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Exploring educational stakeholders' perspectives on the implementation of electrical technology in secondary schools

Thembeka Londiwe Vilakazi[1+]
Douglas Thembinkosi Sibusiso Sotsaka[2]
Philani Brian Mlambo[3]

[1,2,3]*Durban University of Technology, Indumiso Campus, Pietermaritzburg, South Africa.*
[1]*Email: 21721184@dut4life.ac.za*
[2]*Email: douglass@dut.ac.za*
[3]*Email: PhilaniM7@dut.ac.za*



(+ Corresponding author)

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ABSTRACT

The qualitative case study aims to explore educational stakeholders' perspectives on the implementation of Electrical Technology in secondary schools. Electrical Technology is a technical subject that equips learners in Further Education and Training with theoretical and practical knowledge. However, the subject is in jeopardy because it is not implemented effectively in secondary schools compared with other technology subjects. Therefore, the researcher was compelled to explore the perceptions, experiences, and challenges that departmental heads, principals and subject advisors face when implementing this subject. To achieve the study's objectives, an interpretivist paradigm was employed, and the selected participants were members of the School Management Team (SMT), which included five principals and five departmental heads. The participants also included two technical subject advisors. Underpinned by the Diffusion of Innovation and Resource-Based Theory frameworks, data were collected through semi-structured interviews and open-ended questionnaires. Thematic analysis was used to analyse the data. The results indicated that, even in schools that already offer other technology subjects, a lack of infrastructure and resources, as well as financial constraints, hindered the effective implementation of Electrical Technology. Based on the above, this study recommends that subject advisors inform principals about Electrical Technology and encourage them to implement the subject. The study further implies that principals, together with SMT members, should raise awareness of Electrical Technology to enlighten learners and parents about the subject and the benefits of pursuing a career in Electrical Technology.

Contribution/Originality: This article contributes stakeholder perspectives on Electrical Technology implementation in secondary schools. Using the Diffusion of Innovation Theory and the Resource-Based Theory reveals how infrastructure, resources, and awareness hinder the implementation of Electrical Technology in secondary schools. It recommends that SMTs and subject advisors drive awareness and provide support to enable the successful implementation of Electrical Technology as a subject.

1. INTRODUCTION

Technology subjects are practical, career-oriented subjects that focus on the application of scientific and mathematical principles within specific fields. Unlike other traditional academic subjects, they are generally more hands-on and career-focused, aiming to equip learners with the practical skills and foundational knowledge necessary

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for further studies in engineering and related fields (Maeko & Makgato, 2017). In South Africa, technical education is introduced early in the school curriculum. During the Intermediate Phase (Grades 4–6), learners study Natural Sciences and Technology as a combined subject, with greater emphasis placed on science and a smaller component dedicated to technology. As learners progress to the Senior Phase (Grades 7–9), the subject develops into Technology, which focuses strongly on the technological design process. According to Du Toit (2020) and Du Toit and Gaotlhobogwe (2018), the purpose of Technology in the Senior Phase is to provide learners with foundational knowledge and skills that enable them to solve problems, work collaboratively, enhance creativity, and integrate indigenous knowledge through the practical application of technology.

As learners transition to the Further Education and Training (FET) Phase (Grades 10–12), they have the opportunity to choose whether to specialize in Civil Technology, Electrical Technology, Mechanical Technology, or Engineering Graphics and Design (EGD) (Department of Basic Education, 2011). These subjects offer in-depth exposure to applied technological fields, equipping learners for potential careers in engineering and technical industries. This study focused specifically on Electrical Technology in South African public secondary schools. It is relevant to the Department of Basic Education (DBE) because it explores educational stakeholders' perspectives on the implementation of Electrical Technology in secondary schools. The importance of Electrical Technology as a pathway to electrical engineering studies is reflected in the admission requirements of the Central Applications Office (CAO), where it is recognized alongside English, Mathematics, and Physical Sciences as a valuable subject area for entry into engineering programmes.

According to the Department of Basic Education (2012), Electrical Technology involves understanding and applying electrical and electronic principles and is structured around three areas of specialization: Electrical Systems, Electronics, and Digital Systems. Each of these areas contributes uniquely to the development of competencies required for future engineering careers. The Electrical Technology specializations provide foundational knowledge for careers in electrical engineering, mechatronics, renewable energy, technologist, robotics engineer, field service technician, and artisan trades such as electricians and wiremen. In the South African context, these pathways are critical for addressing the national skills shortage in the energy and manufacturing sectors as identified by the DBE and the Department of Higher Education and Training (DHET).

The Curriculum and Assessment Policy Statement (CAPS) for Electrical Technology Grades 10–12 further states that the subject aims to provide learners with a strong foundation in electrical and electronic principles. By the end of Grade 12, learners are expected to transform theoretical knowledge into practical competence through classroom instruction, Practical Assessment Tasks (PATs), and simulated workplace experiences. Electrical Technology is particularly relevant because many learners who study Electrical Technology in secondary school often aspire to pursue electrical engineering and related careers at tertiary level.

This highlights the subject's importance within the South African education system and supports its recognition as a gateway subject for engineering studies (Singh-Pillay & Sotsaka, 2020). As previously noted, many learners often aspire to become engineers after completing Grade 12. Engineering professionals are required to perform complex technical tasks and therefore need comprehensive training and preparation. While South African universities do not make Electrical Technology compulsory for Electrical Engineering admission, the Department of Basic Education (Department of Basic Education, 2014) identifies it as a key technology subject that develops practical skills aligned to engineering. University admission requirements for Electrical Technology indicate that English, Mathematics, and Physical Sciences are compulsory, with a minimum of Level 5 (60%) or Level 6 (70%) typically required (Central Applications Office, 2025). Electrical Technology, although optional, provides learners with hands-on exposure to electrical principles, circuits, and tools that enhance practical readiness for engineering studies (Mgetyana, 2022). Therefore, the subject plays a supportive but vital role in preparing learners who aspire to engineering careers and such preparation begins during the FET phase, where learners acquire the foundational knowledge and practical skills necessary for further engineering education.

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Despite its importance in developing future engineers, the implementation of Electrical Technology in South African secondary schools remains limited, with relatively few schools offering the subject. This finding is consistent with studies by Mokhothu (2015) and Mlambo (2023), which reported the limited availability of technology subjects such as Civil Technology and Engineering Graphics and Design. Recent reports also indicate a growing shortage of engineers in South Africa. Smit, Schultz, and van Hoek (2021) argue that this shortage has negative implications for economic growth and development. One contributing factor is the limited number of schools offering subjects such as Electrical Technology, which serve as foundational pathways into engineering. However, the shortage of engineers is not unique to South Africa. Nguyen and Pudlowski (2007), in a study conducted in Australia, reported a shortage of engineering professionals and suggested that the problem would likely persist due to declining enrolments in university engineering programmes. This situation parallels the South African context, where limited access to Electrical Technology in schools may negatively affect the future supply of electrical engineers.

