Valuation of the Use of Computer Aided Design (CAD) Applications in the Teaching and Learning of Practical Subjects: A Case Study of Private Schools in Mashonaland East, Zimbabwe

Blessing Hove[1], Tendai Blessing Chigora[2*]

CAD Practitioner, St Ignatius College[1]

D&T Practitioner, Peterhouse[2]

***Corresponding Author**

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ABSTRACT

This qualitative study evaluates the use of computer-aided design (CAD) applications in the teaching and learning of practical subjects within private schools in Mashonaland East, Zimbabwe. The research was motivated by the growing need for innovative teaching methods to enhance educational outcomes in practical disciplines. The study involved six educators and six learners from selected private schools, who were purposefully chosen to provide insights into the integration of CAD technologies in their curricula. Data was gathered through semi-structured interviews, document analysis, and observations of classroom practices. The theoretical framework was grounded in constructivist principles, emphasizing the role of technology in facilitating active learning. Findings indicate that while CAD applications enhance student engagement and understanding, educators face challenges including insufficient training in software use, limited access to resources, and a lack of institutional support for technology integration. The study recommends the establishment of targeted training programs for teachers, increased investment in technological resources, and collaboration among schools to share best practices, thereby maximizing the benefits of CAD in practical subject instruction.

Keywords: Computer Aided Design, Teaching and learning, Practical subjects, Private schools**.**

INTRODUCTION

In Zimbabwe's private schools, a technological revolution is underway, driven by the transformative power of Computer-Aided Design (CAD). This digital tool has captivated educators and students, as they recognize its potential to redefine practical learning. Private schools have strategically integrated CAD into their curriculum, providing students with the essential skills and knowledge needed to thrive in the modern workforce. The teaching and learning of CAD is a multifaceted endeavour, blending theoretical knowledge with practical application, allowing students to develop critical thinking, problem-solving, creativity, and technical proficiency. To facilitate this transformation, private schools have invested in state-of-the-art computer labs, ensuring a robust learning environment. As the integration of CAD continues to shape Zimbabwe's educational landscape, the opportunities and challenges that emerge will unlock a future where practical learning is elevated, where the physical and digital realms converge, and where the young minds of Zimbabwe are empowered to shape the world of tomorrow.

BACKGROUND OF THE STUDY

The core issue lies in the lack of a clear and cohesive approach to integrating Computer-Aided Design (CAD) into the teaching and learning of practical subjects within the high school setting. While the importance of CAD knowledge and skills is widely recognized, examination boards and educational institutions have adopted divergent perspectives on the optimal way to incorporate this technology into their curricula. The contrasting approaches of the Cambridge and Zimbabwean Schools Examination Council (ZIMSEC) syllabi highlight the need for a more standardized international framework to ensure high school graduates possess the necessary CAD proficiencies to thrive in an increasingly technology-driven world. These divergent perspectives emphasize the need for a more standardized approach to CAD integration in the teaching and learning of practical subjects at the international level, driven by the understanding that the perceived value of CAD and its implementation will have a direct impact on the preparedness of students entering the workforce or pursuing further studies in design-related fields.

Main Research Question

How can the opportunities and challenges associated with incorporating Computer-Aided Design (CAD) applications be leveraged to enhance the teaching and learning of practical subjects within the context of private schools?

Theoretical Framework

The theories which will guide this study will be Situated Learning Theory (SLT) and the Constructivism Theory of Design (CTD).

Situated Learning theory (SLT)

The Situated Learning Theory (SLT), pioneered by Jean Lave and Etienne Wenger in the 1990s, emphasizes the importance of social interactions and context in the learning process (Lave & Wenger, 1991). Their concept of "communities of practice" revolutionized the understanding of learning as a holistic process involving observation, imitation, collaboration, and reflection (Binti & Besar, 2018). The integration of SLT into Computer-Aided Design (CAD) education can have a transformative impact, particularly in Zimbabwe's private school landscape, as it can engage students more meaningfully with CAD software, develop essential skills, and foster a deeper sense of identity, belonging, and mastery within the CAD community (Pengiran & Besar, 2018). However, the implementation of SLT in CAD education within Zimbabwe's private schools faces challenges, such as limited access to technology, disparities in infrastructure, and cultural differences (Binti & Besar, 2018). To overcome these obstacles, strategies like leveraging community-based learning and integrating digital technologies can be employed (O'Brien & Battista, 2020). Furthermore, the integration of Situated Learning Theory in CAD education can have far-reaching implications for the broader community, as students engage in authentic, contextually relevant projects that contribute to the local ecosystem, address real-world challenges, and drive sustainable development, strengthening the connection between the private school and the community.

