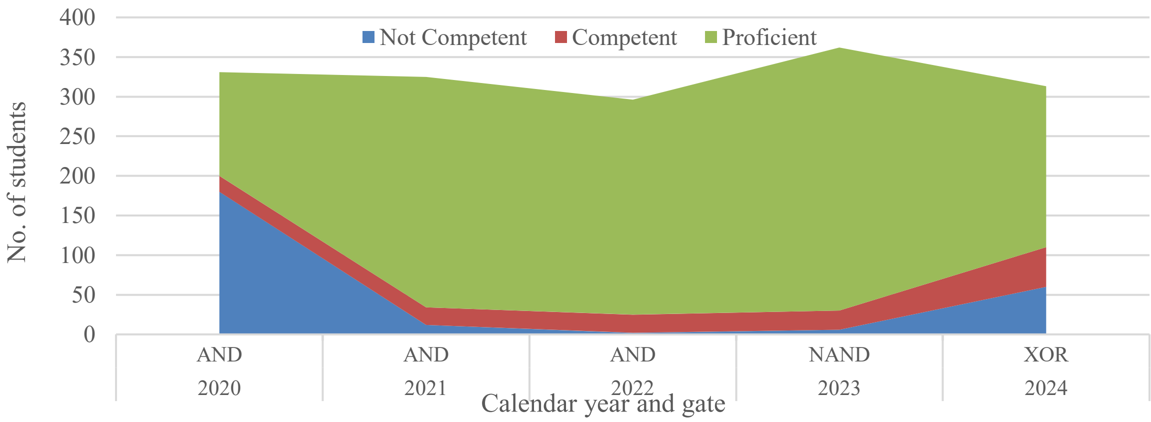

Figure 2. Student results from 2020-2024

Table 3 presents descriptive statistics for the grades awarded to students who completed the P4 practical assignment. The highest kurtosis value (40.59) in 2022 indicates that most students achieved high grades, reflected in a mean score of 9.76. The lowest kurtosis (-1.74) in 2020 highlights a broader distribution of scores, with many students scoring poorly. The standard deviation was highest in 2020 (4.86), indicating a wide variation in student performance, while in 2021 to 2023 the standard deviation remained below 1.5, suggesting a more consistent level of competency among students. No statistically significant relationship (p=0.112) was established between the grades for the assignment and the final mark awarded to the students at the end of the semester.

Table 3. Selective descriptive statisitics for the grades awarded to students for P4

Year	Not Competent	Competent	Proficient	Pass Rate	Mode	Median	Mean	Kurtosis	STD. dev
2020	189	20	131	92%	0	2,4	4,98	-1,74	4,86
2021	14	23	293	96%	10	10	9,58	19,45	1,44
2022	3	26	278	66%	10	10	9,76	40,59	0,88
2023	7	26	338	53%	10	10	9,73	32,23	1,12
2024	60	50	203	60%	10	10	8,01	0,53	3,39

Table 4 illustrates how the assignment facilitated student agency, ownership, authenticity, autonomy, and originality. Discovery-based learning and independent task completion aligned with agency and ownership. Exposure to industry-standard software (such as PPT and an online simulation tool) contributed to authenticity. The ability to manage time and self-evaluate work before submission indicated autonomy. Finally, originality was demonstrated through the requirement that students record their own and provide one personal image in their presentations.

Table 4. The achievement of student agency, ownership, authenticity, autonomy, and originality in the practical assignment (P4)

Concept	Achieved by students in this practical assignment in the following way
Agency	• Discover how to create a PPT presentation with their voice included on each slide. • Discover how to create a circuit using an online simulation tool and copy it into a presentation.
Ownership	• Recording their own voice as they explain the operation of the logic gate. • Selecting a unique picture of themselves for the last slide, explaining its significance to the lecturer.
Authenticity	• Exposure to a well-known software package that is used to design many presentations in the workplace.
Autonomy	• Students completing the assignment ahead of time usually points to good time management skills and proficiency. • Self-assessment is promoted when students review their presentation for completeness before submitting it.
Originality	• Submit a presentation with their own voice, and not a copy of another student's work.

DISCUSSIONS

The findings suggest that students' ability to demonstrate technological literacy improved significantly after 2020. The low competency rate in 2020 (46% for competent and proficient) may be attributed to the challenges associated with online learning during the COVID-19 pandemic. Limited internet access and costly data packages remain challenges in many African nations (Chereka et al., 2025), that negatively impacts student engagement outside of the classroom. However, the sharp increase in proficiency in 2022 (99%) can be linked to improved institutional support, including access to data packages and better adaptation to online learning environments.