Similarly, Zimbabwe has experienced economic challenges linked to shortages of skilled engineers, which have hindered economic growth and poverty reduction efforts (Akpan, Kumba, & Olanrewaju, 2024). In South Africa, the shortage of qualified electrical engineers poses significant risks to both economic development and the built environment (Akinradewo et al., 2022). Bloomfield (2015) argues that deliberate interventions are necessary to encourage learners to develop an interest in engineering and technology-related careers. Expanding the availability of Electrical Technology in secondary schools could contribute significantly to developing a larger pool of capable engineers who possess foundational electrical knowledge from an early stage of their education. Given the importance of Electrical Technology in engineering education and the challenges associated with its limited implementation, this study sought to respond to the research question: What are the perceptions, experiences, and challenges of departmental heads, principals, and subject advisors regarding the implementation of Electrical Technology in secondary schools?

2. LITERATURE REVIEW

2.1. Admission Requirements to Electrical Technology Related Courses

For a candidate to enrol in an electrical course at the tertiary level, they need to have knowledge of both theoretical and practical fundamentals (Department of Basic Education, 2011). In South Africa, a candidate typically needs to have a National Senior Certificate (NSC) or equivalent, with a minimum Admission Point Score of 32 and specific subject requirements, such as English, Mathematics and Physical Sciences (Central Applications Office, 2025). This is supported by Mhlongo and Makgato (2019), who argue that these three subjects provide learners with basic knowledge for electrical engineering courses. However, meeting the minimum requirements does not necessarily mean that learners pursuing Electrical Technology are ready to study at the tertiary level. Existing literature underscores that learners need to perform well in English, Mathematics, Physical Science, and other practical subjects to succeed in Electrical Technology at the tertiary level.

On the other hand, there is limited information about whether the current teaching and learning of Electrical Technology in Grades 10 to 12 are equipping learners with both theoretical knowledge and practical skills in South African schools. Therefore, this study explores educational stakeholders' perspectives on the implementation of Electrical Technology in secondary schools. According to the Department of Basic Education (2011), the intention of introducing Electrical Technology is to provide learners with theoretical knowledge and hands-on skills to improve learner performance and expose learners to a work-related environment. Consequently, research by Ogunyemi and Fakoya (2021) has demonstrated that developing hands-on problem-solving skills, spatial reasoning, and a mechanical mindset substantially enhances learner performance and retention in technical fields. Furthermore, the Department of Basic Education (2011) emphasises that learners who lack basic knowledge and skills in Electrical Technology, such as working with tools, circuits, and electronic systems, often experience difficulties when using equipment and conducting practical work at the tertiary level.

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2.2. Shortages of Engineers Across the Globe

Engineers play a vital role in driving economic growth, technological advancement, and sustainable development. However, a persistent global shortage of engineers threatens to slow down progress in key sectors. World Bank (2021) reports that the engineering shortage undermines innovation, infrastructure development, and progress toward the Sustainable Development Goals (SDGs), including clean energy and climate action. Similarly, Aggarwal (2022) reports larger gaps between the demand of industry and the number of graduates in engineering, particularly in renewable energy, infrastructure, manufacturing, as well as transportation. This tendency is seen across developed and still developing contexts. In the U.S. Bureau of Labor Statistics (2023) forecasts sustained growth in demand for engineers, especially in software, civil, and electrical fields, outstripping the supply of qualified graduates. European countries like Germany and the United Kingdom face major engineering skill shortages, particularly in the fourth industrial revolution and climate adaptation (CEDEFOP, 2022). In developing economies, the challenge is compounded by skills mismatches. Battu and Bender (2020) note that countries like India, Nigeria, and South Africa struggle with a shortage of qualified engineers and a misalignment between graduate skills and industry needs. This further implicates the lack of implementing Electrical Technology in secondary schools, which leads to a shortage of engineers.

Hence, it is worth noting that one of the main contributing factors to the shortage of engineers is the lack of skills among engineering graduates, especially in emerging countries. It is evident that many of our learners are discouraged by the perceived difficulty of engineering programs, the high failure rates in Mathematics and Science, and inadequate secondary-level preparation (Mhlongo & Makgato, 2019). For this reason, very few learners opting for engineering studies, such as Electrical Technology and Engineering. Bloomfield (2015) attests that necessary actions should be taken to encourage learners to develop an interest in engineering and technology professions. Furthermore, the gap between educational output and industry requirements hinders efforts to produce the required number of engineers.

According to UNESCO (2021), engineering education often places greater emphasis on theoretical knowledge than on practical experience, leaving learners underprepared for the demands of industry. Both TVET and university programmes frequently face challenges such as outdated curricula, inadequate laboratory facilities, and a shortage of skilled instructors. The situation is similar in secondary schools, where learners often lack adequate resources to complete the required practical assessment tasks. Consequently, they receive more theoretical instruction than practical training. Furthermore, Mbatha's (2016) study reveals that educators and heads of departments, particularly those in rural areas and townships, encounter substantial obstacles in their efforts to implement the curriculum effectively.

The lack of opportunities for professional growth and development, combined with limited experience and expertise in curriculum implementation, poses a significant challenge (Ntuli, Mncube, & Mkhasibe, 2023). Furthermore, educators often struggle with pedagogical content knowledge (PCK) and understanding the underlying philosophies that inform curriculum changes, making it difficult for them to adapt. Similarly, Themane and Thobejane (2019) highlight that despite extensive research on national curriculum reform, there remains a pressing question about the level of support provided to South African educators in facilitating a seamless transition to new curricula.

This capacity gap is further compounded by a shortage of subject specialists in Electrical Technology who can provide support to educators in schools. The National Planning Commission (2012) identifies the shortage of subject specialists as a key threat to curriculum rollout, a concern that remains relevant over a decade later. Hove and Mazvimba (2024) extend this argument by asserting that curriculum changes necessitate fundamental shifts in teacher roles, from didactic instruction to facilitative, problem-solving approaches. In the context of Electrical Technology, this implies a move from theory-based teaching to workshop-oriented, CAPS-aligned pedagogy (Department of Basic Education, 2011). Technology and Electrical Technology educators are required to be well trained and to participate in professional development so that they can increase their subject knowledge and develop

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critical-thinking skills (Gumbo, 2020). As a result, learners are likely to develop greater interest in and benefit from studying Electrical Technology with well-trained educators, preparing them for further study at universities or colleges. However, the literature tends to present this shift as a technical requirement without interrogating the conditions under which it occurs.

Specifically, Electrical Technology educators are now expected to facilitate competencies such as circuit construction, fault finding, and the integration of renewable energy systems, which demand both updated content knowledge and technical skills (Department of Basic Education, 2011). Yet, as Ntuli et al. (2023) and National Planning Commission (2012) suggest, the absence of subject advisors' support leaves many educators ill-equipped to make these adjustments. This therefore reveals a critical gap: while the demands on Electrical Technology are well documented, there is limited research on how they develop these new competencies in contexts where specialist support is absent. Framed by Diffusion of Innovation and Resource-Based Theory, this study suggests that teacher agency and available resources mediate curriculum implementation. This study addresses this gap by exploring the factors hindering the implementation of Electrical Technology in secondary schools.

Another contributing factor to the shortage of engineers is the ageing workforce in the industry. According to EngineeringUK (2022), developing countries are facing an ageing engineering workforce, with retirements outpacing the entry of new talent into the field and resulting in a significant skills gap. In addition, women remain significantly underrepresented in the engineering profession, accounting for less than 30% of the global workforce, according to UNESCO (2021). This limits diversity and talent in the field. In the context of this study, female learners are encouraged to enroll in subjects such as Electrical Technology in secondary schools where these subjects are offered. This will help promote a more balanced industry and reduce gender and diversity gaps in the future.

