

An investigation into the teaching challenges encountered in the grade 10 engineering graphics and design classrooms

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Abstract

This study investigates the challenges faced by grade 10 teachers in Engineering Graphics and Design (EGD) classrooms and their impact on learners' performance, particularly related to poor outcomes on the National Senior Certificate (NSC) examination. The study used convenience sampling to select five EGD teachers from two schools offering the subject adopting an interpretivist paradigm and a qualitative research approach. Semi-structured interviews were conducted to explore teachers' experiences and perspectives with data analyzed using thematic analysis. The study used the Pedagogical Content Knowledge (PCK) theoretical framework to look at how content delivery and teaching strategies are related. The findings reveal a significant lack of basic resources in EGD classrooms which negatively affects teaching and learning processes. Teachers struggle to deliver effective instruction because of inadequate tools and materials, impacting learners' understanding and performance in the subject. The study concludes that addressing resource shortages in EGD classrooms is crucial for improving teaching effectiveness and student outcomes. Learners are deprived, contributing to poor performance in national examinations without adequate resources. Therefore, the study recommends that the Department of Education prioritize the provision of essential resources in EGD classrooms to enhance teaching and learning experiences, leading to improve learner performance.

Keywords: Challenges, Engineering graphics and design, Grade, Pedagogical content knowledge, Resources, Technical drawing.

Citation: | Mhlungu, N. N., & Mlambo, P. B. (2025). An investigation into the teaching challenges encountered in the grade 10 engineering graphics and design classrooms. *Journal of Education and e-Learning Research*, 12(2), 145–152. 10.20448/jeelr.v12i2.6745
History:
Received: 23 December 2024
Revised: 16 April 2025
Accepted: 28 April 2025
Published: 5 June 2025
Licensed: This work is licensed under a [Creative Commons Attribution 4.0 License](https://creativecommons.org/licenses/by/4.0/) 
Publisher: Asian Online Journal Publishing Group

Funding: This study received no specific financial support.
Institutional Review Board Statement: The Ethical Committee of the Durban University of Technology, South Africa has granted approval for this study on 2 May 2024 (Ref. No. IREC 024/24).
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: Both authors contributed equally to the conception and design of the study. Both authors have read and agreed to the published version of the manuscript.

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Contribution of this paper to the literature

Many studies focus on grade 12 Engineering Graphics and Design (EGD) challenges, overlooking grade 10, the foundation of the Further Education and Training (FET) band. This study addresses this gap by investigating grade 10 EGD classroom challenges, contributing to literature and supporting efforts to mitigate issues that may arise in grade 12.

1. Introduction

The Curriculum and Assessment Policy Statement (CAPS) document (Department of Basic Education (DBE), 2011) says that Engineering Graphics and Design (EGD) is taught at the Further Education and Training (FET) phase which is the same as grades 10–12 in high school. One of the technical-practical courses, EGD is primarily concerned with line work, correctness, and neatness. A study conducted by Conradie (2011) states that technical drawing was superseded by EGD which was given a new meaning with the release of Curriculum 2005 (C2005). The integration of cognitive and manipulative skills required for visual design and communication is known as EGD. Singh-pillay and Sotsaka (2020) state that in South Africa, engineers are scarce. The skills scarcity identified in the engineering field has been associated with schooling systems' incapability to evolve fundamental skills required in the engineering courses. The educational system in South Africa prioritizes written text over spatial visualization emphasis the development of verbal, written, and numerical skills. EGD expects learners to not only learn how to communicate visually but also to read and comprehend graphical materials. However, according to a study by Singh-Pillay and Sotsaka (2016) many EGD practitioners lack the pedagogical subject expertise necessary to help learners develop the spatial visualization skills they need to understand engineering drawings. Furthermore, the examiners and moderators report for the National Senior Certificate (NSC) EGD underlines the (in)capacity of matric learners to read and comprehend engineering drawings such as assembly drawings (AD) (Department of Basic Education (DBE), 2011, 2018).

