



Factors Contributing to the Erosion of Freehand Sketching Competence in Technology Education: A Case Study of Bayero University, Kano

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Abstract

Many undergraduate students in the Department of Technology Education at Bayero University, Kano, exhibit reluctance toward answering sketch-based questions, potentially hindering their engagement and understanding in subjects requiring visual representation. This study explores the underlying causes of this trend, focusing on factors such as self-perceived confidence in sketching abilities, clarity of instructional guidance, perceived relevance to learning outcomes, and fear of peer or instructor judgment. A structured survey questionnaire was administered to 147 technology education undergraduates using a random sampling method. The study reveals that insufficient practice, time constraints, and inadequate instructional support are the primary contributors to declining sketching proficiency. Findings suggest that integrating regular hand sketching exercises into the curriculum, providing timely and constructive feedback, and fostering an encouraging classroom environment can enhance students' willingness to engage visually. These interventions may ultimately improve both academic performance and creative problem-solving skills in technology-related disciplines. The study emphasises the importance of reinforcing foundational visual communication skills in contemporary technology education programs.

Keywords: Freehand sketch, competence, technology, education, visual communication.

1.0 Introduction

A sketch serves as a simple tool to communicate ideas and visualise concepts. It's an informal visual representation which helps convey complex ideas simply and understandably. Sketching is often used in the early stages of design to brainstorm, reiterate and visualise ideas before drafting fully detailed technical drawings [1]. Competency was described [2] as a concept with components that include skills, knowledge, and attitude related to a specific cluster. In this context, sketching competency comprises the capacity to quickly and accurately create visual representations of technical concepts, things, or systems by hand that are clear, communicative, and spatially precise. Sketching competency is essential in technology education, especially for visualisation and conceptualisation. It acts as a fundamental tool that helps students transform abstract ideas into concrete forms, thereby enhancing their understanding of complex technological concepts. Sketching helps students visualise their ideas, improving their understanding of complex systems. It boosts spatial reasoning and allows for exploring different design options. As highlighted [3], sketching is vital in design, thinking, connecting hands and minds, and enabling engineers to communicate and develop their ideas effectively. It has been identified [4] that sketching helps students develop creative solutions by allowing them to quickly visualise and modify ideas, which is essential for exploring multiple solutions in engineering design. Additionally, sketching acts as a powerful learning tool that encourages active engagement with the material [5]. When students incorporate sketching into their learning process, they are more likely to gain clarity about the subject and retain essential details with respect to gender. Improving students' sketching ability in technology education enhances students' abilities to visualise and conceptualise complex ideas, fostering a more profound understanding and facilitating the development of innovative solutions.

Despite the significance of sketching in technology education, many students shy away from sketch-based questions. It has been ascertained [6] that lack of confidence, self-efficacy, and insufficient instruction and practice are among other factors that bring about avoidance of sketching. Self-efficacy refers to an individual's belief in their ability to execute tasks successfully. Students with low self-efficacy may doubt their sketching abilities, leading to avoidance of sketch-based activities [7]. The lack of confidence can result in decreased participation and hindered skill development. It is indicated [3] that low self-confidence among students leads to reduced participation and negatively impacts their learning process.

Among other factors, anxiety contributes to students' avoidance of sketching. It is perceived [8], anxiety and fear of negative evaluation are significant factors contributing to students' avoidance of engaging in sketching within technology education [9]. Students may experience heightened anxiety when required to perform tasks like sketching, especially in a classroom setting where their work is subject to peer and instructor scrutiny. This anxiety can stem from concerns about making mistakes, being judged, or not meeting perceived

standards, leading to avoidance behaviours that impede skill development. It was testified [10] that fear of negative evaluation is a primary factor underlying student anxiety in active learning environments. Prior study [11] ascertained that the fear of negative assessment plays a substantial role in student anxiety within active learning settings. Students often worry about being poorly judged by their peers, which can deter them from sharing their sketches. This uneasiness can restrict their involvement and reduce their chances for practice and development.