Talent migration also contributes to engineering shortages; for instance, countries like Zimbabwe experience significant brain drain as skilled engineers emigrate to regions with better job prospects, leading to chronic local shortages (Chikarara, 2019). This migration results in underdeveloped infrastructure and slows technological progress. According to UNESCO (2021), sub-Saharan Africa faces a deficit of over 1 million engineers, hindering infrastructure and energy development. While countries like Nigeria and Kenya are introducing STEM-focused reforms, progress remains slow. Despite producing large numbers of engineers, concerns persist about training quality. A report by Aspiring Minds (2014) found that fewer than 20% of Indian engineering graduates are employable in core roles. In Europe and North America, companies are struggling to find enough engineers for fast-growing fields like software, aerospace, and energy. The reason is not just one thing, but it comes down to how people are educated, who is entering the workforce, and the state of the economy. That is why this study argues that there is a need to bring Electrical Technology into Grades 10 to 12. If learners are given hands-on experience early, we can build a stronger pipeline into engineering. As Bloomfield (2015) pointed out, we have to start sparking that interest in school before we lose more talent.

2.3. The Roles Played by School Management Team in Subject Implementation

The effective implementation of technology subjects such as Electrical Technology necessitates strong instructional leadership within the school. Typically, the School Management Team (SMT) consists of key administrators and leaders who are responsible for overseeing the daily functioning of the school. The SMT comprises the principal, deputy principals, and departmental heads, who are all tasked with different roles to ensure that the school operates effectively. Below are some of the duties that each stakeholder is expected to perform within the school, as outlined in the Department of Education's guidelines.

2.4. Principal

The principal, as headmaster, works with the SMT to lead curriculum reforms and ensure high-quality teaching throughout the school. Key responsibilities include establishing effective teaching and learning frameworks,

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allocating resources, and providing professional development opportunities for educators. In collaboration with the SMT, the principal ensures that the school runs smoothly and that subjects are implemented successfully.

2.5. Deputy Principal

The deputy principal reports to the headmaster about everything that happens on the school premises. When the principal is absent from school, the deputy principal takes over as principal. The deputy principal manages the school and contributes to the progress and implementation of the curriculum, including the selection of textbooks. The deputy principal is also responsible for improving learners' educational outcomes, developing the quality of teaching and learning, and ensuring positive relationships between learners and educators.

2.6. Departmental Heads

Departmental heads report to the Deputy Principal and, as part of the School Management Team (SMT), oversee educators and ensure that they meet curriculum requirements. Key responsibilities include supervising educators, providing support through classroom visits and constructive feedback to improve teaching practices, and developing and implementing curricula that align with school goals and meet learners' needs.

According to Ntuli and Mahlangu (2023), SMT should hold a clear understanding of curriculum policies to provide effective leadership and support to educators. The SMT plays a vital role in shaping the school's culture, academic environment, and overall effectiveness. The SMT performs different duties and is often responsible for setting school policies and goals, managing budgets and resources, supervising the staff, and ensuring learners' welfare and discipline. Also, ensuring that the curriculum is effectively implemented and monitors academic performance.

In the context of this study, for Electrical Technology to be implemented in schools, the School Management Team should gather and implement it with the leadership of the principal as the foremost driver of the curriculum change. It is worth noting that the principals are the ones that has powers of implementing subjects at the school premises, so it will be very helpful to also put our focus on the principals in assisting the study to have all secondary schools implement technology subjects, especially Electrical Technology. By so doing, the deputy principals and departmental heads will contribute positively towards ensuring that the subjects are effectively and successfully implemented. Subsequently, the effective implementation of Electrical Technology in secondary schools relies heavily on the School Management Team's leadership and support.

2.7. Duties and Responsibilities of a Subject Advisor in Supporting Teaching and Learning

Department of Basic Education (2014): subject specialists are sometimes referred to as Curriculum Implementers or Subject Specialists. They are office-based educators working in district or circuit offices, and they are responsible for facilitating curriculum implementation. They also visit schools to improve the teaching and learning environment and process. To provide support, they consult with school principals and educators about curriculum matters. Their key roles and responsibilities include:

2.8. Guiding Curriculum Interpretation and Implementation

Subject Advisors help educators to understand and correctly implement the CAPS, or any updated curriculum frameworks. They give clarity to subject content, ways of teaching, assessment strategies, and progression requirements. In this study, Subject Advisors' contributions are highly significant in implementing Electrical Technology. For that reason, they will assist educators in understanding and knowing how to correctly implement the existing CAPS. During school site visits, they will provide clarifications regarding teaching methods, subject content, and assessment strategies involving all four cognitive levels as per the CAPS documents as well as progression requirements.

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2.9. Providing Professional Development

They organize and facilitate workshops, subject-specific meetings, and training sessions to upskill educators. In the form of introducing new policies, technological tools, or assessment guidelines relevant to the subject. This will be an advantage should Electrical Technology be implemented in most schools because this means that educators will be supported and trained to improve their expertise. Educators will be exposed to new policies, technological tools, and Electrical Technology assessment guidelines.

2.10. Conducting Regular On-Site Support Visits to Educators

Like departmental heads, subject advisors conduct classroom visits to support educators by observing lessons, providing feedback, and conducting individualised coaching based on learner performance and classroom observations. They often write reports to support instructional improvement where necessary. In this study, these activities will promote effective teaching and learning, benefit all stakeholders, and increase educators' confidence in teaching Electrical Technology because they will receive assistance from their superiors. If all the leaders responsible for implementing Electrical Technology and ensuring its successful implementation perform their roles effectively, there is no reason why Electrical Technology should not be implemented in most schools, particularly those offering technical subjects other than Electrical Technology.

2.11. Resource Provision and Recommendations

They assist with sourcing appropriate learning and teaching aids. They may also evaluate the adequacy of resources at a school. As subject specialists, they may recommend improvements or report resource gaps that need to be addressed at district offices. Subject specialists will provide and recommend improvements to all resources required for implementing Electrical Technology, working hand in hand with schools to ensure the successful implementation of the subject.

There are other key roles and responsibilities that Subject Advisors play in ensuring the implementation of a subject at a school level, such as ensuring quality assurance and moderation, analysing learner performance data to intervene, promoting subjects and advocating for resources, and liaising between schools and education authorities. By collaboratively working with educators, SMT, and district officials, Subject Advisors ensure effective subject teaching and learning, which is what this study is looking for, to assist in implementing Electrical Technology from grade 10 to 12 in secondary schools of Zululand District. In accordance with the Department of Basic Education (2020) Subject Advisor Profile Analysis attest the above uttering that: "The chief function of Subject Advisors is to monitor and support curriculum delivery in order to ensure that quality teaching and learning takes place in schools."

While the policy clearly outlines the responsibilities of the SMT and Subject Advisors, limited research has examined how these roles are implemented in practice to support the teaching of Electrical Technology in Grades 10–12 in under-resourced South African schools. Specifically, little is known about the challenges that SMTs and Subject Advisors face and the types of support educators actually need. This study seeks to address this gap by exploring the perspectives of educational stakeholders on the implementation of Electrical Technology in secondary schools.