Mtshali (2021) elaborated that the majority of teachers lack practical experience in teaching EGD in classrooms because they only studied it in postsecondary (tertiary) institutions. Therefore, given that they were not exposed to classroom discourse during their teacher training, how can they use it? Skosana (2017) points out that most learners complete work-based learning programs without receiving enough mentor teacher assistance to obtain their EGD teaching certificate. Furthermore, teachers strive to complete the syllabus. In the last three years (2022–2024) of the EGD examination, the DBE in South Africa has released diagnostic results that show how poorly learners scored in analytical drawing concepts, particularly in knowledge, calculations, and symbols. These consist of calculating area, volumes, and perimeters as well as sketching orthographic symbols for the first or third angle. A possible reason for students' difficulties with analytical drawing is that teachers may not include them effectively in class discussions to help them understand, apply, and evaluate the content they have learnt. According to the moderator's report, learners also face difficulties in sections like assembly drawing (Makgato & Khoza, 2016) and isometric drawing (ID) which emanate from the challenges surrounding the teaching and learning of EGD.

This study investigated the challenges faced by teachers in the teaching and learning of EGD in grade 10 classrooms. This study was done to ensure that teaching and learning in EGD classrooms are done properly and learners are getting the best possible education. On the side of learners, it has been revealed that they lack crucial skills required in EGD such as spatial visualization ability (Khoza, 2014; Mlambo, 2023; Sotsaka, 2019). Researchers have also observed learners producing work that is not of the expected standard because of the lack of drawing instruments. The challenges faced by students in the grade 12 EGD examinations are consistently highlighted in examiners' and moderators' reports. These challenges continue to exist annually though they are frequently discussed. This persistent issue has prompted the need to investigate the teaching and learning challenges in grade 10, the entry grade of the FET phase which lays the foundation for grade 12. Identifying and addressing these challenges at an early stage is crucial for mitigating their impact on learners' performance in subsequent grades. Therefore, this study seeks to explore the difficulties faced by teachers in teaching EGD in grade 10, a critical gateway subject for engineering courses.

The purpose of this study was to investigate the challenges faced by EGD teachers in teaching EGD in grade 10 classrooms.

This study was guided by the following research question:

What are the challenges faced by EGD teachers in grade 10 classrooms?

The above main research question is underpinned by the following sub research questions:

- How do resource availability and classroom environment impact the teaching and learning of EGD in grade 10?
- What strategies do EGD teachers employ to overcome the challenges in teaching grade 10 learners, and how effective are these strategies?

2. Literature Review

Perez-Belis et al. (2020) claim that the challenge of seeing 3-D things represented in 2-D makes it difficult for learners to understand the mechanics, which contributes to the high failure rate in EGD. This shows that by the time learners finish school, their spatial abilities have not fully developed. Chinonso (2021) discovered a link between this high failure rate and conventional teaching strategies that do not help learners improve their performance in EGD. These techniques fall short in highlighting the relationships between the sketch and the product's actual design. Teachers need to set up a classroom where learners can do drawing exercises if they want their learners to improve their performance. Furthermore, Branoff and Dobelis (2012) observed that the high failure rates of EGD learners were caused by a mismatch between the teaching styles of the teacher and the learning styles of learners. On the other hand, Killen, Rutland and Jampol (2009) identify two distinct problems that impede the implementation of EGD instruction imposed by the administrative system and a teacher. In light of the above, the teacher must come up with solutions for any constraints that would prevent him or her from