Avoidance of sketching can impede students' ability to grasp fully and apply technological concepts, as visualisation is integral to understanding technological concepts, and sketching avoidance discourages critical thinking and problem-solving, as it allows students to break down problems and see the bigger picture [12]. Avoiding engagement in sketch-based questions may negatively affect students' performance in technology-related assessments. Sketching aids students in visualising and internalising complex concepts [13]. Failing to sketch may result in a superficial understanding, hindering their ability to tackle detailed solutions to questions. When it comes to problem-solving, especially in technology-related fields, visual representations are particularly effective [14]. Not utilising sketches can restrict a student's capacity to break down and address technological concepts and problems effectively. It was identified [15], Sketches are a clear way for students to communicate technical ideas and perceptions. This ability is essential for proving comprehension and receiving full credit on tests. Using certain techniques could encourage students to sketch more. It is believed [16] that the methods of increasing student engagement through a skill development workshop may improve students' sketching ability. Skill development workshops are instrumental in enhancing technology students' engagement and proficiency in sketching. Workshops provide structured, hands-on experiences that build foundational skills and boost confidence. Workshops offer targeted instruction on sketching techniques, enabling students to develop essential skills in a supportive environment [17]. This focused approach allows for the gradual building of competence, which is essential for mastering complex tasks. Digital tools are frequently used in workshops nowadays, exposing students to programs and software that make digital sketching easier. Integration has improved students' readiness for contemporary technological environments where digital competency is essential [18]. Technology education students can strengthen their drawing skills and build the visualisation and conceptualisation abilities necessary for their area by taking part in skill development programs.

Reducing anxiety related to sketching tasks in technology education [19] required the creation of a safe learning environment that promotes risk-taking and sees errors as teaching opportunities. This method creates an environment in the classroom where learners can try new things, be creative, and grow as individuals without worrying about being judged negatively. Educators are urged to adopt several strategies to promote the development of this enabling environment, such as positive reinforcement strategies to enhance students' sketching abilities in technology education by encouraging desired behaviours and fostering a supportive learning environment [20]. Furthermore, positive reinforcement encompasses verbal praise, Tangible reward, Access to preferred activities, a positive feedback loop and the incorporation of technology [21]. Incorporating Technology; utilising digital tools and platforms makes sketching more engaging for students, and integrating drawing tablets or design software provides a novel and motivating experience [22]. Prior study showed [17] perceived that employing positive reinforcement approaches by educators means the establishment of an environment that fosters practice, minimises anxiety, and enhances proficiency in sketching among technology students.

Moreover, among the several supporting strategies adopted by educators to foster a supportive learning environment is collaborative learning. Smith et al., [23] mentioned collaborative learning as an effective way to boost creativity and technical skills. The engaged students in group activities shared ideas, techniques, and feedback with one another. The peer interaction helps them identify areas for improvement, learn new approaches, and avoid common mistakes. The students' teamwork on a sketching project allows students to discuss different methods, compare styles, and challenge each other's assumptions, which can lead to deeper insights and a broader skill set. Additionally, the supportive environment promotes confidence, making it easier for students to take risks and experiment with new techniques [24]. Among the other supportive strategies for sketching skills learning is reflective practice. In addition, [25] explained a reflective practice as a process in which a student actively analyses experiences and actions to gain a deeper understanding of self and improve their skills. Involves looking back at past actions, analysing what worked and what didn't, and determining how to apply those lessons to new circumstances. Encouraging students to reflect on their mistakes allows them to see errors not as failures, but as valuable learning opportunities. After sketching, students can analyse aspects that didn't go as planned, such as proportions, shading, or perspective and think about what they could do differently next time. This process of reflection helps them understand their weaknesses, develop problem-solving strategies, and refine their technique over time [26]. A learning strategy that will accommodate different genders should be identified, and the specific needs of each gender have to be targeted. However, genders indicate a difference in the learning strategies needed for particular content [27]. Implementing these strategies,

educators create a learning environment that enhances students' willingness to engage in sketching tasks, ultimately leading to improved proficiency and confidence in technology education.

Statement of the problem

In technology education, sketching and sketch-based exam questions are integral for assessing students' understanding and application of technological concepts [1]. However, there has been a noticeable hesitancy on the part of students to engage in these tasks, which may be impeding their ability to understand and acquire practical skills [28]. This avoidance may stem from various factors, including anxiety, fear of negative evaluation, and insufficient instructional support [8]. As a result, students' learning outcomes and competency in technology-related areas may suffer if they skip drawing tasks. Addressing this issue is essential to enhance educational practices and improve student performance in technology education.