Constructivism theory of design (CTD)

The theory of constructivism in design has been a transformative force, shaping the way we conceptualize and interact with the built environment (Yoders, 2014). At the heart of constructivism lies the fundamental belief that knowledge is not a passive acquisition, but rather an active process of construction, where individuals are dynamic agents, shaping their understanding through direct engagement with their surroundings (Smith, 2015). This revolutionary perspective, traced back to influential philosophers like John Dewey, challenges the traditional top-down approach in design, where designers are envisioned as facilitators, providing tools, resources, and opportunities for users to actively construct their own meaning and understanding, (Vaughan, 2018). One powerful example of a constructivist approach in design is parametric design, which allows users to manipulate various parameters, exploring different design possibilities and observing the effects of their changes, encouraging active engagement and the construction of understanding, (Eltaweel & Yuehong, 2017). As the theory of constructivism continues to evolve, its influence can be seen across an ever-widening spectrum of disciplines, and the future holds exciting possibilities as we continue to explore the boundless potential of active, user-centric design.

Attributes that enhance effective teaching and learning of CAD

a. Availability of Resources and Infrastructure

The effectiveness of Computer-Aided Design (CAD) education is closely tied to the availability of robust

resources and state-of-the-art infrastructure ,(Dube et al., 2018), and for private schools aspiring to deliver a transformative CAD experience, the strategic investment in well-equipped computer laboratories and cutting-edge software and hardware is a crucial step, housing powerful workstations with the processing power and graphics capabilities necessary to handle modern CAD applications, (Martinek & Villányi, 2015), and integrating specialized peripherals, such as 3D printers and scanners, to enable students to seamlessly transition from the digital realm to the physical world, further enhanced by a digital infrastructure that connects the laboratory, empowering students to explore online resources, stay informed about industry trends, and collaborate with their peers on projects, (Lin, 2019), cultivating a mindset of innovation, problem-solving, and adaptability – qualities in high demand within the ever-evolving design landscape, and demonstrating an unwavering commitment to providing their students with a truly transformative CAD education, preparing them for the realities of the professional world and positioning them as trailblazers in the field of computer-aided design.

b. Teacher Competence and Professional Development

The competence and expertise of teachers emerge as a pivotal factor in ensuring the effectiveness of teaching and learning in CAD education, (Verner & Merksamer, 2015). While also maintaining proficiency in the use of CAD software to effectively demonstrate and guide students through the design process, which is sustained through continuous training programs, workshops, and seminars to keep educators abreast of the latest advancements in CAD technology, (Hahlani et al., 2023). Empowering teachers with the knowledge, skills, and confidence to navigate the ever-evolving world of CAD, leading to the development of innovative teaching methodologies and transforming lessons from passive lectures to dynamic, hands-on explorations, demonstrating a steadfast commitment to nurturing the next generation of design pioneers (Hahlani et al., 2023).

c. Student Engagement and Motivation

In the dynamic realm of Computer-Aided Design (CAD) education, engaging students actively in the learning process emerges as a crucial factor in ensuring its effectiveness (Chao et al., 2015), and private schools aspiring to cultivate a thriving CAD program must recognize the transformative power of captivating and motivating their learners, guiding them on a journey of exploration and discovery through hands-on activities and experiential learning that spark and sustain student engagement (Dasgupta et al., 2021), where teachers tap into their inherent creativity and problem-solving abilities to ignite a genuine passion for CAD, further enhanced by the power of collaborative learning through group projects and design competitions that foster a spirit of camaraderie and teamwork, providing invaluable opportunities for students to develop crucial communication, critical thinking, and decision-making skills (Chao et al., 2015), positioning learners to thrive in the ever-evolving landscape of the 21st-century workforce where adaptability and innovation are highly coveted, as private schools that embrace this ethos of active student engagement will not only reap the rewards of exceptional student outcomes but also position themselves as beacons of educational excellence in the field of computer-aided design, (Lin, 2019).