teaching EGD, whether they are from the teacher or the result of the system. Killen et al. (2009) further outline different types of system limitations. One of these would be doing too much administrative work which results in spending more time on it and not enough time on instruction. In teaching in general and EGD in particular, there is a dearth of recognizable materials and current reference books (textbooks and workbooks). Students usually perceive the subject to be slightly dull and uninteresting. They criticize the complexity of their primary concepts and the challenges of some of the pictures. The above discussion has been identified some of the factors that contribute to poor performance in teaching and learning. Apart from the above-mentioned challenges, frequent absenteeism from school is also linked to detrimental effects on one's academic performance. According to Allen, Diamond-Myrsten and Rollins (2018) schools and government agencies frequently ignore and fail to act on learners' high rate of absenteeism. Absenteeism from school is a hidden educational catastrophe as well as a public health concern. It is a multifaceted and intricate phenomenon with numerous interacting factors. The primary objective of previous initiatives to reduce absenteeism was on differentiating between excused absences based on a fear of missing school and truancy. However, recent data indicates that missing school can often have negative effects, even when parents or doctors approve. As a result, the focus of EGD has shifted to minimizing absenteeism for all reasons. According to Zwane, Simelane-Mnisi and Skosana (2021) course drawings are end of chapter exercises that are used to calculate learners' School Based Assessment (SBA) at the end of each term. If a learner is absent and misses what was taught in class and the course drawing that was done in class. The teacher is expected to give that learner extra time to do what was done when he or she was absent.

Research has shown that the persistent use of teacher-centered instructional techniques in teaching EGD in secondary schools contributes to various teaching challenges. Specifically, these outdated methods are often linked to difficulties teachers face when addressing EGD concepts such as solids geometry, interpenetration and development proofs. Teacher-centered approaches in EGD frequently reduce learners to passive recipients of rote-memorized visualizations, principles, and theorems (Armah et al., 2018). However, EGD is a practical subject that requires active learner engagement to enhance understanding, particularly through sustained interaction with its concepts. Although these challenges are most evident in grade 12, their roots often lie in earlier grades where they remain unaddressed until they escalate. This underscores the need to investigate teaching challenges in grade 10 classrooms as a proactive strategy to address these issues at their inception.

2.1. Theoretical Framework

This study investigates the challenges in grade 10 EGD classrooms which result in poor results produced in EGD. These poor results have been evident in topics such as ID and AD; these challenges have also been highlighted in the yearly moderator's report. One of the reasons was the way teachers teach these topics which is the pedagogical content knowledge (PCK) as mentioned by Mlambo (2024). Based on the above discussion, this study has adopted the PCK framework by Shulman (1986) to investigate the challenges in grade 10 classrooms.

Shulman (1986) explains that teacher knowledge goes beyond knowledge of a subject matter. In addition, he defines PCK as the category most likely to separate the understanding of the subject specialist from that of the teacher as that specific combination of content and pedagogy that is exclusive to teachers, their own distinctive professional understanding. The study used the PCK concept to determine the process of knowledge transfer to others (Geddis, Onslow, Beynon & Oesch, 1993). This was accomplished by evaluating the way instruction led to learning in the EGD classroom. The researchers can gain insight into the formulation of explanations, examples, demonstrations and drawings in grade 10 EGD classrooms Shulman (2002). Interviews were used to determine the didactic activities followed by the EGD teachers in the classrooms when carrying out the lessons.

It emphasises more the traits that teachers have, including their subject-matter competence or instructional abilities. Nonetheless, the PCK concept was applied in the study to watch the difficulties teachers experienced. The salience of the curriculum that EGD teachers showed as well as representations of how EGD teachers use technologies for illustrations is what the researchers searched for in EGD instruction. Other studies done by Kekana, Mtshali and Ramaligela (2024) and Mtshali and Singh-Pillay (2023) allude to the PCK as the essential element in teaching and learning. As a result, PCK was seen as a tool to assist in investigating how teachers are teaching and further investigate the challenges they face in teaching EGD.

Therefore, a teacher with well-developed PCK would be perceived as having many approaches to presenting the material learnt, having made thoughtful decisions about the teaching strategies associated with a certain topic for specific learners who have learning challenges related to the issue. PCK is viewed as a process of understanding how to teach in which this knowledge is built by integrating the knowledge components rather than a product of the integrated knowledge components. Cochran, DeRuiter and King (1993) refer to it as PCK. According to Magnusson, Krajcik and Borko (1999) pedagogical content knowledge is a distinct area of teacher knowledge that emerges from the transformation of many types of knowledge for teaching. In this study, PCK was used to investigate how EGD teachers teach EGD and discover PCK- related challenges.

