A PICTURE IS WORTH A THOUSAND WORDS: THE ROLE OF DRAWING IN SECONDARY SCHOOL EDUCATION

May Okafor[1], Osariyekemwen Uyi[2] & Joseph Vershima Itiav[1]
[1]University of Nigeria, Nsukka, [2]University of Benin, Benin-City
May.okafor@unn.edu.ng, osariyekemwen@uniben.edu, itiavvershima@gmail.com 08065976563

Abstract
In recent times, drawing-to-learn techniques have gained attention due to technological advancements in AI systems that can create illustrations at the click of a button. Traditional drawing methods, whether on hard-copy paper or a screen using smart pens (as against mere commands), have become of renewed interest. It has been observed, for instance, that there is significant disinterest in traditional draughtsmanship skills even in graphics classes that, before now, would depend largely on freehand sketches and drawings (Saunders 2021). Based on the cognitive load theory, this study joins that conversation to investigate the impact of the ability to draw effectively (or lack of it) on the psyche of school students and how that may affect academic performance. It examined students perceived academic performances in secondary school subjects that the major examination body (WAEC — West African Examination Council) specifically recommends the use of illustrations in their teaching. In doing so, the quantitative method of data collection and analysis was employed. Specifically, it involved the use of questionnaires administered to 300 participants from 10 purposely selected secondary schools in Nsukka metropolis, Enugu State. The data was analysed using the four-point Likert scale of measurement. The study found that drawing-to-learn encourages students to think creatively and visually, promoting problem-solving skills and innovative approaches to learning.

Introduction

Drawing is a significant factor in our cognitive development, aiding in learning writing skills, fostering creativity, improving hand-eye coordination, enhancing analytical abilities, and facilitating the conceptualization of ideas (Fan et al. 2023; Ainsworth & Scheiter 2021; Fernandes, Wammes & Meade 2018). The old saying, a picture is worth a thousand words, offers an insight into the place of pictorial representations like drawing in articulating ideas and transferring knowledge. Supporting these, multiple studies have showcased that drawing is a fundamental form of illustrations and an innate human expression that is essential for critical observation, representation, and education (Kennedy & Romig 2024; Matney, Fischer & Jackson 2023). Despite these recognized importance of basic drawing skills in teaching and learning, however, there is still limited use of its potential in schools. Sometimes, teachers who lack fundamental drawing skills are found to play down on teaching exercises related to critical observation and representation necessary for drawing (Saunders 2021). This is particularly so with the outburst of smart AI systems that can create complex images with simple commands. As a result, some students struggle through drawing-to-learn and sometimes dismiss it as unimportant while admiring, however, other students who can draw (Saunders 2021). The impact of the ability to draw effectively (or lack of it) on the psyche of secondary school students and how they may affect academic performance remains unclear. This study aims to contribute to that gap.

This study is, therefore, student-oriented. First, it expands the understanding of drawing and argues that drawing skills can be appreciated, and strategically improved on, if their roles in teaching and learning are better understood. With a focus on the Nigerian secondary school education, secondly, the interest of the research is anchored on students' perceived performances in practical subjects particularly ones that the major examination body (WAEC) specifically recommend the use of illustrations for their teaching. Based on these, the study then asks, (1) What is the direct relationship between drawing and practical subjects in secondary school? (2) How do students with proficient drawing skills typically perform in these subjects? (3) What psychological differences exist between students with and without drawing skills in approaching practical subjects? (4) What strategies can be implemented to enhance students' critical observation and representation skills for drawing?

The study, therefore, explores the role of drawing in enhancing students' understanding and confidence in secondary school subjects. In doing so, it draws on cognitive load theory to interrogate the use or lack of drawing exercises in some secondary school subjects and the impact that this has on the students involved. As will be explained further in this text, cognitive load theory posits that the human cognitive system has limited capacity and excessive cognitive load can hinder learning. As the old saying goes, 'a picture is more than a thousand words,' visual aids like

drawing can simplify complex information, making it easier for the brain to process (Kennedy & Romig 2024). In the following paragraphs, a review of literature will be presented. Then, the methods for data collection and analysis will be discussed followed by a presentation of results, findings and conclusion.