d. Integration into the Curriculum

Integrating Computer-Aided Design (CAD) into the curriculum can be a powerful tool for enhancing effective teaching and learning, particularly in private schools. Practical subjects like Design and Technology, Art, Technical Graphics, or Wood Science, schools can unlock a wealth of benefits for their students by incorporating CAD as a core component in the syllabi. One of the key advantages of this integration is the way it aligns with the overall learning objectives of these subjects. Rather than being a mere add-on, CAD becomes an integral part of the coursework, allowing learners to develop a deeper understanding of the subject matter and apply their CAD skills in real-world contexts, (Ranger & Mantzavinou, 2018). Imagine a design and technology class where students are not only learning the principles of product design but also bringing their ideas to life through the use of CAD software. They can experiment with different materials, explore intricate details, and refine their designs with the precision and flexibility that CAD tools provide. This hands-on experience not only enhances their technical skills but also fosters their creativity and problem-solving abilities, (Range, 2018).

LITERATURE REVIEW

This study investigates the implementation of computer-aided design (CAD) applications in the teaching of practical subjects in private schools in Mashonaland East, Zimbabwe. The primary aim is to assess how CAD tools can enhance educational practices and improve student outcomes in technical disciplines. The research is particularly relevant in the context of increasing technological integration in educational curricula, which is crucial for preparing students for modern workforce demands (Ning et al., 2015).

The authors conducted a thorough review of relevant literature to identify strategies that support the effective use of CAD in classrooms. This aligns with the study's objective of understanding the value that CAD may bring in the field of practical subjects. The findings reveal that while CAD applications have the potential to deepen student engagement and comprehension, several obstacles hinder their effective integration. Educators report facing challenges such as inadequate training and limited access to necessary resources (DuFour & Reeves, 2016). This highlights a critical gap, as proper CAD implementation requires strong funding for accessibility of hardware and software. In support of this, (Musekiwa & Musakwa, 2020), alluded that the effective integration of Computer-Aided Design (CAD) software into the practical education realm requires a strong foundation of appropriate infrastructure. Similarly, Ndlovu & Moyo, (2018), has to say “The integration of Computer-Aided Design (CAD) software into modern education has emerged as a transformative catalyst, yet the substantial cost of acquiring and maintaining these digital tools poses a significant challenge for many educational institutions”. The other crucial dimensions was raised by (Breivik, 2014) who also elucidated that, Integrating CAD technology into the curriculum requires thoughtful instructional strategies that blend real-world applications, project-based learning, and design challenges, allowing students to engage in both physical and virtual design experiences.

Furthermore, it is abundantly clear that comprehensive training in CAD for teachers is crucial, as they are the key to unleashing the full potential of this transformative technology in the classroom. Kim & Lee (2018), in this vein alluded that, for educators to create meaningful learning experiences that enhance students' understanding and equip them with valuable technical and problem-solving skills they require a deep understanding of both the technical aspects of CAD and the core concepts of the practical subject being taught. Chigora & Manokore (2024) also underpin the significance of CAD in practical subject instruction, especially in project based learning (PBL), where they submit that the use of CAD software, 3D printing, and other digital tools can help learners visualise their designs, prototype their ideas, and gain a better understanding of the manufacturing process prior to fabrication. Therefore, without adequate training, teachers may struggle to effectively demonstrate the capabilities of CAD software which is a direct hinder to the potential of a meaningful integration.

Migratory Strategies in Implementing CAD in High School Classrooms

The integration of CAD in the teaching and learning of practical subjects can have a significant impact on student's long-term career development. Therefore, by exposing students to CAD technology early, they can develop valuable skills and knowledge that will be highly sought after in various industries (Mohd Salleh et al., 2015). This can open avenues for career opportunities for students, from engineering and architecture to industrial design and product development. Furthermore, CAD applications in the classroom can foster critical thinking, problem-solving, and creative skills, which are highly valued in the job market.

Pilot Initiatives for Teacher Education

Effective implementation of CAD in the teaching and learning of practical subjects requires a strong emphasis on teacher education. Hahlani et al., (2023) also emphasise that pilot initiatives that provide comprehensive

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training and support for teachers can be instrumental in ensuring the successful integration of CAD in the classroom. These initiatives can include workshops, hands-on training sessions, and ongoing professional development opportunities to help teachers develop the necessary skills and knowledge to apply CAD technology in their instruction.