3. Methodology

3.1. Research Approach

This study aimed to understand the difficulties faced by EGD teachers in grade 10 EGD classrooms. A qualitative approach was employed in this study. According to Roberts (2010) a qualitative research is a type of investigation that collects detailed descriptive data from individuals. To put it simply, it implies that you obtain your data directly from the source, often known as a main source of data. This approach was chosen by the researchers because of its ability to provide a thorough understanding of the phenomenon being studied, which is investigating difficulties faced by EGD teachers in EGD classrooms.

3.2. Research Design

A descriptive research design was used in this study to gather data that would help characterized the phenomena. To collect data on social issues, descriptive design is a research method that answers questions such as "what, who, where, why, and how." A descriptive research design was used in this study to gather data that would

help characterize the phenomena because of its ability to provide a comprehensive understanding of any topic being studied (Sumeracki, 2018). This part of gaining a comprehensive understanding of the subject matter was clear since the researcher needed to investigate the difficulties teachers in grade 10 EGD classrooms experienced and the best method to do that was to obtain a comprehensive understanding of the teachers. The efficacy of the selected data collection procedures to elicit detailed information from the participants was a deciding factor.

3.3. Research Paradigm

This study also adopted an interpretive paradigm. According to Rehman and Alharthi (2016) interpretivism research relies mostly on verbal data. Hence, this study used semi-structured interviews to exploit the advantages of interpretivism research. This study adopted the interpretivism paradigm since it used a qualitative technique to examine the challenges faced by teachers in grade 10 EGD classrooms. This paradigm was used to examine the challenges faced by EGD teachers through verbal interaction which is best suited for the interpretivist studies.

The interpretivist paradigm was required for this qualitative study since the goal was to employ in-person interviews to understand the EGD teachers' views about the challenges they are faced with in their classrooms.

3.4. Sampling and Population

This study conveniently sampled five EGD teachers from two schools that offered EGD. According to Stratton (2021), in convenience sampling, the researchers announce the study to participants. Researchers sometimes accomplish this through interviews, profiling participants for traits that align with the study objectives. Table 1 shows the demographic information of the participants that were used as the sample in this study.

Table 1. Participants demographics.

Schools	Name	Gender	Majors	Experience
School A	Teacher A	F	EGD and civil technology	3 years
	Teacher B	M	EGD and electrical technology	6 years
School B	Teacher C	M	Technical drawing and civil technology	22 years
	Teacher D	F	EGD and civil technology	7 years
	Teacher E	F	EGD and mechanical technology	1 year

3.5. Instruments and Analysis

Data for this study were collected through semi-structured interviews to explore the challenges faced by grade 10 EGD teachers. The participants in this study were five EGD teachers conveniently sampled from two schools offering EGD in KwaZulu-Natal. These teachers were selected based on their experience in teaching grade 10 EGD and their willingness to participate in the study. Semi-structured interviews were chosen to gather in-depth qualitative data allowing for flexibility in probing participants' views and experiences.

The data collected were analyzed using thematic analysis, a widely accepted method for analyzing qualitative data. According to Caulfield (2019) a thematic analysis involves identifying recurring patterns and trends within the data to develop meaningful themes. This study followed the six-step framework for thematic analysis as outlined by Braun and Clarke (2006): (1) familiarization with the data. (2) Generating initial codes. (3) Searching for themes. (4) Reviewing themes. (5) Defining and naming themes and (6) producing the report.

The study provides valuable insights into the challenges of teaching EGD in this foundational grade by selecting participants with direct experience in teaching grade 10 EGD and using a systematic analysis approach.

3.6. Ethical Considerations

The researchers requested approval from the KwaZulu Natal Department of Education to carry out this study because of ethical concerns. The principals of both schools were asked to utilize their institutions as the research site and to observe in the classes after permission had been secured. The relevant teachers received letters of informed consent and participated.

3.7. Institutional Review Board Statement

The Ethical Committee of the Durban University of Technology, South Africa approved this study with reference no: IREC 024/24.