3. THEORETICAL FRAMEWORK

This study adopted two complementary frameworks to gauge educational stakeholders' perspectives on the implementation of Electrical Technology. These frameworks were the Diffusion of Innovation theory and resource-based theory. The Diffusion of Innovation theory (DOI), introduced by Rogers (1962), was used in this study to explore the adoption of Electrical Technology in schools within existing technical programmes. According to Sherry and Gibson (2002), given its widespread application across disciplines, the theory offers valuable insights into the

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adoption process and is especially useful for studying technology integration in educational settings (Medlin, 2001; Parisot, 1995).

This study adopted the Diffusion of Innovation (DOI) theory because it provides a structured approach to understanding the factors influencing the implementation of Electrical Technology in educational settings. This theoretical framework enabled the identification of stakeholders and their roles in the adoption process, and it facilitated an analysis of the factors contributing to the lack of implementation of Electrical Technology in schools. It also assisted in developing strategies to address potential barriers to implementation. Through the application of this theory, the study gained insights into the complex process of implementing Electrical Technology in Grades 10 to 12, ultimately informing educators, principals, and policymakers and guiding practice.

Resource-based theory, developed by Barney (1991), posits that the successful implementation of new technologies, including electrical systems, depends on an organization's access to and strategic use of resources that are valuable, rare, inimitable, and non-substitutable (VRIN). Applied to this study, the theory suggests that schools lack the basic resources required for the technology subjects already offered. Consequently, the implementation of Electrical Technology is constrained. Barney (1991) classifies organizational resources into tangible resources, intangible resources, human resources, and organizational capabilities. Institutional success is therefore contingent on adequate resourcing. In this context, the poor implementation of Electrical Technology can be attributed to resource shortages in workshops for existing technology subjects. These resources form the foundation for developing institutional capabilities, which, in turn, support improved performance and subject delivery.

4. METHODOLOGY

4.1. Research Paradigm and Approach

According to Khatri (2020), a research paradigm is a foundational belief system or worldview that shapes how a researcher understands and interprets phenomena and data. This study adopted an interpretivism paradigm. This paradigm was therefore appropriate for exploring how educators make sense of, and interact within, their school environments. Specifically, it enabled an in-depth understanding of educators' perspectives on the limited implementation of Electrical Technology in schools offering other technology subjects.

A qualitative research approach was also employed. Bhandari (2020) defines qualitative research as the interpretation and analysis of data gathered through interviews and observations. This approach provided in-depth insights into educators' experiences of the problem. Consequently, a qualitative approach was deemed suitable to explore educational stakeholders' perspectives on the implementation of Electrical Technology in secondary schools.

4.2. Sampling and Population

Sampling is the process of selecting a specific group from which research data will be collected. As McCombes (2023) explains, a sampling method enables a researcher to choose a representative group to draw valid conclusions. This study used a combination of purposive and convenience sampling, both forms of non-probability sampling. Participant selection was based on professional background and teaching experience. The sample included five departmental heads from the technical stream, five principals, and two technical subject advisors from the Zululand District in KwaZulu-Natal. The target population comprised School Management Team members and subject advisors. Five schools in the district were included.

The decision to include two subject advisors reflects the limited size of the technical stream within a single district. The researcher used convenience sampling because the participants were in close proximity: the researcher was employed by the Department of Basic Education in Zululand District, and the schools used as study sites were nearby. On the other hand, purposive sampling was adopted because the researcher selected participants with characteristics required by the study. The selection criteria were based on the participants' professional backgrounds and teaching experience. In this case, the researcher sought members of the School Management Team (SMT),

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specifically principals, departmental heads, and technical subject advisors, because they were relevant to the study and could provide the required data.

4.3. Data Collection Method

This study adopted a qualitative research approach. According to Faloye, Ajayi, Raghavjee, and Faniran (2020), common data collection methods employed by researchers include interviews and questionnaires. In line with this, the present study utilized semi-structured interviews and open-ended questionnaires as its primary data collection methods. These methods are discussed in detail below.

4.4. Semi-Structured Interviews

According to Hussein, Ow, Al-Azawei, and Ibrahim (2022), interviews are an effective method to collect detailed information from participants, and this method allows researchers to gain in-depth information about participants' experiences. This article selected semi-structured interviews as one of the key data collection methods. The researcher conducted interviews with the School Management Team (SMT), including principals and departmental heads. With participants' consent, interviews were conducted face-to-face with all five principals, five departmental heads, and two subject advisors in their respective offices to ensure a comfortable and professional environment. English served as the medium of communication throughout the interview process. The interviews explored their roles, challenges, and intervention strategies related to Electrical Technology implementation. Each interview lasted about 40-50 minutes and was telephonically recorded with permission.

4.5. Open–Ended Questionnaires

According to Faloye et al. (2020), a questionnaire is a document consisting of a series of questions arranged in a specific order. Between an open-ended questionnaire and close-ended questionnaire, this study opted for open-ended questionnaires. Open-ended questionnaires provide participants with the opportunity to express their views freely without being restricted (Taherdoost, 2016), thereby enhancing the validity and richness of the data collected. In this study, the researcher personally distributed and administered the questionnaires to all participants. This approach enabled the researcher to explain the purpose of the study in detail and address any questions requiring clarification. Participants were given two weeks to complete and return the questionnaires, using either WhatsApp or the researcher's email address. This method proved valuable in exploring the views of the principals, departmental heads and subject advisors regarding the limited implementation of Electrical Technology in schools offering technology subjects.

4.6. Data Analysis

According to Bhatia (2018), data analysis allows researchers to convert large volumes of collected information into clear and meaningful insights. In this study, data were gathered through semi–structured interviews and open–ended questionnaires. A thematic analysis was used to analyse the data collected. Thematic analysis is a qualitative research method of analyzing data that involves identifying and presenting patterns or themes in data (Braun & Clarke, 2006). This form of analysis, according to Braun and Clarke (2006), involves analyzing data following six steps. These steps are as follows: Familiarizing yourself with your data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report. The six steps mentioned were followed when analyzing data gathered from the semi-structured interviews and open-ended questionnaires.

4.7. Research Rigor

Research rigor refers to the systematic, thorough, and transparent processes employed to ensure the credibility, trustworthiness, and quality of qualitative research findings. According to Lincoln and Guba (1985) there are four

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key criteria for establishing trustworthiness in a qualitative research study, which are credibility, dependability, confirmability, and transferability. The trustworthiness of this study was therefore dependent on the methodological rigour and transparency applied throughout the research process. To ensure the rigour and trustworthiness of this study on factors affecting the implementation of Electrical Technology in Grades 10–12, this study employed several contemporary strategies grounded in recent qualitative research standards (Nowell, Norris, White, & Moules, 2017).

4.8. Triangulation

As per Cohen, Manion, and Morrison (2018), cited by Sotsaka and Singh-Pillay (2020), triangulation is described as the employment of two or more data collection methods in a study. To achieve triangulation, this study collected data using multiple methods, including non-participant observation, semi-structured interviews, and open-ended questionnaires, to validate findings and minimise researcher bias (Flick, 2018). The methodological triangulation enriched the study by incorporating diverse perspectives on the challenges that affect the implementation of Electrical Technology.

4.9. Validity

Validity in qualitative research refers to the extent to which the collected and analysed data accurately represent participants' experiences, perceptions, and viewpoints (McKim, 2023). In this study, validity was enhanced through member checking, a process that enabled participants to verify whether the researcher's interpretations accurately reflected their intended meanings and perspectives (Birt, Scott, Cavers, Campbell, & Walter, 2016). This approach ensured that the findings remained valid and accurately represented participants' experiences regarding the implementation of Electrical Technology in secondary schools.