Establish Inter-School Partnerships

Establishing inter-school partnerships can be a valuable strategy in the implementation of CAD in the teaching and learning of practical subjects. In collaboration with other schools, teachers can help share best practices, resources, and insights, which can assist in streamlining the integration process and ensure a more consistent and effective approach across different educational institutions (Mohd Salleh et al., 2015). Inter-school partnerships can also facilitate the sharing of equipment, software, and expertise, which can be particularly beneficial for schools with limited resources.

Continuous Evaluation and Feedback

Ongoing evaluation and feedback are essential for the successful integration of CAD in the teaching and learning of practical subjects. Regular assessments of student learning outcomes, teacher satisfaction, and overall program effectiveness can help to identify areas for improvement and inform future iterations of the CAD integration process (Mohd Salleh et al., 2015). This continuous feedback loop can ensure that the implementation of CAD remains relevant, effective, and responsive to the evolving needs of students and teachers.

Fostering Collaboration and Interdisciplinary Approaches

The integration of CAD in the teaching and learning of practical subjects can also foster collaboration and interdisciplinary approaches. By encouraging students to work on cross-disciplinary projects that involve CAD, educators can promote the development of teamwork, communication, and problem-solving skills (Hahlani et al., 2023). This collaborative approach can also facilitate the sharing of knowledge and expertise across different subject areas, leading to a more holistic and integrated understanding of the practical applications of CAD.

METHODOLOGY

This paper adopted qualitative research, critiquing, comparing and contrasting related literature and face to face interview of randomly sampled six Design and Technology teachers and six students. Three teachers have CAD currently running in their curriculum with their three learners whilst the other three don’t have. The study aimed to see the value which CAD may bring in the teaching and learning of practical subjects hence it involved students and teachers perspectives.

FINDINGS

The reviewed literature indicates that continuous skill enhancement for teachers is vital in our rapidly evolving technological landscape. As learners adapt to new approaches in education, they are often inundated with vast amounts of information that must be processed thoughtfully. In this context, the integration of computer-aided design (CAD) applications in practical subjects has shown promising potential. Students express enthusiasm for using CAD, finding it an engaging tool that enhances their learning experiences. However, while teachers recognize the benefits that CAD can bring to their instruction, many are uncertain about the most effective ways to incorporate it into their teaching practices. This lack of clarity can hinder their ability to fully leverage CAD's capabilities. Additionally, teachers from schools that do not currently use CAD are aware of its advantages but face significant barriers, primarily due to financial constraints that prevent their institutions from adopting this technology.

Interestingly, some students have encountered CAD applications at home and appreciate the advantages they offer, yet their schools do not provide access to these tools. This disconnect highlights the necessity for professional learning communities (PLCs) that can support teachers in developing strategies to integrate CAD effectively into their curricula. By fostering collaboration and shared learning, educators can better guide

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students in harnessing the full potential of CAD, ultimately enriching the teaching and learning experience in practical subjects.

Experiences of Teachers and Students on CAD as part of their curriculum

In terms of effectiveness teacher A1 had this to say, *"The societal expectations and the changing nature of design practices have compelled us to embrace CAD technologies in our curriculum. Our students recognize the value of these tools and are eager to develop proficiency in their use, we have changed the way we used to do our projects because of CAD."* Teacher A3, in support of teacher AI submits that, when he first started incorporating CAD into his classes, it was not necessarily his preferred choice, but the demands from students and the industry, highlighted a gap that could not see.

On the student side, student B1 alluded that "*The environment in which we are exposed because of CAD in class is increasingly becoming digital and interesting, the ability to effectively utilize CAD tools has become a crucial skill for our future success, here CAD came at the right time and moment."* And student B2 has also to say, *"I find the CAD interface and workflow to be intuitive and satisfying to use. The level of detail and realism I achieve when creating 3Ds is truly impressive, and it makes the design process feel much more interactive and dynamic compared to traditional methods."* The general feel of the sampled group indicates that both students and teachers wholeheartedly acknowledge the powerful impact of CAD in practical subjects, celebrating its ability to transform learning and elevate the design process to new heights.

In terms of primary benefits Teacher A1 has to say, *"CAD has undoubtedly transformed the learning experience and ignited a genuine passion among our students, it has brought less work to our students and also provided them a platform to visualise as they design".* Similarly, student B3 shared the same view highlighting that CAD has revolutionized the way he engage with practical subjects. The interactive, visually stunning environment has made complex concepts so much more accessible and enjoyable to learn. These insights clearly illustrate that CAD not only enhances engagement and accessibility in practical subjects but also fosters a deeper passion for learning among students.