4. Findings and Discussions

Data was gathered through semi-structured interviews to respond to the main research question. The main research question was structured as follows: What are the challenges faced by EGD teachers in grade 10 classrooms? The data from five teachers who participated in this study is presented below.

4.1. Presentation of Findings from Semi-Structured Interviews

Data from the semi-structured interviews was analyzed using thematic analysis and five themes emerged. Table 2 shows the emerging themes.

Table 2. Themes emerged from the findings.

Themes emerged from the findings
Theme 1: Lack of EGD classroom requirements
Theme 2: Number of challenges in grade 10 classrooms
Theme 3: Strategies and methods of teaching EGD
Theme 4: Lack of availability of ICT resources in schools
Theme 5: Content workshops

Table 2 shows five themes that were identified from the findings. These five themes will be used to present and discuss the findings of this study and how they relate to the research questions and the theoretical framework that underpinned this study.

Table 3 presents teachers’ views about the availability of resources in EGD classrooms and how it impacts teaching and learning. Teachers’ views are presented in Table 3 below.

Table 3. Lack of EGD classroom requirements.

Participants	Responses
Teacher E	“Not having EGD classroom and desks is a major challenge I have experience as I am new in the field. I had expectations that all EGD classes are the same as the one from university. Having learners who aren’t drawing while teaching because their drawing boards and drawing instruments got stolen adds to teaching challenges”.
Teacher D	“Sharing of instruments by learners causes the lesson to take long because learners are expected to follow every instruction I give and apply it. So, when sharing they are left behind with what I am teaching, and I must explain again and that’s time - consuming”.
Teacher C	“Sometimes, we run out of A3 drawing sheets and no teaching and learning takes place during that time. I end up working on Saturdays to be in line with the ATP or pacesetter. Loadshedding adds to the postponement of classes”.
Teacher B	“In my workplace, we offer 20 subjects in the FET phase and the school has been recognised as a technical school, but still there is no change in the infrastructure. There are two photocopying machines and only one that does A3 copies. If it runs out of toner when I am supposed to copy learners work, then I am forced to not teach. It is a major challenge when I am teaching perspective drawing since learners do not have workbooks”.

Teaching and learning in the grade 10 EGD classrooms are loaded with challenges that hinder the smooth daily content delivery. Table 4 presents the challenges experienced by grade 10 EGD teachers.

Table 4. Number of challenges in grade 10 classrooms.

Participants	Responses
Teacher C	“In grade 10, there are a lot of challenges because you must introduce a new subject and drawing instruments and instruct learners on how to use them. You must constantly remind learners how to use instruments sometimes you must show them on their drawing boards”.
Teacher B	“Grade 10 with the high number of learners in class, it is even hard to move around monitoring what you have taught. In my school, since there is no classroom for EGD that’s adding to the challenges”.
Teacher D	“The grade where I encountered challenges in EGD is grade 10, where three are new learners who have never done EGD. I must start afresh with some of the things and organise extra classes for them”.

Teachers were asked to share the strategies and teaching methods they use in their EGD classrooms. Table 5 presents their views about the strategies and methods they employ in the teaching and learning of EGD.

Table 5. Strategies and methods of teaching EGD.

Participants	Responses
Teacher C	“I normally use the trial and error method. I instill the drilling method so that learners would learn the skills of accuracy and drawing neatly”.
Teacher A	“I use a feedback method after marking. I give learners their papers and also give them a memorandum to see where they made mistakes and also show them how to fix them.”
Teacher D	“I use a surface approach that encourages learners to obtain more than the previous term and show them the work of other learners who obtained more marks than them. I encourage competition”.

Technologies are equipment and machines created by applying scientific understanding. These technologies are integrated into EGD classrooms to improve teaching and learning. However, most teachers experience the lack of access to ICT resources in their schools, which hinders teaching and learning of EGD. Table 6 presents EGD teachers’ responses about the lack of ICT resources in EGD classrooms.

Table 6. Lack of availability of ICT resources in schools.