Related Literature

As a critical tool in cognitive development, visualization which is an essential part of teaching and learning new ideas is a foundation for technology, a driving force for progress in many nations. Likewise, drawing serves as a foundation for nurturing technological ideas that have been cultivated in the imagination through visualization. Technology encompasses various fields of science and the arts, making drawing skills not only essential for visual processing and shaping of crucial ideas for implementation but for teaching and learning. Therefore, it is not surprising that, as Ainsworth and Scheiter (2021) rightly point out, "The technique of drawing to learn has received increasing attention in recent years." This is particularly so in this era loaded with an outburst of technological advancements in AI systems that can create ideas and images at the click of a button. Traditional means of representation, whether on a hard-copy paper or or screen using smart pens, have become of renewed interest (Richardson & Lacroix 2024; Fan, Bainbridge, Chamberlain & Wammes 2023; Fernandes, Wammes & Meade 2018; Lyon, Letschka, Ainsworth & Haq, 2016). These authors agree that drawing is a method that encourages active, productive, and interactive learning while studying.

In their study, Richardson and Lacroix (2024) examined whether memory retention and performance varied depending on the encoding modality. They specifically analyzed writing, typing and drawing as distinct modes of encoding. Drawing was found to be the foremost encoding modality that heightened attentiveness, retention and performance. One may be reminded of Dale's cone of experience that explained that images and visuals are of higher symbolic experience than speeches or written texts. Illustrations are known to create better concrete experience for reflection, observation and conceptualization (*see* Cecep, Amalia, Hafidz, Alwi, & Sania 2024; Saunders 2021). Similarly, Fernandes, Wammes and Meade (2018) explored whether drawing "to-be-learned information" enhanced memory. They then found that it is not only reliable, but a replicable means of boosting performance. The authors further found that drawing can be applied in any type of learning including textbook definitions. Conclusively, Fernandes, Wammes and Meade (2018) suggest that being a simple and effective strategy, drawing has shown measurable performance gains in memory enhancement in both aging individuals and dementia patients.

In situations where verbal communication is limited, drawing and gestures can serve as effective means of conveying messages, similar to how early humans used drawings to communicate without clear verbal language or written texts. Supporting this, Fan, Bainbridge, Chamberlain & Wammes (2023) noted that the earliest known drawings date about 40,000 to 60,000 years old (also, *see* Hoffmann et al. 2018). The drawings served as constructive tools with which the early men navigated their daily lives. Developing drawing skills enhances the effectiveness of visual communication, making it a valuable tool for self-expression and cross-cultural communication.

Drawing is a versatile language that transcends disciplines, periods, and cultures, as noted by various scholars and artists alike (Jager 2012; Moore 2011). These experts emphasize the role of drawing as a creative process that facilitates learning across different contexts. Moore (2011:35) categorizes various types of drawing, including representational, figural, symbolic, personal, non-representational, abstract, decorative, schematic, diagrammatic, physical, perceptual, and expressive, among others. These types of drawing can be broadly classified into three main categories— technical drawing, scientific drawing, and artistic drawing— each suitable for various purposes. In this context, particularly focusing on the secondary school level as the primary target of this study, drawing encompasses all of these subcategories and aims to depict ideas, thoughts, or experiences in a simplified and understandable way. It does not prioritize scientific accuracy, technical precision, or artistic flair, but rather aims to truthfully represent facts, which may include elements of imaginative drawing, representational drawing, schematic drawing, expressive drawing, diagrammatic drawing, and outlining. Betts (2011) put it rightly when he wrote:

> What I hope for is that the confidence to draw in whatever method is relevant to the individual student, not weighed down by believing that *'good drawing'* belongs to one particular group of practitioners, will ultimately allow our students to understand their past and construct their futures.

The West African Examination Council (WAEC), which is the major examination body for secondary schools in Nigeria, recognizes the importance of drawing skills and incorporated them into the teaching and learning of certain subjects. For example, in senior secondary

Biology exams, candidates are assessed on their ability to draw and label animals, organisms, or plants they have studied. Geography students are required to identify and draw maps of relevant countries and continents. In Chemistry, lab tests and titrations involve drawing and documenting observed processes. Physics students may need to justify laws and theories with diagrams. Junior secondary classes also emphasize drawing skills in subjects like Introductory Technology. Agriculture, Clothing and Textile, and Fine Arts also require drawing skills. Some primary schools in the country have introduced drawing as a standalone subject to help students develop these skills early on, preparing them for the demands of secondary school and life in general.