Participants also raise the extent to which CAD has improved learning outcomes in practical subjects with Teacher A1 had this to say, "*With the integration of CAD applications, we have witnessed a remarkable transformation in the design process among our students. Tasks that would have traditionally taken weeks to complete can now be accomplished in a matter of days, as the software streamlines the workflow and enables our students to rapidly iterate and refine their designs. The quality of the drawings and designs produced by our students has reached unprecedented levels, often matching the standards and expectations set by industry professionals. CAD applications have provided the tools and resources necessary for our students to develop highly polished, technically accurate, and visually appealing outputs "* Student B3 agrees with teacher A1's observation and had this to said, *"I'm amazed by the level of sophistication and polish I'm able to achieve in my designs using CAD. The tools and features provided by these applications have enabled me to create drawings and models that rival the quality of industry-standard work, something that would have been unimaginable just a few years ago. "*

In terms of challenges encountered in the use of CAD, Teacher A2 had this to say, *"The exorbitant licensing costs associated with CAD software have put a significant strain on our limited educational budget, forcing us to make difficult choices about which programs we can realistically afford to implement across our practical subject lessons. Also, the time-consuming nature of mastering CAD tools, coupled with the intricate design tasks, often leaves our students struggling to maintain their focus and engagement, especially when faced with the fast-paced expectations of our curriculum."*

Student B3 has also to say, *"The over-reliance on CAD applications in our practical lessons has made it increasingly difficult for me to develop a well-rounded skill set, as I find myself spending more time trying to navigate the software than actually applying the core concepts and principles of the subject matter."*

Experiences of Teachers and Students on schools that are not offering CAD

In terms of familiarity teacher C1 had to say, *"As teachers, we have been exposed to CAD applications during* *our college and university studies, but we lack the specific knowledge and pedagogical training to effectively incorporate these tools into our practical subject teaching and learning activities. And while we recognize the potential benefits of CAD in enhancing student understanding and skill development in our practical subject areas, we are unsure of the best practices and strategies for seamlessly integration of these design applications into our existing curriculum and instructional approaches."* Student D9 also said, *"Two of my friends have mentioned that their parents use CAD software for their work, but I've never had the chance to try it out myself."* And Student D8, *"My parents use some CAD software at their jobs, but I've never had the opportunity to learn or work with those tools myself. To be honest what I see from their work is amazing."* These insights indicate that both teachers and students are keenly aware of the immense potential CAD holds for enhancing learning and skill development, even as they seek greater opportunities for engagement with the technology.

On the other hand, in terms of how they perceive the value of using CAD applications Teacher C3 said, *"While our students may not have much prior exposure to CAD, I believe integrating these design tools into our practical subject curriculum could open up a world of possibilities.'*' Teacher C2 posit that: *"As teachers, we recognize the immense potential that CAD applications have in enhancing the teaching and learning of our practical subject areas."* Similarly student D7 said "*I don't have much experience with CAD applications, but I've heard they can be really powerful for creating detailed models and visualizations.'*' These perspectives reflect a shared recognition among both teachers and students of the transformative potential that CAD applications offer for enriching the teaching and learning of practical subjects.

DISCUSSION OF FINDINGS

The findings highlight the transformative impact of computer-aided design (CAD) applications in the teaching and learning of practical subjects. In schools that have integrated CAD into their curriculum, there is a palpable enthusiasm surrounding its effectiveness. The shift to digital tools has not only modernized project execution but also fostered a deeper engagement among students, making complex concepts more accessible and enjoyable. The primary benefits of CAD are evident in the enhanced learning experiences it provides. It streamlines the design process, allowing students to produce high-quality, industry-standard work in significantly less time than traditional methods would allow. This efficiency, paired with the interactive nature of CAD, has sparked a genuine passion for learning, prompting students to explore practical subjects with renewed interest.

However, challenges remain, particularly regarding the financial implications of CAD implementation. High licensing costs and the time required to master these tools can strain educational resources and affect student engagement. Additionally, an over-reliance on CAD may hinder the development of well-rounded skill sets, as students can find themselves focusing more on software navigation than on fundamental design principles. In contrast, schools without CAD applications illustrate a different scenario where both educators and students recognize the potential benefits of these tools. Despite limited exposure, there is a strong desire for engagement with CAD, indicating a keen awareness of its capacity to enhance learning and skill development.