Participants	Responses
Teacher D	“In my working area, there are ICT tools that the DOE brought in 2020, but the problem is that we do not have an EGD classroom. In case, I prepared a lesson that needs a projector, I must bring along my extension from home so that I can use it. The classes do not have electric sockets. They also brought the laptop with AutoCAD installed and the district has been promising an AutoCAD training workshop. I use the laptop for printing SBA tasks and moderation tools”.
Teacher E	“I am sharing the laptop with my HOD for EGD and sometimes I am scared to ask for it for lesson preparation; I only use it when printing SBA tasks and memorandums.”
Teacher C	“There are ICT tools, but I am not a digital native, with the help of my colleagues. I manage to project some of my lessons and also do printouts for learners.”
Teacher D	“There is a projector from DOE specified for EGD but was taken to be used in a computer lab for Computer Applications Technology (CAT) lessons. Occasionally, I check with the CAT teacher to use a computer lab for my lessons and for the Practical Assessment Task (PAT) for phase 1 where learners type their design brief and do their research.”

Content workshops are additional subject content knowledge provided to teachers to improve their content knowledge on a subject. These workshops are conducted by subject advisors at the district or provincial level to capacitate teachers. Teachers were asked about the development workshops they have attended to gain insight about content workshops. Their responses are articulated in Table 7.

Table 7. Content workshops.

Participants	Responses
Teacher C	<i>"We used to attend workshops on EGD content, and they were very helpful. New ideas and strategies were shared by subject specialists and discussed among teachers. After each topic we were given handouts with detailed information on a specific topic and exercise to do with learners."</i>
Teacher A	<i>"I have never attended any content workshop. We usually attend orientation at the beginning of the year and discuss the feedback from the markers and moderators."</i>
Teacher E	<i>"I have never attended any workshop. I think content workshops would be helpful since am new and I started EGD at the tertiary level".</i>
Teacher B	<i>"In our district, we do not have subjects' advisors for technical subjects. I think that is why they no longer conduct workshops".</i>
Teacher D	<i>"No, since I started teaching EGD, I have never attended a content workshop. I have seen in the other subject I am teaching that content workshops are very important. They are not just developing a teacher as an individual, but they are also contributing to learners' performance. Getting to know or learn what other teachers teach on a certain topic is what I think is a development. We are lifelong learners' new developments need to be shared".</i>

4.2. Discussion of Findings from Semi-Structured Interviews

The findings of this study revealed that the lack of essential classroom resources for EGD hinders the delivery of quality results. According to the DBE (2011) schools must comply with specific requirements for EGD classrooms to ensure efficient and productive teaching and learning. The absence of these critical resources leads to challenges such as teachers relying on outdated textbooks and struggling to implement new programs because of the lack of ICT skills and tools. Mtshali (2018) highlighted that inadequate teaching materials and insufficient skills in the subject contribute to poor learner performance in EGD.

Teachers' responses pointed to grade 10 as the root of these challenges. As EGD is introduced in grade 10, it serves as the foundation for the subject. If foundational challenges arise, they negatively impact the quality of outcomes in later grades. Branoff and Dobelis (2012) noted that challenges among grade 10 EGD learners often stem from a mismatch between teachers' teaching styles and learners' learning preferences. Similarly, Okolie and El (2014) identified that traditional teaching methods are a significant contributor to these challenges.

Some strategies and methods have helped EGD teachers maintain a 100% pass rate since the subject's introduction despite these obstacles. A surface approach which focuses on avoiding failure has been effective for some teachers. Killen and O'Toole (2023) described the surface approach where learners are motivated to achieve a passing grade without necessarily engaging deeply with the material. Teachers emphasized to learners that no one had ever failed EGD which motivated them to strive for better results. However, Biggs (2014) and Biggs, Tang and Kennedy (2022) argue that a deep approach characterized by a meaningful and engaged interaction with learning tasks is more effective in promoting long-term understanding.