Cognitive science recognizes the importance of including drawing in school curriculum. One of its theories, known as the cognitive load theory, explains that our cognitive system has limited capacity such that when presented with too much information at once, learning is hindered. Primarily developed by John Sweller in the late 1980s and early 1990s (*see* Sweller 2020), the study has had a significant impact on educational psychology and instructional design. Following the cognitive load theory, studies have shown that simplifying information, using clear and concise language, and specifically, providing visual aids maximizes learning outcomes. In a recent study, Kennedy and Romig (2024), for instance, demonstrates the importance and application of the theory in helping students with disabilities to learn better, that is, with adequate attention to their cognitive capacity.

Similar studies have also shown how visual aids, like drawing, can simplify complex information (Saunders 2021), enhance memory (Fernandes, Wammes & Meade 2018) and improve learning (Ainsworth & Scheiter 2021) by providing concrete representation of abstract concepts, making them easier to understand (Fan, Bainbridge, Chamberlain & Wammes 2023). As a researcher-practitioner and graphic designer, Saunders (2021) acknowledged that drawing-to-learn positioned them and their clients in a space that provided a seamless flow of thoughts and creative ideas for each project. Like Betts (2011) earlier quoted in this essay, Saunders emphasized that such constructive drawings require the courage to draw in whatever manner is appropriate for the person(s) involved, without being constrained by the idea that "good drawing" is the domain of a specific set of practitioners. By reducing cognitive load and enhancing memory and understanding, drawing-to-learn then can be a powerful tool for effective learning in the classroom and beyond. The next section presents the basic objectives of some secondary school practical subjects that form the basis of the study.

WAEC Syllabus

The syllabus provided by the West African Examination Council shall be used to analyze these objectives. Highlights will also be shed on the subjects' relatedness with the acquisition of drawing skills for better clarity on the extant theoretical framework of this research. These subjects include Biology, Agriculture, Physics, Chemistry, Geography and Garment Making.

In the aims and objectives of Biology, seven items were provided. Among them, is that candidates are expected to have:

i. "Acquisition of adequate laboratory and field skills to carry out and evaluate experiments and projects in Biology;
ii. acquisition of necessary scientific skills for example observing, classifying and interpreting biological data;
iii. acquisition of scientific attitudes for problem-solving." (n.p)

In this list, it is evident that drawing is an integral aspect of both laboratory and field skills in biology. To be specific, drawing-to-learn appears in the week-to-week breakdown of the activities. One instance states: “Candidates should examine and draw dissected male and female small mammals showing the reproductive organs. They should also draw sperm and ovum from prepared slides.” Such drawings and studies sharpen students' observatory skills which help them in properly classifying and interpreting biological data and in the long run, develop their scientific attitudes to problem-solving.

In Agricultural Science, one of the key objectives is to provide students with the necessary knowledge and practical skills to prepare them for further studies and related careers in agriculture. Practical skills in this subject involve proper observation and visual recording of forms, as well as maintaining practical notebooks to document field findings and experiences. These notebooks typically include plain sheets for drawings alongside ruled ones for written text. One of the weekly tasks specifically requires “Drawing and labeling of parts of farm animals would be assessed. Identification of important organs and their functions would be assessed.”

Physics requires students to utilize visual, oral, and written information, including symbolic, diagrammatic, and graphical data, to solve scientific problems. Practical tasks in Physics often involve drawing and plotting graphs. Similarly, Chemistry experiments are visually represented in laboratory settings and includes drawing of charts and graphs. Other subjects like Geography, Garment Making, Visual

Arts typically involve visual reports, graphs, charts, sketches, diagrams designed to enhance the students' ability to perceive the world more keenly. This fall in line with a statement by Geer (2011:50) who wrote, "I believe drawing is about seeing. The more I look around me, as I am drawing, the more the world opens up as if under an old magnifying lens". Hence, these subjects inculcate drawing in teaching and learning as a way to open up the eyes of the students for them to continuously observe the world around even more clearly.