4.10. Member Checking

According to McKim (2023), member checking plays a significant role in ensuring the credibility and accuracy of qualitative findings. In this study, participants were allowed to review, verify, and provide feedback on the information collected from them as well as the researcher's interpretations of the data. Through this process, participants were afforded the opportunity to confirm that their views had been accurately captured and interpreted. Consequently, the findings of this study were strengthened by ensuring that they authentically reflected participants' perspectives and experiences on the implementation of Electrical Technology.

4.11. Reliability (Dependability)

Reliability is commonly referred to as dependability, and it relates to the uniformity and stability of the research process over time in qualitative research. Bhandari (2020) notes that dependability in qualitative research is achieved when similar conclusions are presented by another researcher through examining the same data and following the documented procedures. In this study, dependability was ensured through the consistent application of data collection methods, systematic data analysis procedures, and accurate recording of research activities. In addition, the research instruments were reviewed by experienced scholars in the field to assess their appropriateness and consistency, thereby further strengthening the reliability and trustworthiness of the study.

4.12. Ethics and Gaining Access

Ethical clearance was obtained from the Durban University of Technology Ethics Committee, assigned protocol number (IREC 015/26), enabling the researcher to collect data for the study, with further gatekeeper's letter (Ref: 4/8/2689) permission secured from the KZN Department of Education, the Zululand District Manager, and participating school principals. All participants provided written informed consent and were informed of their right

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to withdraw at any time (Steenkamp, 2020). Pseudonyms were used, and all data were securely stored to ensure confidentiality and anonymity.

5. RESULTS AND FINDINGS

This study aimed to explore educational stakeholders' perspectives on the implementation of Electrical Technology in secondary schools. As mentioned above, the data collected in this study were obtained through semi-structured interviews and open-ended questionnaires. These methods were used to address the research question: What are the perceptions, experiences, and challenges of departmental heads, principals, and subject advisors regarding the implementation of Electrical Technology in secondary schools?

5.1. Presentation of Data and Discussion from Semi–Structured Interviews

This study involved three stakeholder groups as participants: principals, departmental heads, and subject advisors. Principals must offer at least one technical subject in their secondary schools, while departmental heads and subject advisors must both be from the technical stream. Below are participants' views on interventions that can be recommended to enhance the effective implementation of Electrical Technology.

5.1.1. Theme 1: School Support and Capacity Building

Participants emphasized that support from district officials is critical for the effective implementation of Electrical Technology. When participants were asked what interventions could be recommended to enhance the effective implementation of Electrical Technology in Zululand District schools, Principal A responded, "*Subject advisors and district managers must ensure that all principals are made aware of these subjects and their importance by supporting educators and providing them with all the necessary resources to effectively deliver the content to learners, as well as making technology subjects compulsory in schools.*"

Reinforcing this perspective, Principal D asserted that district officials should support schools offering technology subjects: "*To enhance the effective implementation of Electrical Technology in Zululand District schools, these technology subjects should be part of the curriculum, with support from superiors in terms of providing resources and financial assistance, because we cannot effectively implement Electrical Technology without equipment for both educators and learners.*"

In the same vein, Departmental Head G alluded to the support that subject advisors should provide to schools: "*All stakeholders' continuous involvement, both locally and in higher education. Schools offering Electrical Technology subjects should cooperate and support one another with resources. Teacher subject committees should participate in circuit- and district-level training and workshops. The cost-effective provision of Learner Teacher Support Materials (LTSM), task resources, and state subsidies for Electrical Technology facilities would ensure that even underprivileged learners are equipped and have access to resources.*"

The findings align well with the Department of Basic Education (2014), which describes subject advisors as curriculum implementers responsible for facilitating curriculum implementation and supporting educators as well as principals. Department of Basic Education (2020) further explains the role of the subject advisors in monitoring and supporting the curriculum delivery to ensure quality teaching and learning. However, this is in contrast to what the participants revealed. Participants in this study reported inconsistent support, particularly regarding a lack of awareness of Electrical Technology, a lack of resources and the frequency of visits.

This resonates with the National Planning Commission (2012), which highlighted a significant national shortage of subject specialists to assist technology subject educators. Similarly, Lidegran, Hultqvist, Bertilsson, and Börjesson (2021) found that South African educators often feel undertrained and unsupported in implementing curriculum reforms due to inadequate pedagogical and content support. The call by participants for technology subjects to be made compulsory also implies that increased prioritization at district level would need to be matched with increased resourcing. The gap between policy expectations and participant experiences suggests that strengthening subject

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advisor capacity and resource allocation is necessary for effective Electrical Technology implementation in the Zululand District.

5.1.2. Theme 2: Local Community Projects Involvement

Participants put forth that community involvement can aid in the implementation of electrical technology in secondary schools. Below are excerpt of the participants views regarding the involvement of the community to enhance implementation of Electrical Technology.

When participants were asked what they would recommend to enhance the effective implementation of Electrical Technology, Principal C responded, *"I recommend that companies sponsor schools in terms of infrastructure so that Electrical Technology can be implemented. There are companies conducting construction projects in the community, whether water supply or road construction; they should also sponsor schools by offering to do something needed or required when the principal makes a request. For example, in this case, I would ask them to assist me in building a workshop for the technical stream. A lot can be done if we are united and genuinely committed to technology subjects in schools."*

Correspondingly, Departmental Head H elaborated on his views about effective ways to enhance implementation in schools: *"Zooming into the community and seeking assistance on how we can effectively implement Electrical Technology. Encourage learners to choose Electrical Technology by sharing information about the importance of studying Electrical Technology."*

Similarly, Subject Advisor K responded that industries can also sponsor schools with resources and help build infrastructure to enhance the effective implementation of Electrical Technology: *"I think Electrical Technology can be improved in secondary schools by creating a workshop, inviting principals from all secondary schools, and presenting the benefits of having Electrical Technology in their schools. Invite other stakeholders as well from different industries, such as Eskom, Transnet, SASOL, and SAPPI, to come forward and encourage principals to offer Electrical Technology in their schools and perhaps sponsor schools with resources to assist them in effectively implementing Electrical Technology."*

The views of participants regarding community involvement align with Atunde, Abdulraheem, Abdussalam, Medupin, and Adewara (2022), whose study found that communities provided schools with facilities such as buildings, science equipment, computers, and library resources through local development projects. The emphasis on sponsorship from construction companies also addresses a key challenge noted by Bonisile, Kajimo-Shakantu, and Opawole (2019), who emphasized that rural schools are characterized by a huge shortage of educational facilities due to improper planning and lack of investment. The findings suggest that if construction companies working in local communities could sponsor schools with materials and workshops, this would ease resource constraints for Electrical Technology implementation. While literature on structured school-industry partnerships in secondary technical education remains limited, this study highlights community involvement as a practical intervention that could be adopted to support under-resourced schools.

5.2. Presentation of Data and Discussion from Open–Ended Questionnaires

Following the semi-structured interviews, data were also collected through open-ended questionnaires. This method was useful because it gave the researcher an opportunity to collect additional data that had not been obtained from the semi-structured interviews. The themes that emerged are presented and discussed in detail below.