The findings also highlighted the lack of ICT resources as a significant barrier to integrating technology into EGD classrooms. Four out of five teachers indicated they were familiar with technology and would utilise it if resources were available. However, the absence of ICT tools and infrastructure in schools remains a major challenge. This aligns with the findings of Munje and Jita (2020) who reported that many schools lack the necessary resources to implement ICT effectively.

In addition, the study underscored the importance of workshops in improving teachers' proficiency in EGD content. According to the teachers' responses, four out of five had never attended any EGD content-specific training since beginning their teaching careers. Teachers expressed a strong need for content workshops to enhance their confidence and competence in teaching during semi-structured interviews. Gudmundsdottir and Shulman (1987) defined PCK as the combination of content and pedagogy that is unique to teachers and critical for effective teaching. The evaluation of PCK in this study provided insights into how teachers formulated explanations, examples, demonstrations, and drawings to facilitate learning in grade 10 EGD classrooms. Although teachers showed an understanding of the content and communicated it effectively to learners, they emphasized the need for professional development opportunities to refine their skills further.

5. Conclusion

This study highlights several critical challenges impacting the teaching and learning of EGD in grade10 classrooms. The lack of essential classroom resources, including ICT tools, severely limits the ability of teachers to provide quality education and implement modern teaching strategies. Teachers face foundational challenges in grade 10, a pivotal year that lays the groundwork for learners' future performance in the subject. These challenges, if not addressed, risk undermining learner outcomes in subsequent grades.

Despite these difficulties, some strategies have proven effective in maintaining learner performance, such as motivational techniques and a focus on achieving pass rates. However, there remains a need to shift towards deeper, more meaningful engagement with the subject to foster long-term understanding and success.

Teachers' lack of professional development chances makes the problem harder because most of them are unable to attend seminars or courses that may improve their teaching methods and topic understanding. Addressing this gap is crucial to empowering teachers to deliver high-quality lessons confidently and competently.

In a nutshell, the findings underscore the urgent need for improved resource allocation, integration of ICT tools, and targeted professional development programs to address the challenges faced by teachers in grade 10 EGD classrooms. The education system can better support teachers and learners by addressing these issues at the foundational level, ultimately improving outcomes in EGD.

6. Limitations and Future Research

The study had several limitations. First, it focused on only two schools, limiting the breadth of data and insights that could have been gained from a larger sample. Including more schools in diverse regions could have provided a broader understanding of teaching and learning challenges. The study's geographical constraints and

reliance on a case study design also mean that findings are specific to the two schools and may not be fully generalizable to other contexts. In addition, time constraints may have restricted the ability to capture long-term patterns, and the qualitative methods used, although insightful, might have introduced biases or limited the depth of exploration in certain areas.

Future research should address these limitations by expanding the sample size to include schools from varied regions and contexts to enhance generalizability. Longitudinal studies are recommended to track long-term impacts of teaching strategies and interventions. Studies could also explore the integration of technology into classrooms, building on existing research about ICT in education, to assess its effects on learner performance.

Further investigations into effective teacher training programs, particularly in specialized subjects like EGD, would provide valuable insights. Quantitative methods could complement qualitative approaches to offer statistically significant findings while research into learner-centered strategies and practical skills acquisition could inform teaching practices. Addressing these gaps would provide a more comprehensive understanding of challenges and opportunities in teaching and learning, ultimately contributing to improved educational outcomes.

7. Recommendations

Based on the findings, it is recommended that principals engage with the DBE in KwaZulu-Natal before introducing new subjects like EGD. This should involve formal written requests outlining the need for the subject with its specific classroom and resource requirements. Schools should conduct comprehensive research on the curriculum, resource implications, and teacher training needs to ensure successful implementation. Collaboration with subject specialists and educational researchers can provide valuable insights into the practical and theoretical demands of EGD. Furthermore, the DBE should consider providing training workshops and resources for teachers to enhance their PCK. Schools must also establish partnerships with local industries and higher education institutions to support curriculum delivery and foster real-world application of skills. Finally, periodic evaluations should be conducted to assess the subject's impact on learners' performance and make necessary adjustments for continuous improvement.

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