In summary, drawing cuts across several secondary school subjects. It does not just belong to one discipline, and as Betts (2011, 27) emphasized, "we all know that drawing can be a tool for research, reflection, analysis, investigation and experimentation... All of these are transferable skills and drawing as a process can support and enhance learning and understanding in many subjects and disciplines." Furthermore, teachers and learners should understand that "when we draw, we teach, and when we study a drawing, we learn. If we take the time to study our own drawings, we learn even more" (Moore, 2011:36).

Method

The study utilized a quantitative method of data collection and analysis. This involved the use of questionnaires administered to 300 participants from 10 purposely selected secondary schools in Nsukka metropolis, Enugu State. The city was selected based on its merit as having reputable secondary schools in the state. Considerably, therefore, data collected reflects the broader educational landscape in the state and, perhaps, country. The 300 participants comprised 300 senior secondary school students selected through a combination of random and stratified sampling. In each school, 10 student volunteers were randomly selected from each senior class (S.S.1 to S.S.3) totaling 30 students per school. The questionnaire included four clusters of questions focusing on the relationship between drawing and practical subjects in secondary schools, students' performance with drawing skills, psychological differences between students with or without drawing skills, and approaches to enhance critical observation and representation skills. Also, the questionnaire used a four-point Likert scale of measurement (Strongly Agree, Agree, Disagree, Strongly Disagree) with an additional column for comments. The reliability of the instrument was tested using the test-retest technique, which yielded a high-reliability index of 0.76. This technique also served as a pilot test to identify errors in the questionnaire and enhance response rates. The research instrument was personally administered by the researchers with assistance from knowledgeable individuals in the respondent schools. This approach helped establish rapport with the participants, clarify the study's purpose, ensure confidentiality, and encourage sincere responses.

Collected data was analyzed by the use of a mean and frequency table. The four-point Likert scale of measurement was assigned numerical values as in the rating scale of response options and these were the basis of the analysis as given below:

SA	-	Strongly Agree	4 Points
A	-	Agree	3 Points
D	-	Disagree	2 Points
SD	-	Strongly Disagree	1 Points
Total	-		10 Points

The formula for computing the nominal value of response is $x = \frac{\Sigma fn}{n}$

Where:

Σ = Summation
x = Nominal Value of Response
f = Frequency of Response
n = Number of Respondents

Therefore, $x = \frac{4+3+2+1}{4}$ i.e. $x = \frac{10}{4} = 2.5$

Since x is the Normal Value of Response and its value is 2.5, by implication, the acceptance limit for data analysis is 2.5. Thus, any item with a mean response of 2.5 and above is acceptable or agreeable while any one with 2.49 and below is rejected or disagreed by the respondents. In addition, real limit of numbers was adopted using

the following ranges for interpretation:
3.50 — 4.00 = Accepted (Strongly Agree)

2.50 — 3.49 = Accepted (Agree)
1.50 — Rejected (2.49 = Disagree)
0.50 — Rejected (1.49 = Strongly Disagree)

Following the research questions posed by this study and subsequent data collection using questionnaires, responses were summed up and data analysis followed.

Results and Discussions

Table 1 displays the respondents' perspective on the connection between drawing and secondary school practical subjects. The data reveals that respondents strongly agreed (weighted mean of 3.50) that drawing skills are beneficial for science students as they enhance their ability to represent laboratory experiments effectively. Additionally, they strongly agreed (weighted mean of 3.65) that drawing skills are advantageous in social science and art subjects. The respondents also acknowledged that teachers' use of drawings on the board aids in student comprehension, as indicated by a weighted mean of 3.42. Conversely, they disagreed (weighted mean of 1.81) with the statement that student participation in drawing does not contribute to better understanding. Overall, the respondents agreed (weighted mean of 3.37) that drawing is directly related to various secondary school practical subjects.

Table 1: Perceived relatedness of drawing with secondary school practical subjects.

