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Adoption of CAD Tools Among Nigerian Engineering Students: Trends, Challenges, and Opportunities

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Abstract: *This study aimed to investigate the adoption of Computer-Aided Design (CAD) tools among engineering students in Nigerian institutions, focusing on trends, challenges, and opportunities. A survey of 101 students from three institutions revealed that while CAD tools are perceived as highly important for future careers, access and training remain significant barriers. Key findings include the predominance of university lab usage (62.4%), limited proficiency among beginners (41.6%), and course requirements as the primary motivator for learning (54.5%). The study highlights the need for improved institutional training and infrastructure to bridge the gap between CAD education and industry demands.*

Keywords— CAD tools; engineering education; Nigeria; student proficiency; training challenges

1. INTRODUCTION

Computer-Aided Design (CAD) software is now a key part of modern engineering education and industrial design. With this digital software, students and professionals can create, model, simulate, and visualize complex systems with high accuracy and ease [1]. Today, where technology is dominant, knowing how to use CAD software is often necessary for engineering graduates who want jobs or further education. As industries increasingly rely on digital prototypes and models, being skilled with CAD tools is essential for driving innovation and boosting productivity [2].

While CAD tools are used in engineering programs in developed countries, their use among university students in developing countries, like Nigeria, is inconsistent and not well studied. Many engineering schools include CAD training in their curriculum, but lack the necessary infrastructure, trained staff, or updated software to facilitate effective learning. This gap hampers students' readiness for industry demands and limits their exposure to practical applications of CAD technologies. This study explores the trends, challenges, and opportunities related to CAD tool usage among undergraduate and postgraduate engineering students at selected universities in Nigeria. It specifically looks at how often students use CAD tools, the level of support they get from their institutions, the difficulties they encounter during learning and application, and how relevant they believe these tools are for their academic and professional futures [3].

The research involved an online survey distributed through Google Forms to over 100 participants from three major institutions: Imo State University, Owerri; Federal University of Technology, Owerri; and Federal Polytechnic, Nekede. The data collected offers valuable insights into students' views on software availability, training effectiveness, usability issues, and awareness of job opportunities linked to CAD skills. Understanding how students in Nigeria use CAD tools can inform policy decisions, enhance curriculum development, and guide institutional investments in tech-based learning. Furthermore, recognizing common challenges, such as limited access, insufficient training, and complicated software, can help educators and policymakers develop targeted strategies to improve student engagement and skills in CAD technologies [4].

This paper contributes to ongoing discussions about technological literacy, skill development, and workforce readiness in developing economies. It highlights current issues related to CAD in engineering education and the potential for growth. It emphasizes the need to connect academic training with industry requirements to ensure that engineering graduates are well prepared for success in a rapidly evolving digital landscape.

2. METHODOLOGY

2.1 Study Design

A cross-sectional survey was conducted using Google Forms to gather data from engineering students across three Nigerian institutions: Imo State University, Owerri; Federal University of Technology, Owerri; and Federal Polytechnic, Nekede. The survey included questions on demographics, CAD tool usage, proficiency, motivations, challenges, and perceptions of institutional training.

2.2 Sample Size and Demographics

The study involved 101 respondents, comprising undergraduate and postgraduate students from various engineering fields. The demographic breakdown is as follows:

- University Distribution:

- Imo State University, Owerri: 52.5%
- Federal University of Technology, Owerri: 41.6%
- Federal Polytechnic, Nekede: 5.9%

- Level of Study:
  - Undergraduate (100–200 level): 65.3%
  - Undergraduate (300–500 level): 11.9%
  - Postgraduate: 22.8%
- Field of Study:
  - Mechanical Engineering: 55.4%
  - Electrical/Electronics Engineering: 17.9%
  - Civil Engineering: 14.9%
  - Other fields: 11.9%

2.3 Data Collection and Analysis

Data were collected over a period of two weeks. Descriptive statistics were used to analyze responses, and charts were generated to visualize trends and patterns.