5.2.1. Theme 1: Lack of Infrastructure in Secondary Schools

Participants identified the lack of infrastructure, resources, and a suitable electricity supply as some of the major challenges to implementing Electrical Technology. When participants were asked about the challenges affecting the implementation of Electrical Technology as one of the technology subjects in their schools, Principal A responded, "Our *school is in a rural area; there is no sponsor to sponsor us, and we do not have the infrastructure to assist learners with practical work."*

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Reinforcing this perspective, Departmental Head H asserted that infrastructure was one of the challenges affecting the implementation of Electrical Technology: *"Lack of infrastructure and power supply are among the biggest challenges we face in implementing Electrical Technology. The type of electricity the school uses is prepaid, whereas Electrical Technology requires a three-phase electricity supply."*

Elaborating on this matter, Principal B alluded: *"The unavailability of local workshops to cater to both teachers and learners is one of the challenges we face. Educators are always the ones who go to Newcastle for PAT simulations because the workshops there are well equipped, but learners are left behind, whereas the main priority should be the learners. It does not make sense that senior officials only train educators, knowing very well that the majority of schools lack the necessary infrastructure. Their policies require practical assessments, whereas schools are in an underdeveloped state and situated in rural areas."*

Even district officials are aware of the lack of infrastructure. This was reported by Subject Advisor K, who indicated: *"We are currently facing the issue of providing infrastructure to schools that already have technology subjects."*

The challenges regarding infrastructure that were reported by participants align with policy requirements outlined in the Republic of South Africa (1996), which underscores the government's role in providing quality infrastructure for conducive learning. Department of Basic Education (2011) further states that well-equipped workshops are indeed a key requirement for Electrical Technology, particularly for learners to complete Practical Assessment Tasks (PATs). However, participants' experiences contradict this policy. The lack of workshops means learners cannot complete PATs at schools, forcing educators to travel to better-equipped schools in Newcastle for simulations.

This is consistent with Ogunode and Hadi (2021), who contend that adequate infrastructure is crucial for successful implementation of technical subjects. Alavi (2021) also notes that despite curriculum models, infrastructure remains a fundamental barrier. In the same vein, Mary Metcalfe, as cited by Mafolo (2022), further highlights that historical inequalities and DBE inefficiencies have left many South African public schools, particularly in rural areas, with crippling infrastructure deficiencies. The findings of this study therefore confirm that lack of infrastructure continues to undermine the quality and implementation of Electrical Technology in secondary schools in Zululand District.

5.2.2. Theme 2: Awareness Need for Electrical Technology

Participants elaborated on their concerns about how learners, parents, and the community lack awareness of Electrical Technology as a subject and career pathway. Below are some excerpts from participants' views regarding stakeholders' argument that there is a lack of awareness about the existence of technology subjects. When Principal A was asked about the challenges faced when implementing Electrical Technology, the response was, *"The community lacks knowledge of technology subjects, and parents always encourage their children to pursue the science stream so that they may become "doctors", instead of also encouraging learners to pursue the technical stream so that they may become engineers."*

In the same vein, Principal D also emphasized the importance of raising awareness of technology subjects: *"Yes, if electrical technology can be piloted first, starting with those schools that are said to be comprehensive high schools, and gradually introduced to other schools, learners will become familiar with these subjects and eventually choose to pursue these streams."*

Similarly, Departmental Head F attested that learners and parents are not informed about technology subjects: *"Learners are not familiar with these subjects, nor are their parents. Hence, we still have a few learners who choose these subjects, even though we, as educators, try by all means to encourage Grades 8 and 9 to choose technical subjects, including Electrical Technology, as early as they are in the General Education and Training (GET) phase."*

The need for awareness of Electrical Technology identified by the participants is reinforced by Bloomfield (2015), who argued that necessary actions should be taken to encourage learners to pursue engineering and technology professions. Stitt and Happel-Parkins (2019) also found that learners lack awareness of opportunities within the engineering field, which affects subject choice. According to Department of Basic Education (2012), Electrical

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Technology prepares learners for careers in Electrical, Electronics, and Digital Systems. Early awareness in the GET phase, as suggested by participants, is therefore critical for informed subject choices.

Mgetyana (2022) and Department of Basic Education (2014) further state that the subject prepares learners for both engineering and trade apprenticeships. Halim et al. (2023) highlight that parents are influential in shaping children's career choices. The participants' observation that parents encourage science over technical streams reveals this. The International Energy Agency (2025) also notes that Electrical Technology is important for economic development. The data suggest that without deliberate awareness campaigns aimed at learners, parents, and communities, implementation of Electrical Technology will remain slow in the Zululand District.

5.2.3. Theme 3: Financial Constraints to Fund Technical Stream

Participants pointed out financial constraints as one of the significant challenges to implementing Electrical Technology. Below are some excerpts from participants' views regarding financial constraints. When Principal C was asked about challenges, including the financial situation, the response was, "*Electrical Technology is very expensive, and purchasing all the equipment can be a challenge since the school has not been adopted by any stakeholder, such as a company like Eskom, and depends on Norms and Standards for its functionality.*"

Similarly, Principal E elaborated that financial constraints hinder the successful implementation of Electrical Technology and that their school would definitely not cope with adopting this subject as part of the curriculum: "*These subjects demand a lot financially, and the Department of Education does not have enough money allocated for schools to cater for such subjects. I do not think we would cope if we had to implement another technical subject, given the current situation. We do not have money, and therefore we simply cannot risk offering Electrical Technology when there will be no materials to assist learners practically. Sometimes I use my own money because a teacher will tell you that there is nothing else that can be done if something is missing or unavailable. This means that I have to use my own money to buy whatever is needed. If I cannot afford to buy it, then it means that we have to find other means.*"

In the same vein, one of the district officials alluded to the challenges stemming from financial constraints. Subject Advisor K also said, "*Our department is facing a lot of challenges when it comes to finances due to budget cuts.*"

The financial constraints reported by participants align with Akhter, Khan, and Rehman (2018), who stated that allocation of financial resources is pivotal to improving teaching and learning in technical subjects. Department of Basic Education (2011) policy also requires that schools offering Electrical Technology must have well-equipped workshops and adequate materials for PATs. However, the reliance on stakeholder adoption mentioned by Principal C, and the use of personal funds reported by Principal E, show a gap between policy and practice. This is consistent with Samuel and Mokaya (2022), who argued that quality technical education depends on adequate government funding for infrastructure and consumables. The budget cuts mentioned by the Subject Advisor further compound the problem. Without dedicated and sufficient funding, schools cannot sustain the practical component of Electrical Technology. The findings therefore suggest that financial support from the DBE and partnerships with industry are essential for effective implementation of Electrical Technology in Zululand District.

6. CONCLUSION

This study explored educational stakeholders' perspectives on the implementation of Electrical Technology in secondary schools in the Zululand District. The findings reveal that principals, departmental heads, and educators perceive implementation as severely constrained by inadequate infrastructure, insufficient resources, and limited institutional support. Stakeholders consistently reported that the absence of workshops and electrical installations, coupled with under-resourced existing technology subjects, makes it difficult to offer Electrical Technology in accordance with the Department of Basic Education's standards.

Participants further highlighted systemic challenges, including inadequate funding, limited teacher training opportunities, and low awareness among school management of the subject's educational and career value. Despite

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these barriers, stakeholders recognized Electrical Technology as an important pathway to engineering and technical careers. The study therefore concludes that successful implementation will require coordinated action, including increased investment in infrastructure and resources, targeted support and professional development for educators, and active advocacy by Subject Advisors to promote the subject's value to school leadership. Without these measures, the perspectives of stakeholders indicate that Electrical Technology will remain largely excluded from the curriculum.