An anomaly is visible in 2024, where the number of students who were not competent rose to 60. This may have been due to the change in the logic gate (from AND in 2022 to NAND in 2023 to XOR in 2024) that could be an effective strategy for mitigating plagiarism. The pass rate in 2023 was at its lowest, being 53%, which means that many students would be repeating the module in 2024. They would not be able to simply reuse their PPT from 2023 but would rather need to design a new one. Keeping an eye on the results in coming years would help to clarify this anomaly. However, research (Swart, 2024) does suggest that raising awareness about academic dishonesty can enhance originality where students cannot copy their own work, or that of someone else.

Noteworthy, despite the improved assignment performance, is the decrease in the overall pass rate from 92% in 2020 to 53% in 2023 (Table 3). This decline may be linked to students' preparedness levels post-COVID-19. Research (Fenner & Canton, 2023) suggests that students from lower socioeconomic backgrounds, who were disproportionately affected by the pandemic, faced greater challenges in transitioning to higher education.

Technological literacy can be demonstrated through the five concepts shown in Table 4. The discovery-driven nature of the task fosters agency, while the requirement to record one's own voice strengthens ownership and originality. The use of authentic software applications prepares students for real-world engineering tasks, supporting the importance of authenticity in education (Han & Resta, 2020). Additionally, the ability to complete tasks within a given timeframe and perform self-assessments aligns with autonomy, a critical skill for future engineers (Alrabai, 2021).

One could further argue that a student's critical thinking or problem-solving skills could be improved with this assignment. Critical thinking relates to the abilities of students to make logical arguments and to use evidence purposefully (Cole, Ullman, Gannon, & Rooney, 2015) while problem-solving requires students to cultivate and develop knowledge, which allows them to work with a variety of processes and concepts (Ilmi, Makmuri, & Wiraningsih, 2022). Students need to use the LED in the online simulation to provide evidence of the operating principle of a specific logic gate. They further need to use their newly acquired knowledge of PPT to present this evidence in a way that they satisfy the five concepts listed in Table 4.

LIMITATION & FURTHER RESEARCH

The purpose of this study was to highlight an activity that was used to enable first-year engineering students in South Africa to demonstrate the acquisition of technological literacy. This activity may help fellow engineering educators to design and develop similar activities for their students. The article contrasted the graduate attributes of the IEA, CUT, and ECSA. This contrast reiterated the thought that different terms exist for similar attributes that can be tied together by a single sentence definition. Secondly, the importance of student agency, ownership, authenticity, autonomy, and originality was substantiated and how these are achieved by students completing a single practical assignment. The percentage of students who could demonstrate technological literacy was low in 2020, being only 46%. However, this increased significantly in subsequent years. Students who were found to be proficient averaged 75% over the 5-year period. They could successfully design and develop a 5-slide PPT presentation, where they explained the operation of a logic gate using a simulation tool along with their own voice.

This approach can be adapted across disciplines where technological literacy is vital. For example, in Mechanical Engineering, students can create PPT on fluid dynamics using simulation tools. Civil Engineering students may model structural components with software like AutoCAD or Revit to visualize complex systems. In Renewable Energy, a PPT can be used to demonstrate photovoltaic or wind energy systems with data analysis. Similarly, non-engineering fields, like Business and Health Sciences, can use this method to explain financial models or medical case studies. Integrating software tools and multimedia presentations fosters student engagement outside of the classroom and enables the development of essential academic and professional skills.

The study was limited to only one module in Electrical Engineering. However, this descriptive study does highlight an activity that can help students demonstrate the acquisition of technological literacy. Furthermore, a total of 1672 students were exposed to the concepts of agency, ownership, authenticity, autonomy, and originality. A further limitation is the type of students who enrolled for this module who primarily come from the Free State Province in South Africa. A follow-up study could be done in another province or country where a similar practical assignment is used to assess technological literacy. Additionally, it is recommended to observe the results of students using other logic gates in their presentations to determine if the gate provides challenges or helps to reduce plagiarism. In this article, the AND gate was used for three consecutive years, with only 2020 providing poor results. It is also further recommended to make use of these types of PPT presentations to enable student agency, ownership, authenticity, autonomy, and originality which are sound reasons for pursuing technological literacy.

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