3. RESULTS

3.1 CAD Tools Used

The most commonly used CAD tools were:

- AutoCAD: 77.2% (n = 78)
- Fusion 360: 47.5% (n = 48)
- SolidWorks: 11.9% (n = 12)
- Other tools: CATIA (1%), Revit (5%), SketchUp (3%), Inventor (2%)

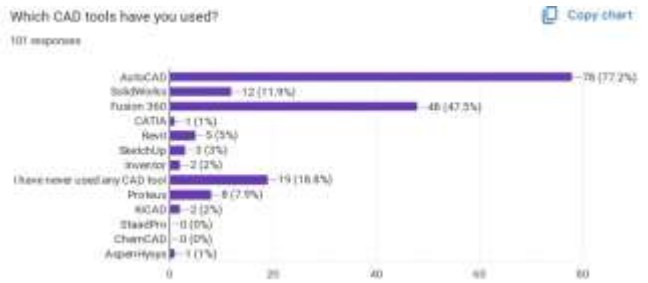

Fig. 1. *CAD tools used by surveyed students*

3.2 Importance of CAD Tools

When asked about the importance of CAD tools for their future careers, the majority of respondents (64%, n = 64) rated CAD tools as highly important (score of 5 on a scale of 1–5). Only 5.9% (n = 6) considered them unimportant (score of 1).

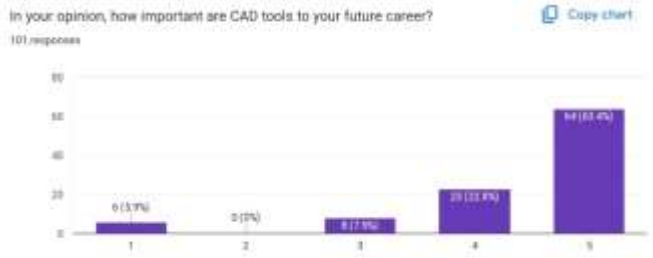

Fig. 2. *Career importance of CAD tools.*

3.3 Usage Frequency

The frequency of CAD tool usage varied significantly among respondents:

- Daily: 36.6% (n = 37)
- Weekly: 27.7% (n = 28)
- Monthly: 14.9% (n = 15)
- Rarely: 16.8% (n = 17)
- Never: 3.9% (n = 4)

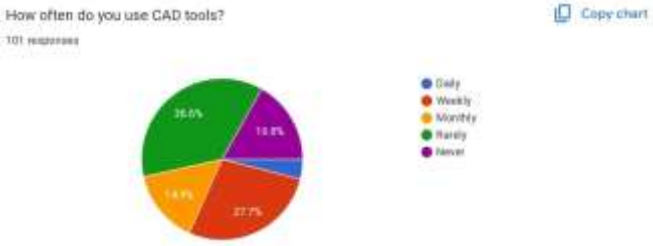

Fig. 3. *Career importance of CAD tools.*

3.4 Primary Access to CAD Tools

Respondents primarily accessed CAD tools through:

- Personal laptop: 62.4% (n = 63)
- University lab: 23.8% (n = 24)
- Online/Cloud-based platforms: 8.9% (n = 9)
- No access: 4.9% (n = 5)

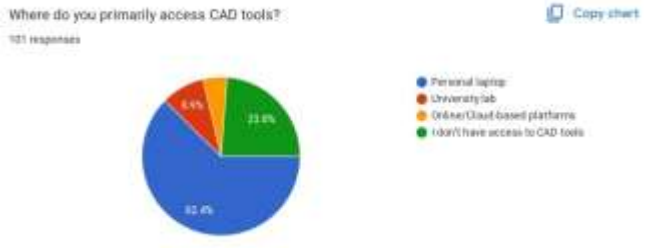

Fig. 4. *Access platforms.*

3.5 Proficiency Levels in Using CAD Tools

The proficiency levels of respondents were distributed as follows:

- Beginner: 41.6% (n = 42)

- Intermediate: 32.7% (n = 33)
- Advanced: 15.8% (n = 16)
- Expert: 8.9% (n = 9)
- Never used a CAD tool: 0.9% (n = 1)