S/N	Statements	SD	D	A	SA	Mean	Decision
1	In pure science subjects such as Biology, Chemistry, Physics, Agriculture, etc. knowledge of drawing skills is essential in enabling students to excel in pencil representation of laboratory experiments.	7	11	107	175	3.50	Accepted
2	In social science and art subjects such as Geography, Garment Making, Fine Arts, etc., drawing skills help students in pencil representations and illustrations	2	10	78	210	3.65	Accepted
3	When teachers illustrate concepts on the board, the concepts appear clearer for easy comprehension by the students.	5	16	127	152	3.42	Accepted
4	Making drawings does not help students in understanding new topics or learning new ideas.	127	125	26	22	1.81	Rejected
5	Generally, drawing has a direct relationship with most secondary school practical subjects.	5	19	136	140	3.37	Accepted

The data presented in Table 2 illustrates the perceived performance of students with proficient drawing skills in practical subjects. The respondents, with a weighted mean of 3.39, agreed that good drawings can enhance the grades of students in science practicals. Interestingly, they disagreed, with a weighted mean of 2.26, that these improved grades in practical exams would impact the overall grades of students in those subjects. In contrast, for arts and social science subjects, respondents agreed that students who excel in drawing tend to receive higher grades due to their illustrations. They disagreed that students with adequate drawing skills perform equally to those without in practical exams. Then for written exams, the respondents accepted that there are no performance difference between students with or without adequate drawing skills.

Table 2: Perceived Performance of students with adequate drawing skills in practical-related subjects

S/N	Statements	SD	D	A	SA	Mean	Decision
1	In science practical, the grades of students who draw well are usually boosted by the good illustrations they present.	6	18	130	146	3.39	Accepted
2	If students with adequate drawing skills perform well in science practicals, their general grades in those subjects are affected.	117	39	93	51	2.26	Rejected
3	In arts and social science subjects, grades of students who draw well are usually boosted by the students' good illustrations.	6	29	150	115	3.25	Accepted
4	In practical examinations, there exists no difference between the performance of students with adequate drawing skills and those without.	99	124	51	23	1.97	Rejected
5	In written examinations, there exists no differences between the performance of students with adequate drawing skills and those without.	65	34	131	70	2.68	Accepted

Psychological differences between students with and without adequate drawing skills

In Table 4, the weighted means of 3.31, 3.36, 3.35, and 3.59 indicate that respondents agreed that students from various disciplines (science, social science, and arts) who are proficient in drawing tend to feel more confident during classes and exams that involve visual representations. The weighted mean of 3.33 in Table 3 also shows that respondents agreed that students who struggle with drawing skills often feel less confident in exams that require drawings.

Table 3: Psychological differences between students with and without adequate drawing skills.

S/N	Statements	SD	D	A	SA	Mean	Decision
1	Science students with adequate drawing skills are usually confident during practical classes, especially as regards representing laboratory experiments.	5	35	115	143	3.31	Accepted
2	Science students who have acquired drawing skills are also more confident in practical examinations, especially as regards visual illustrations.	4	14	151	131	3.36	Accepted
3	In arts and social sciences, students with adequate drawing skills are usually excited by classes that require visual illustration and representation.	6	24	129	141	3.35	Accepted
4	Art and social science students who draw effectively are usually more confident in examinations that require drawing.	4	17	78	201	3.59	Accepted

5	Students who cannot draw well usually feel less confident when asked in examinations to represent observations or ideas using drawing.	18	22	103	157	3.33	Accepted

Table 4 presents the respondents' opinions on strategies to enhance students' critical observation and representation skills as a foundation for learning drawing. The respondents indicated agreement, with a weighted mean of 3.47, that drawing should be a mandatory subject at the primary school level. They also favoured Fine Arts over Cultural and Creative Arts as a compulsory subject in Junior Secondary Schools. Notably, the current curriculum combines Fine Arts, Music, and Theatre Arts under Cultural and Creative Arts, unlike the previous curriculum that treated Fine Art and Music as separate subjects. The respondents, with a weighted mean of 3.11, supported the idea of Fine Arts being a standalone subject and compulsory in Junior Secondary Schools. Additionally, they agreed, with a weighted mean of 2.64, that drawing should be integrated into science classes for visual illustrations and then rejected, with a weighted mean of 1.74, that drawing should not be emphasized in technology education and awareness. With a weighted mean of 3.42, lastly, the respondents emphasized that teachers should hone their drawing skills in order to teach, effectively, the practical subjects that require drawing.

Table 4: Respondents' views on approaches that could boost students' art of critical observation and representation as a pre-requisite to learning drawing.