Research Objectives

1. To determine the factors contributing to the avoidance of students engaging in sketch and sketch-based exam questions.
2. To determine the extent to which sketch avoidance affects overall learning outcomes.
3. To determine the Effective Strategies to enhance the effective engagement of students in sketching tasks.

Research questions

1. What factors contribute to students' avoidance of engaging in sketching and sketch-based exam questions within technology education?
2. To what extent does sketch avoidance affect overall learning outcomes?
3. What strategies can be implemented to enhance students' confidence and proficiency in responding to sketching questions during technology-related examinations?

2.0 Methodology

The study adopted a descriptive survey using technology education students from the Department of Science and Technology Education, Bayero University, Kano. A sample of 147 students (32 female and 114 male) was selected randomly. A validated five-point Likert scale questionnaire with 34 items was used. Descriptive statistics using mean and standard deviation were used. z test statistic at the 0.05 level of significance was used to test the null hypothesis.

3.0 Results and Discussion

3.1 Results

Research Question 1: What are the factors contributing to students' avoidance of engaging in sketching and sketch-based exams?

Table 1: Mean Score of the items on factors contributing to students' avoidance of engaging in sketching and sketch-based exams

S/N	Items	\bar{X}_F n=31	SD_F	\bar{X}_M n=116	SD_M	\bar{X}_T n _t =147	Rem
1	My sketching is not always as good as I want it to be.	3.45	1.12	3.67	1.23	3.56	A
2	Sketching takes up much of my time in exams	4.23	0.98	4.12	1.05	4.18	A
3	I often worry that my sketches won't meet the standards expected in my sci/tech course.	3.78	1.34	3.56	1.22	3.67	A
4	I lack personal effort for improvement and mastery of Sci/engineering Sketching	3.12	1.45	3.34	1.33	3.23	MA
5	I tend to avoid tasks that involve a significant amount of sketching	3.67	1.21	3.45	1.18	3.56	A
6	I perceived sketching as outdated	2.89	1.56	2.78	1.45	2.84	MA
7	I am not motivated to improve my sketching abilities because of the relevance to science.	3.34	1.23	3.12	1.34	3.23	MA
8	Lack of well-organised sketching lessons and a logical sequence to follow	3.56	1.45	3.45	1.33	3.51	A
9	No feedback on my sketches that helps me understand how to improve.	3.78	1.23	3.67	1.34	3.73	A

S/N	Items	\bar{X}_F n=31	SD_F	\bar{X}_M n=116	SD_M	\bar{X}_T n _t =147	Rem
10	I have not previously engaged often in sketching activities	3.45	1.45	3.56	1.33	3.51	A
11	I have not received any formal education or training in sketching techniques before.	3.12	1.56	3.23	1.45	3.18	MA
12	No encouragement to participate in sketching activities from classmates	3.67	1.23	3.56	1.34	3.62	A
13	No collaboration with peers on sketching assignments to boost my sketching effort	3.78	1.45	3.67	1.33	3.73	A
14	There are no resources available to help develop sketching skills	3.45	1.56	3.34	1.45	3.40	MA

Table 1 indicates that "Sketching takes much of my time in exams" had the highest mean scores of 4.18, and females had a higher mean factor of 4.23, indicating that these are significant contributors to avoidance and felt more by females. "I perceived sketching as outdated" had the lowest mean scores of 2.84. Females reported slightly higher mean factors of 3.78 in desire for feedback and peer collaboration, respectively.

Research Question 2: What are the impacts of the avoidance of sketching tasks in assessment on students' comprehension and application of technology concepts?

Research Question 2: To what extent does sketch avoidance affect overall learning outcomes?