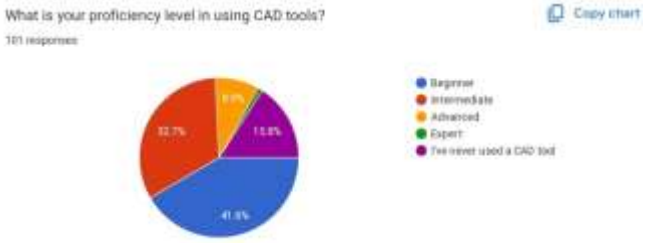

Fig. 5. *Proficiency levels.*

3.6 Motivations for Learning CAD Tools

The primary motivations for learning CAD tools were:

- Course requirement: 54.5% (n = 55)
- Personal interest: 45.5% (n = 46)
- Internship/job requirement: 21.8% (n = 22)
- Peer influence: 10.9% (n = 11)
- Online tutorials: 10.9% (n = 11)
- Faculty encouragement: 22.8% (n = 23)

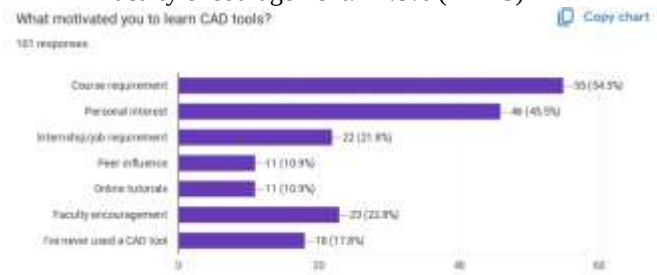

Fig. 6. *Motivations for learning CAD.*

3.7 Challenges in Learning or Using CAD Tools

The most significant challenges reported were:

- Limited training/guidance: 51.5% (n = 52)
- Lack of access to software: 27.7% (n = 28)
- High hardware requirements: 20.8% (n = 21)
- Complex user interface: 12.9% (n = 13)
- Lack of time: 22.8% (n = 23)

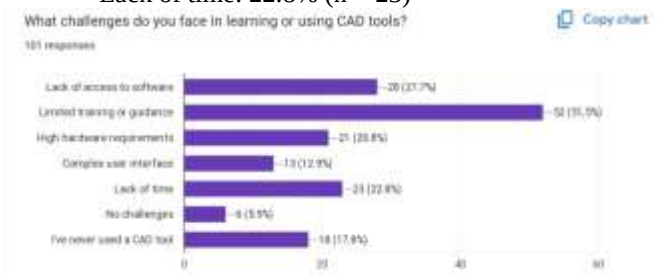

Fig. 7. *Challenges in Learning or Using CAD Tools*

3.8 Effectiveness of Institutional CAD Training

The perceived effectiveness of CAD training provided by institutions was rated as follows:

- Very ineffective (1): 19.8% (n = 20)
- Ineffective (2): 29.7% (n = 30)
- Neutral (3): 19.8% (n = 20)
- Effective (4): 12.9% (n = 13)
- Very effective (5): 17.8% (n = 18)

Fig. 8. *Effectiveness of Institutional CAD Training.*

3.9 Awareness of income opportunities through CAD

52.5% knew peers earning through CAD skills, suggesting untapped opportunities

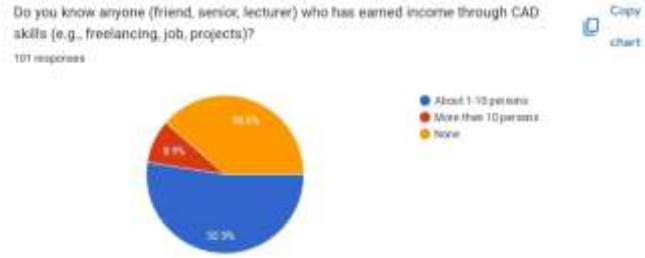

Fig. 8. *Awareness of income opportunities.*

4. DISCUSSION

The findings of the research shed light on how Nigerian university students are currently making use of CAD tools. Based on the findings, while students are cognizant of the applications of CAD tools in shaping their studies and future careers, there is a huge disparity between practice and awareness. This disparity is due to several connected problems, including limited access to software, poor training in institutions, and the complexity of the interface of CAD.