S/N	Statements	SD	D	A	SA	Mean	Decision
1	In order to encourage drawing skill acquisition in students, Drawing (as a subject) should be made mandatory at primary school level.	8	11	101	176	3.47	Accepted
2	Since Fine Arts undoubtedly helps in critical observation and representation, it should, rather than Cultural and Creative Arts, be made compulsory for junior secondary schools.	12	44	143	101	3.11	Accepted
3	Particularly for science subjects that require visual illustrations, Drawing should be taught as whole topics (and not sidelined).	27	112	102	59	2.64	Accepted
4	The place of drawing in developing ideas for technological advancement ought **not** to be emphasized in secondary schools.	119	138	37	4	1.74	Rejected
5	For practical subjects that require drawing, teachers should develop their drawing skills.	9	13	112	162	3.42	Accepted

The findings of this study have significant educational implications for students, teachers, schools, and educational systems. It emphasizes the importance of expanding students' perspectives on drawing beyond its association with art, highlighting its relevance in various disciplines. Encouraging secondary school students to develop drawing skills can boost their confidence in visual representation and better prepare them for specialized fields in higher education.

Additionally, the study underscores the significance of teachers honing their drawing abilities to motivate students and enhance the learning process. Active engagement in drawing alongside students can improve teaching effectiveness and student engagement. These findings offer valuable insights for school boards and educational planners on the role of drawing in teaching and learning, emphasizing the importance of nurturing future scholarship to be adept

at communicating ideas through drawing for societal and national progress. Despite the study's contributions, some limitations were encountered, such as reluctance among students to fill out questionnaires due to busy schedules. Strategies were implemented to address these challenges, ensuring the integrity of the data collected.

Suggestions for further research include expanding the study to other locations within Enugu State and Nigeria to provide a comprehensive understanding of drawing skills' impact on academic performance. Evaluating teachers' drawing skills and exploring non-institutional avenues for maximizing drawing potentials are also recommended for future research. The study's findings benefit both teachers and students by enhancing classroom participation and academic performance. It challenges science students' biases against drawing as an art-related skill and reshapes arts students' perceptions of drawing as interdisciplinary and essential for national development. Ultimately, the study advocates for the acquisition of drawing skills by all students as tools for learning, communication, pedagogical advancement, and technological progress.

Conclusion

The research findings led to the drawing of conclusions. Drawing is intricately connected to various secondary school subjects, particularly those with practical applications. It is essential to have a comprehensive understanding of the art of drawing, which goes beyond creating beautiful images or diagrams using techniques like perspectives and chiaroscuro. Drawing is not strictly scientific or technical; rather, it involves the ability to represent ideas, forms, and images in a communicable manner that aids in easy comprehension by viewers. Drawing encompasses all aspects of life and is a fundamental skill that contributes to excellence and psychological stability in both art and science disciplines. Developing adequate drawing skills in teachers and students can significantly enhance performance in related subjects, as it helps in effectively portraying and mastering learned concepts. Therefore, drawing-to-learn plays a crucial role in facilitates understanding and retention of information. Teachers and students can benefit from incorporating drawing into their educational practices, as it enhances teaching effectiveness and promotes deeper learning.

Recommendations

The findings of this study suggests that drawing should be a mandatory subject at the primary school level. This will help emphasize to students the importance of learning how to draw and increase their interest in drawing from an early age. Only teachers specializing in drawing, illustration, or draughtsmanship should teach these subjects unless other teachers have demonstrated proficiency in the skill.

Also, the concept of drawing should be redefined for secondary school students, moving away from its exclusive association with Fine Art disciplines. Students should be encouraged to see drawing as a skill that can be developed through practice and effort, rather than relying solely on talent. Every student needs to acquire this skill for lifelong benefits.

It is important for Fine Arts to be a standalone subject at the Junior Secondary School level, separate from Music and Theatre Arts under Cultural and Creative Arts. This separation can enhance students' critical observation and representation skills, aiding in the acquisition of drawing skills.

Lastly, drawing should be incorporated into basic education programs such as the National Certificate for Education (NCE), Bachelor of Education (B.Ed.), and Postgraduate Diploma in Education (PGDE) to ensure that teachers are equipped with this essential skill to effectively teach students drawing-to-learn.

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