7. RECOMMENDATIONS AND FUTURE RESEARCH

Based on the findings, this study recommends that Subject Advisors take a leading role in promoting the inclusion of Electrical Technology in the secondary school curriculum. This can be achieved by raising principals' awareness of the subject's educational value and potential to create career pathways for learners. Subject Advisors should also provide ongoing support and guidance to schools to facilitate effective implementation. Key areas of support should include curriculum planning, teacher development, and the monitoring of instructional practices. For future research, this study recommends two areas of focus. First, research should examine how effectively the Practical Assessment Task (PAT) is administered and implemented in schools offering technology subjects. Second, studies should investigate the pedagogical strategies educators use to teach the Electrical Technology PAT and how these strategies affect learners' practical skill development and academic achievement.

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REFERENCES

Aggarwal, A. (2022). *The clean energy sector needs more young people. World Economic Forum.* Retrieved from https://www.weforum.org/stories/energy-transition/clean-energy-sector-young-people-africa/

Akhter, N., Khan, A. M., & Rehman, A. (2018). Efficient management of financial resource and constraints in implementation of budget at secondary schools. *Global Social Sciences Review, 3*(3), 529-542. https://doi.org/10.31703/gssr.2018(iii-iii).31

Akinradewo, O., Akinshipe, O., Aigbavboa, C., Maake, M., Thwala, D., & Onyia, M. (2022). Mitigating engineering skills deficiency in South Africa. *AIP Conference Proceedings, 2437*(1), 020120. https://doi.org/10.1063/5.0092297

Akpan, J., Kumba, H., & Olanrewaju, O. (2024). Sustainable energy in Zimbabwe—status, challenges and solutions. *Renewable Energies, 2*(2), 1-18. https://doi.org/10.1177/27533735241276201

Alavi, S. (2021). Introducing a model for infrastructure improvement to develop intelligent schools. *Journal of Human, Earth, and Future, 2*(3), 210–224. https://doi.org/10.28991/HEF-2021-02-03-03

Aspiring Minds. (2014). *National employability report: Engineers—Annual report 2014.* Gurgaon, India: Aspiring Minds Assessment Pvt. Ltd.

Atunde, M. O., Abdulraheem, J. W., Abdussalam, T. A. B., Medupin, A. J., & Adewara, J. O. (2022). Resource development and library effectiveness in Kwara State public secondary schools: A school-community synergism. *WE: A Multidisciplinary and Multilingual Peer-Reviewed Research Journal, 3*(1), 15–32.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120. https://doi.org/10.1177/014920639101700108

© 2027 Conscientia Beam. All Rights Reserved.

Battu, H., & Bender, K. (2020). Educational mismatch in developing countries: A review of the existing evidence. In S. Bradley & C. Green (Eds.), *The economics of education: A comprehensive overview* (2nd ed., pp. 269-289). Amsterdam, Netherlands: Academic Press. https://doi.org/10.1016/B978-0-12-815391-8.00020-3

Bhandari, P. (2020). *An introduction to qualitative research.* Netherlands: Scribbr.

Bhatia, M. (2018). *Your guide to qualitative and quantitative data analysis methods. Humans of Data.* Retrieved from https://humansofdata.atlan.com/2018/09/qualitative-quantitative-data-analysis-methods/

Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research, 26*(13), 1802-1811. https://doi.org/10.1177/1049732316654870

Bloomfield, G. (2015). *Is there REALLY a skills shortage in the engineering industry, or are employers just not paying up?* London, UK: Engineering and Technology Jobs (E&T).

Bonisile, N., Kajimo-Shakantu, K., & Opawole, A. (2019). Assessment of alternative building technologies (ABT) for pre-tertiary school infrastructure delivery in the Eastern Cape Province, South Africa. *Management of Environmental Quality: An International Journal, 30*(5), 1152-1170. https://doi.org/10.1108/MEQ-06-2018-0111

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

CEDEFOP. (2022). *Annual report 2022: The future of work is learning.* Luxembourg: Publications Office of the European Union.

Central Applications Office. (2025). *CAO handbook entry 2025.* Durban, South Africa Central Applications Office.

Chikarara, S. N. (2019). The precariatization of Zimbabwean engineers in South Africa. *Professions and Professionalism, 9*(3), e3303. https://doi.org/10.7577/pp.3303

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). London & New York, NY: Routledge.

Department of Basic Education. (2011). *Curriculum and assessment policy statement (CAPS) of Technology grade 7-9.* Pretoria: Department of Basic Education.

Department of Basic Education. (2012). *Curriculum and assessment policy statement: Electrical technology grades 10–12.* Pretoria, South Africa: Department of Basic Education.

Department of Basic Education. (2014). *Curriculum and assessment policy statement (CAPS): Grades 10–12, Electrical Technology.* Pretoria, South Africa: Department of Basic Education.

Department of Basic Education. (2020). *National Senior Certificate: Diagnostic report 2020, Part 3: Technology subjects.* Pretoria, South Africa: Department of Basic Education.

Du Toit, A. (2020). Threading entrepreneurship through the design process in technology education. *African Journal of Research in Mathematics, Science and Technology Education, 24*(2), 180-191. https://doi.org/10.1080/18117295.2020.1802153

Du Toit, A., & Gaotlhobogwe, M. (2018). Unheeded potential: Indigenous knowledge in the intended technology curricula of Botswana and South Africa. In M. A. Mokoena & I. Oosthuizen (Eds.), *A scholarly compendium for teaching and learning* (pp. 213–236). Potchefstroom, South Africa: Ivyline.

EngineeringUK. (2022). *Trends in the engineering workforce between 2010 and 2021.* London, England: EngineeringUK.

Faloye, S. T., Ajayi, N. A., Raghavjee, R., & Faniran, V. (2020). *Managing the challenges facing the adoption of e-books: A case of UKZN.* Paper presented at the 2020 International Conference on Artificial Intelligence, Big Data, Computing and Data Communication Systems (icABCD) (pp. 1–7). Durban, South Africa: IEEE.

Flick, U. (2018). *An introduction to qualitative research* (6th ed.). London: SAGE Publications.

Gumbo, M. T. (2020). Professional development of technology teachers: Does their training meet their needs? *Perspectives in Education, 38*(1), 58-71. https://doi.org/10.38140/pie.v38i1.4416

Halim, M. L. D., Atwood, S., Osornio, A. C., Pauker, K., Dunham, Y., Olson, K. R., & Gaither, S. E. (2023). Parent and self-socialization of gender intergroup attitudes, perceptions, and behaviors among ethnically and geographically diverse young children. *Developmental Psychology, 59*(10), 1933–1950. https://doi.org/10.1037/dev0001586

Hove, B., & Mazvimba, N. (2024). Teachers' perceptions and preparedness for implementing the new AS & A Level Design and Technology syllabus by Cambridge Assessment International Education in Zimbabwean context: Challenges and

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opportunities in adapting to a technology-oriented curriculum. *International Journal of Research and Scientific Innovation*, *11*(11), 647–655.

Hussein, M. H., Ow, S. H., Al-Azawei, A., & Ibrahim, I. (2022). What drives students' successful reuse of online learning in higher education? A case of Google Classroom. *Australasian Journal of Educational Technology*, *38*(3), 1-21. https://doi.org/10.14742/ajet.7335

International Energy Agency. (2025). *Financing electricity access in Africa*. Paris, France: International Energy Agency.