A major conclusion is that more than half of the respondents placed themselves at beginner or intermediate levels when it comes to CAD competency. What this means is that even though many students are familiar with CAD tools during their period of study, learning is not necessarily profound. The minimal percentage that views themselves as advanced or expert-level users indicates a lack of frequent, structured practice with the tools.

In terms of usage rate, about one-third of the participants reported daily usage, which is remarkable. Yet, near half the

participants utilize them weekly or less often. That means they touch CAD tools occasionally, mostly due to coursework requirements and not necessarily interest or a habit of frequent usage. This occasional usage may shortchange them in terms of mastering and feeling comfortable handling complex design work.

Availability of CAD software remains a big obstacle. While many students only use personal laptops to utilize CAD facilities, a significant majority responded that they had limited or no access through university facilities. This is a sign of infrastructural inadequacies in universities, especially in public institutions where financial constraints inhibit provision of modern software and hardware.

Effectiveness of training was also a critical issue. More than half of the participants found institutional CAD training to be ineffective or very ineffective. This underlines the necessity for reviewing existing teaching approaches, course materials, and instructor preparedness in presenting CAD-based instruction. Lacking guidance, students rely excessively on self-directed learning, which is not always sufficient or trustworthy.

In a surprising turn of events, even though the majority of students recognized the applicability of CAD tools in various industries, few understood income-related opportunities associated with CAD competencies. This suggests inadequate exposure to entrepreneurial ventures such as freelance design work, product modeling, and virtual prototyping where CAD competencies can translate into tangible financial remunerations.

5. CONCLUSION AND RECOMMENDATION

This study has revealed that while Nigerian engineering students as a whole value the contribution of CAD tools to their fields, several barriers deter successful implementation and application. Some of these obstacles include insubstantial access to software, insufficient training, high system requirements, and low familiarity with career opportunities associated with CAD skills.

In order to alleviate these obstacles and promote greater integration of CAD tools into engineering education, the following are suggested:
Better Institutional Support: The institutions can invest in newer CAD software packages and provide them in computer labs. Subscription plans or open-source versions can be considered so that expenses are kept to a minimum.

Curriculum Integration: CAD training should be incorporated systematically into the curriculum at all levels of study with sequential modules specific to respective engineering disciplines.

Faculty Development: Periodic training should be given to the teachers to familiarize them with evolving CAD technology and pedagogy. Class room teaching can also be improved by interaction with industry professionals.

Peer Learning Promotion: Peer mentoring and workshops organized by the students should be encouraged to create a collaborative learning environment and aid memory retention.

Career Prospects Awareness: Seminars and outreach programs must be organized by institutions alerting students to freelance, internship, and entrepreneurial opportunities in CAD design.

Hardware Upgrades: Computers in the laboratories must be upgraded so that they are equipped with minimum hardware configurations for effective performance of CAD software.

By bridging such gaps, Nigerian universities are better positioned to prepare engineering students for the digital needs of today's job market and help develop a technologically capable workforce.

6. REFERENCES

[1] M. Koziar, H. Hubal, I. Burchak, M. Botviniev, and D. Saveliev, “The impact of CAD software on the teaching of engineering graphics: a systematic review,” *Periodicals of Engineering and Natural Sciences (PEN)*, vol. 13, no. 1, pp. 17–39, Mar. 2025, doi: 10.21533/pen.v13.i1.278.

[2] S. Şeker, “Computer - aided learning in engineering education,” *Procedia - Social and Behavioral Sciences*, vol. 83, pp. 739–742, Jul. 2013, doi: 10.1016/j.sbspro.2013.06.139.

[3] J. J. Maina, “Barriers to effective use of CAD and BIM in architecture education in Nigeria,” *International Journal of Built Environment and Sustainability*, vol. 5, no. 3, Sep. 2018, doi: 10.11113/ijbes.v5.n3.275.

[4] J. Singh *et al.*, “Using machine learning to predict engineering technology students’ success with computer-aided design,” *Computer Applications in Engineering Education*, vol. 30, no. 3, pp. 852–862, Jan. 2022, doi: 10.1002/cae.22489.