Table 2: Mean Score of the items on the extent to which sketch avoidance affects overall learning outcomes

S/N	Items	\bar{X}_f n=31	SD_f	\bar{X}_m n=116	SD_m	\bar{X}_T n _t =147	Rem
15	I find it challenging to fully understand Tech concepts without using sketching.	4.12	1.23	4.23	1.34	4.18	A
16	Sketching activities help me to link the theory learned to practice.	4.45	0.98	4.34	1.05	4.40	A
17	It is not easy for me to solve a problem without the use of sketching.	4.23	1.34	4.12	1.22	4.18	A
18	Sketching helps me to visualise abstract Tech ideas for easy understanding.	4.56	1.45	4.45	1.33	4.51	HA
19	Sketching activities help me apply the theory learned in practice.	4.34	1.21	4.23	1.18	4.29	A
20	I retain scientific information better when I sketch.	4.12	1.56	4.23	1.45	4.18	A
21	I lost confidence when I avoided the sketching task I was asked to draw.	3.89	1.23	3.78	1.34	3.84	A
22	Avoiding sketching tasks reduces my engagement with the technology course content	3.67	1.45	3.56	1.33	3.62	A
23	Not engaging in sketching exercises hampers my critical thinking skills in solving science problems.	3.78	1.23	3.67	1.34	3.73	A
24	I find it difficult to explain technology concepts to others without using sketches.	3.89	1.45	3.78	1.33	3.84	A

Table 2 revealed that "Sketching helps me to visualise abstract technology ideas for easy understanding" topped the mean impact list with a 4.51 mean score, followed by "Sketching activities help me to link the theory learned into practice" with a mean score of 4.40. "Avoiding sketching tasks reduces my engagement with the technology course content" had the lowest mean factor of 3.62 mean score.

Research Question 3: What strategies can be implemented to enhance students' confidence and proficiency in responding to sketching questions during technology examinations?

Research Question 3. What strategies can be implemented to enhance students' confidence and proficiency in responding to sketching questions during technology-related examinations?

Table 3: Mean Score of the items on the strategies that can be implemented to enhance students' confidence and proficiency in responding to sketching questions during technology-related examinations

S/N	Items	\bar{X}_f n=31	SD_f	\bar{X}_m n=116	SD_m	\bar{X}_T n _t =147	Rem
25	Regularly practice basic sketching techniques to build foundational skills.	4.56	0.98	4.45	1.05	4.45	A
26	Gradually increase the difficulty of sketching tasks to develop proficiency over time	4.34	1.21	4.23	1.18	4.23	A
27	Providing constructive feedback and motivation to boost students' confidence in their sketching abilities	4.45	1.23	4.34	1.34	4.34	A
28	Encouraging group activities where students can learn from each other's sketching methods	4.12	1.45	4.23	1.33	4.23	A
29	Utilising digital tools and software to make sketching more accessible and engaging.	4.23	1.56	4.12	1.45	4.12	A
30	Demonstrating the importance and use of sketching in real-world sci/tech professions to highlight its relevance.	4.34	1.23	4.23	1.34	4.23	A
31	Incorporating sketching into simpler, fashionable assessments to reduce anxiety and improve skills.	4.12	1.45	4.23	1.33	4.23	A
32	Providing guided sketching exercises to help students follow structured steps and build confidence.	4.45	1.23	4.34	1.34	4.34	A
33	Teaching specific approaches for effectively tackling sketching questions during exams.	4.23	1.45	4.12	1.33	4.12	A
34	Ensuring students have access to quality materials and tools necessary for practising sketching.	4.34	1.23	4.23	1.34	4.23	A

The table revealed that “Regularly practise basic sketching techniques to build foundational skills” has the highest mean score of 4.45, indicating these are highly effective strategies, followed by the need for feedback and guided sketching exercises for students, having 4.34 mean scores each, respectively. Utilising digital tools and using specific teaching approaches attracted the lowest mean score of 4.12 each, respectively.

Hypothesis 1: There is no significant difference between females and males on the factors contributing to students' avoidance of engaging in sketching and sketch-based exams.

	Mean	Df	Z	Sig.	Decision
Female	3.69	145	3.73	0.55	Accepted
Male	3.60				

Hypothesis 2: There is no significant difference in the mean response between females and males on the impact of avoidance of sketching tasks in assessment on comprehension and application of technology concepts.

	Mean	Df	Z	Sig.	Decision
Female	3.31	145	2.34	0.04	Not Accepted
Male	3.64				

Hypothesis 3: There is no significant difference in the mean response between females and males on the strategies to enhance students' confidence and proficiency in responding to sketching questions during technology examinations.