Overall, the findings underscore the necessity for thoughtful integration of CAD in practical subjects. Addressing the barriers of funding and training will be crucial in unlocking the full benefits of CAD, ultimately enriching both teaching practices and student outcomes. The collective recognition of CAD's potential presents an opportunity for educational institutions to innovate and adapt in a rapidly evolving technological landscape.

Migratory Strategies in Implementing CAD

Cheng, (2017) underscore that implementing CAD in high school classrooms can be a complex and challenging process, as it requires the integration of technology, curriculum, and teaching strategies. This is primarily because of the nature of training and infrastructure required. However, one migratory strategy that can be employed is a gradual and phased approach to the integration of CAD. The first phase strategy involves the introduction of CAD software and basic training for both teachers and students. This phase can include workshops, tutorials, and hands-on activities to familiarise the users with the software and its functionalities. During this phase, it is essential to ensure that the selected CAD software is user-friendly and accessible to both teachers and students. This means that the CAD applications can include AutoCAD, Inventor, Revit, Maya, just

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to mention a few.

The second phase involves the integration of CAD into the existing curriculum. This bond well with Sorby's (2009) observation that an innovation into the existing curriculum must blend into the existing one to avoid discord. This can be done by identifying specific topics or projects within the practical subjects that can benefit from the use of CAD. Teachers can then develop lesson plans and activities that incorporate CAD software and align with the learning objectives of the course.

The third phase focuses on the continuous professional development of teachers. As technology evolves, it is crucial for teachers to stay up-to-date with the latest developments in CAD software and teaching strategies. This can be achieved through ongoing training, workshops, and collaboration with other educators who have successfully implemented CAD in their classrooms.

The fourth and final phase involves the evaluation and refinement of the CAD integration process (Cheng, 2017). This phase involves assessing the effectiveness of the CAD implementation, gathering feedback from students and teachers, and making necessary adjustments to the curriculum, teaching strategies, and software selection.

Challenges and Considerations

While the integration of CAD in the teaching and learning of practical subjects can be highly beneficial, there are also several challenges and considerations that must be addressed. One of the primary challenges is the cost associated with the acquisition and maintenance of CAD software and hardware (Cheng, 2017). High-quality CAD software can be expensive, and schools may need to invest in specialised computer hardware to support its use. Additionally, ongoing software updates and maintenance can add to the financial burden. Another challenge is the need for comprehensive teacher training and professional development. Effective implementation of CAD in the classroom requires teachers to have a strong understanding of the software, as well as the pedagogical strategies to integrate it effectively into their teaching practices.

Finally, the integration of CAD may require changes to the existing curriculum and assessment methods (Dutta & Burgess, 2003). Teachers may need to adapt their lesson plans, learning activities, and assessment criteria to align with the use of CAD software, which can be a time-consuming and complex process.

CONCLUSION

The study highlights how computer-aided design (CAD) applications can be a game-changer in practical subject education. Educators extol CAD's ability to foster active student participation and skill development, transforming classrooms into engaging spaces. Students, both experienced and novice, express enthusiasm for CAD's empowering impact on their learning. However, the study also underscores the crucial role of teacher expertise and the education policy framework in ensuring seamless CAD integration. Educators emphasize the need for comprehensive training and curricular inclusion of CAD, along with the development of customized educational software. The education policy framework must also evolve to clearly delineate the role of CAD and ensure robust implementation, including resource allocation and support services. Notably, students express a desire for a level playing field, where CAD is equally accessible, ensuring that it becomes a unifying tool rather than a divisive one.

RECOMMENDATIONS

The following recommendations are made as a result of this study:

1. Teachers to incorporate CAD applications into the curriculum for practical subjects, ensuring that they are formally recognized and integrated into the teaching and learning process.

2. Schools to provide comprehensive training and professional development opportunities for teachers to enhance their expertise in utilizing CAD applications and integrating them effectively into their teaching practices.

3. Schools, examining boards and teachers to collaborate with software developers and research institutions to create educational software that is specifically tailored to the needs of practical subject learning, incorporating features such as assistive technologies and personalized learning pathways.

4. Examining boards to adapt examination and assessment practices to include the use of CAD applications, recognizing and evaluating the skills and knowledge acquired by students through their utilization of these tools.

5. Schools to ensure adequate resource allocation for the procurement and maintenance of CAD software and hardware, as well as the necessary infrastructure to support its implementation in classrooms.

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