Khatri, K. K. (2020). Research paradigm: A philosophy of educational research. *International Journal of English Literature and Social Sciences*, *5*(5), 1435-1440.

Lidegran, I., Hultqvist, E., Bertilsson, E., & Börjesson, M. (2021). Insecurity, lack of support, and frustration: A sociological analysis of how three groups of students reflect on their distance education during the pandemic in Sweden. *European Journal of Education*, *56*(4), 550-563. https://doi.org/10.1111/ejed.12477

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications.

Maeko, M. S. A., & Makgato, M. (2017). The transfer of requisite Civil Technology hands-on practical skills to student teachers in South African Civil Technology Teacher Training Universities. *International Journal of Educational Sciences*, *18*(1-3), 147-157.

Mafolo, K. (2022). *Hot button concern: Equal Education looks forward to roll out of new mechanism for school infrastructure delivery*. Cape Town, South Africa: Daily Maverick.

Mbatha, M. G. (2016). Teachers' experiences of implementing the Curriculum and Assessment Policy Statement (CAPS) in Grade 10 in selected schools at Ndwedwe in Durban. Master's Dissertation, University of South Africa, Pretoria, South Africa.

McCombes, S. (2023). *Sampling methods | Types, techniques & examples*. Retrieved from https://www.scribbr.com/methodology/sampling-methods/

McKim, C. (2023). Meaningful member-checking: A structured approach to member-checking. *American Journal of Qualitative Research*, *7*(2), 41-52. https://doi.org/10.66815/ajqr/12973

Medlin, B. D. (2001). The factors that may influence a faculty member's decision to adopt electronic technologies in instruction. Doctoral Dissertation, Virginia Polytechnic Institute and State University. ProQuest Dissertations and Theses.

Mgetyana, J. (2022). *Implementation of the revised electrical technology curriculum in selected South African secondary schools*. Paper presented at the Proceedings of the 7th Annual International Conference on Public Administration and Development Alternatives (IPADA).

Mhlongo, G. T., & Makgato, M. (2019). The role of mathematics in technical and vocational education and training. *Journal of Technical Education and Training*, *11*(3), 82 – 90.

Mlambo, P. B. (2023). Information and communications technology in engineering graphics and design classrooms: A post COVID-19 era. *Jurnal Penelitian dan Pengkajian Ilmu Pendidikan: E-Saintika*, *7*(2), 160-175. https://doi.org/10.36312/esaintika.v7i2.1321

Mokhothu, K. G. (2015). The integration of technical subjects in civil technology curriculum with special reference to FET technical schools. Master's Dissertation. Central University of Technology, Free State, Bloemfontein, South Africa.

National Planning Commission. (2012). *National Development Plan 2030: Our future – make it work*. Pretoria: Presidency of South Africa.

Nguyen, D. Q., & Pudlowski, Z. J. (2007). *Issues and challenges in engineering education and future outlook of the engineering profession in Australia*. Paper presented at the Proceedings of the 18th Annual Conference of the Australasian Association for Engineering Education (AAEE), Melbourne, Australia.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, *16*(1), 1-13. https://doi.org/10.1177/1609406917733847

Ntuli, B. A., Mncube, D. W., & Mkhasibe, G. M. (2023). Partnership to promote school governance and academic experience: Integration of remote learning in the context of the COVID-19 pandemic in the uMkhanyakude district. *South African Journal of Education*, *43*(1), 1-10. https://doi.org/10.15700/saje.v43n1a2023

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Ntuli, L. T., & Mahlangu, V. P. (2023). Legal execution of curriculum in primary schools: School management teams' perspectives. *Research in Educational Policy and Management, 5*(2), 177-206. https://doi.org/10.46303/repam.2023.16

Ogunode, N. J., & Hadi, D. (2021). Shortage of infrastructural facilities in Nigerian public primary schools: Causes, effects and way forward. *International Journal of Development and Public Policy, 1*(7), 96-108.

Ogunyemi, D., & Fakoya, O. (2021). Enhancing practical competencies in electrical installation: A case study of Nigerian technical colleges. *Journal of Vocational Studies, 7*(1), 59 – 68.

Parisot, A. H. (1995). Technology and teaching: The adoption and diffusion of technological innovations by a community college faculty. Doctoral Dissertation, Montana State University, ProQuest Dissertations and Theses.

Republic of South Africa. (1996). *South African Schools Act 84 of 1996. Government Gazette, 377(17579).* Pretoria, South Africa: Government Printer.

Rogers, E. M. (1962). *Diffusion of innovations.* New York, NY: Free Press of Glencoe.

Samuel, T., & Mokaya, O. N. (2022). The influence of level of funding on implementation of physical infrastructure projects in public secondary schools. *Asian Journal of Education and Social Studies, 34*(2), 47-56. https://doi.org/10.9734/ajess/2022/v34i2727

Sherry, L., & Gibson, D. (2002). The path to teacher leadership in educational technology. *Contemporary Issues in Technology and Teacher Education, 2*(2), 178–203.

Singh-Pillay, A., & Sotsaka, D. (2020). An exploration of first year pre-service engineering graphics and design teachers' spatial visualisation ability at a university of technology. *Journal for the Education of Gifted Young Scientists, 8*(2), 681-690. https://doi.org/10.17478/jegys.639351

Smit, P. K., Schultz, C. M., & van Hoek, C. E. (2021). The relationship between talent management, transformational leadership and work engagement: An automotive artisan perspective. *SA Journal of Human Resource Management, 19*, a1578.

Sotsaka, D., & Singh-Pillay, A. (2020). Meeting the challenges first year engineering graphic design pre-service teachers encounter when they read and interpret assembly drawing. *Journal of Education (University of KwaZulu-Natal)*(80), 72-86. https://doi.org/10.17159/2520-9868/i80a04

Steenkamp, I. (2020). *Identifying and critically analysing the 5 main ethical principles to research. UNICAF University–Zambia.* Retrieved from https://www.academia.edu/50807807/Identifying_and_critically_analysing_the_5_main_ethical_principles_to_research

Stitt, R. L., & Happel-Parkins, A. (2019). "Sounds like something a White man should be doing": The shared experiences of Black women engineering students. *The Journal of Negro Education, 88*(1), 62-74. https://doi.org/10.7709/jnegroeducation.88.1.0062

Taherdoost, H. (2016). Sampling methods in research methodology: How to choose a sampling technique for research. *International Journal of Academic Research in Management, 5*(2), 18–27.

Themane, M., & Thobejane, H. R. (2019). Teachers as change agents in making teaching inclusive in some selected rural schools of Limpopo Province, South Africa: Implications for teacher education. *International Journal of Inclusive Education, 23*(4), 369-383. https://doi.org/10.1080/13603116.2018.1434690

U.S. Bureau of Labor Statistics. (2023). *Electrical and electronics engineers: Occupational outlook handbook.* Washington, DC: U. S. Department of Labor.

UNESCO. (2021). *UNESCO science report: The race against time for smarter development (S. Schneegans, T. Straza, & J. Lewis, Eds.).* Paris, France: UNESCO Publishing.

World Bank. (2021). *Quality infrastructure investment partnership: 2021 QII annual report.* Washington, DC: World Bank.

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