	Mean	Df	Z	Sig.	Decision
Female	3.25	145	3.48	0.008	Not Accepted
Male	3.74				

Major findings

- 1 The major significant factors contributing to avoidance of sketching tasks, among others, are time constraint, lack of feedback and peer collaboration. Females experience higher anxiety and desire more feedback. There are no significant differences between female and male respondents for any of the factors ($p > 0.05$).
- 2 The findings indicate that sketching is highly effective in visualising complex technological concepts for easy comprehension and application. There are significant differences between female and male mean respondents for any of the factors ($p < 0.05$).
- 3 The findings reveal regular and guided practice, constructive feedback and fashionable assessments to reduce anxiety and improve skills. There are significant differences between female and male mean respondents for many of the factors ($p < 0.05$).

3.2 Discussion

The findings from research question one identified that "Sketching takes much of my time in exams" and "No feedback on my sketches" had the highest mean scores, indicating these are significant factors contributing to avoidance. This implies that the exams and assessments should be designed to allow sufficient time for sketching tasks to reduce student anxiety, and the provision of structured feedback and accessible resources is essential, such as workshops and tutoring, to support students in developing sketching skills. This aligns with literature suggesting that time constraints and lack of feedback are major barriers to student engagement in sketching [22]. Females reported slightly higher means for factors like "I often worry that my sketches won't meet standards" and "No feedback on my sketches." This shows that females experience higher anxiety and desire more feedback in technology-related tasks. Tailored support (e.g., mentorship, feedback sessions) could be beneficial for female students in technological fields. No significant differences were found between female and male respondents for any of the factors. This finding contrasts with some studies that suggest gender differences in technology-related tasks. However, it aligns with research showing that context-specific factors such as feedback and resources may have a stronger influence on behaviour than gender alone [4].

The findings on the impact of avoidance of sketching affect the overall learning outcome of technology concept, established that "Sketching helps me to visualise abstract technological ideas for easy understanding" and "Sketching activities help me to link the theory learned into practice," indicating that sketching is highly effective for comprehension and application. This aligns with literature suggesting that visualisation and practical application are critical for understanding complex concepts [3]. This implies that teaching methods should emphasise visual aids and sketching to improve retention and comprehension. Females reported slightly higher means for factors like "I find it challenging to fully understand technology concepts without using sketching" and "I retain scientific information better when I sketch. This showed that females benefit more from visual and hands-on learning strategies in fields of technology. Significant differences were found between female and male respondents for many of the constructs, which indicates that learning strategies in sketching have no similar impacts across genders, as females reported slightly higher concerns [9]. A tailored support of visual learning strategies could be beneficial for female students in technological fields.

The findings on the strategies that can be implemented to enhance students' confidence and proficiency in responding to sketching questions, which include regular practice and constructive feedback [24]. These strategies are highly effective for building confidence and proficiency. Educators should incorporate regular practice sessions and timely feedback into their teaching methods. The high mean scores for "Encouraging group activities" and "Providing guided sketching exercises" suggest that collaborative learning and structured guidance are effective strategies [22]. Teaching methods should include group activities and guided exercises to enhance learning outcomes.

4.0 Conclusion and Recommendations

4.1 Conclusion

To conclude, the study identifies a decline in sketching skills among Technology Education undergraduates at Bayero University, Kano. It presents a significant challenge for learning and professional readiness, and it reveals that student reluctance to engage in sketching stems from limited practice, time constraints, unclear instructions, and fear of criticism, which undermine confidence and hinder the development of essential visual communication skills. The findings emphasise the need for structured sketching activities, regular feedback, and a supportive classroom environment. Addressing these issues can enhance student engagement, improve understanding, and cultivate creative problem-solving skills, ultimately restoring sketching as a vital skill for future technology educators.

4.2 Recommendations

1. Structured feedback and accessible resources should be provided, such as workshops and tutoring, to address the lack of feedback and resources and encourage self-motivation through goal-setting to reduce avoidance.
2. Incorporating sketching activities into teaching and assessments to enhance comprehension, application, and retention of technology concepts and ensure sufficient time is allocated for sketching tasks.
3. Implementing regular practice sessions, providing constructive feedback, using scaffolded learning (gradual increase in difficulty), and a supportive learning environment to build confidence and proficiency in sketching tasks.

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