

DEVELOPMENT OF INTERACTIVE MULTIMEDIA FOR ENHANCING THE TEACHING AND LEARNING OF MACRAMÉ IN TEXTILE EDUCATION

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ABSTRACT

Macramé is a textile technique that involves creating intricate patterns by knotting cords in various combinations. In Ghana, it is taught in only a few higher education institutions, including the Kwame Nkrumah University of Science and Technology (KNUST), where it forms part of the Fibre and Fabrics course within the Department of Indigenous Art and Technology (DIAT). However, teaching and learning macramé face significant challenges, such as large class sizes, limited resources, and inadequate studio spaces, which hinder skill acquisition and individualized instruction. This study employed a mixed-methods approach involving 57 Year One students in the Fibre and Fabrics programme. Quantitative data were collected through pre- and post-intervention tests and analyzed using paired t-tests to assess students' understanding and execution of basic knotting techniques. Qualitative data were gathered through observations and interviews. The intervention featured an interactive multimedia video developed to support self-paced learning and enhance classroom instruction. Results showed a statistically significant improvement in students' learning outcomes following the intervention, particularly in their ability to accurately identify and perform foundational knots such as the square knot, lark's head, and half hitch. Students also reported greater confidence, engagement, and motivation to practice independently. The study concludes that integrating interactive multimedia into the macramé curriculum significantly enhances both theoretical understanding and practical skill development. It recommends the inclusion of such digital tools to supplement traditional instruction and address ongoing pedagogical challenges in textile education across Ghana.

Keywords: macramé, textile education, teaching and learning, fibre and fabric, interactive multimedia

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INTRODUCTION

Weaving, Crochet, Macramé, Braiding and Knitting are all hand craft techniques or methods used to create Unique fabrics with varying structural characteristics. While the strands in knitted and Crocheted fabrics have a looped structure, the yarns used in Macramé produce knots and the yarns used in weaving are primarily straight with some crimp (Nawab, 2016). Gong (2015) mentioned that Macramé is the art of knotting yarns without using needles and hooks. It is the art of joining together pieces of flexible materials such as ropes and forming loops or designs by knotting. Knots are used in everyday activities of mankind which includes tying of shoe laces, tying simple bows on gift boxes to mention a few (Petit, 2013). The Fibre and Fabrics course equips students with essential knowledge and skills related to textile fibers, including the ability to identify various textile fibers, recognize raw textile materials, understand the process of converting these raw materials into fabric, and learn proper fabric care. At Kwame Nkrumah University of Science and Technology (KNUST), the Department of Indigenous Art and Technology offers Fibre and Fabrics as one of its six major courses. Within this course, macramé is a key component, taught throughout the four years of study for students who select Fibre and Fabrics as their major. In textile design education, macramé is recognized as a method of producing structural designs (Frankie, 2004). According to Balakrishnan (2022), educational institutions should foster effective learning practices that encourage creative and innovative thinking, motivating students to actively engage in the creative process. From the perspective of 21st-century skills, nurturing creative and innovative thinking is crucial for both teaching and learning.

Macramé, a technique that involves knotting cords into imaginative patterns, is primarily learned through hands-on, project-based interaction with materials. However, as student-to-teacher ratios increase, many students struggle to fully engage during classroom demonstrations. This affects both eager learners, who may miss parts of the demonstration or forget steps due to overcrowding, and passive learners, who may need additional demonstrations to fully grasp the concepts. The learning process, which often requires repetition and revision, is compromised by the overwhelming number of students (Doyle, 2023).

In Ghana, macramé is taught at only a few universities, including Kwame Nkrumah University of Science and Technology (KNUST). However, there is limited research on the teaching of macramé (Horst, 2013), and the teaching methodology largely relies on conventional techniques. Students who lack access to modern, creative media often become passive learners, as there are no interactive tools to help them learn and master macramé techniques (Herdiyono & Martono, 2018). This study aims to analyze the traditional teaching methods and student learning experiences in the macramé component of the Fibre and Fabrics course at the Department of Indigenous Art and Technology at KNUST.

The histories of education and civilization are essentially identical. This proves that education is an essential part of every person's life. Individuals can be developed through a variety of educational fields of which Textile education is one of these fields. Education likely plays a crucial role in fostering independence and holistic personality development. It involves learning and acquiring the skills, knowledge, attitudes, and values necessary for individuals to be responsible and to contribute effectively to the development of their society. Ghana's

rich cultural past includes textiles in general and weaving in particular. One of the main methods used to produce textiles and one of the oldest still-practicing crafts in the world is textile weaving. In certain developing nations, manual textile weaving is still practiced, typically to provide a traditional touch to a textile product's aesthetic value. In textile education, printing, dyeing and loom weaving are covered in the textile discipline of the Visual Art programme in Ghana's formal education system (Boateng, Essel, Vlachopoulos, Johnson & Okpattah, 2022).

In the past, the enthusiasm and zeal of students in the textiles' education of the visual arts or home economics programme was low but is currently increasing gradually. Students are getting interested in textiles and many Senior high schools are adopting more techniques to be added to the textile's curriculum as part of their subjects in the Visual Art and Home Economics programme (Okai-Mensah, 2015). Okai-Mensah, Opoku-Asare & Siaw (2017) also found out that schools do not have the requisite textbooks, art studios, and the basic tools and materials to enable the students acquire enough knowledge and skills specified in the textiles syllabus to enable them pass final examination and/or to establish their own businesses after they leave school. The introduction of Vocational Education into the curricula of Ghana's Education System. The authors further recommended that government together with the Parent-Teacher Associations and Old Students' Associations of the senior high schools should support the schools with adequate facilities and equipment such as art studios, workshops, galleries and exhibition rooms for effective teaching and learning.

Macramé helps to relieve tension in the fingers as they tie the knots and make the technique of knotting Macramé a comforting interest. Knotting Macramé has

an additional advantage of appreciating the creative activity of making the intrinsic goal unknown within (Knotter, 2012). Instead of Knitting or Weaving, Macramé is a form of textile produced using knotting techniques. The fundamental knots of Macramé are the square knot and clove hitch, which is various combinations of half hitches. It was long crafted by sailors, especially in ornamental or elaborate knotting forms, to decorate anything from knife handles to bottles to parts of ships (Mate, 2019). According to Ibrahim (2018), Macramé is an interesting art, which is part of traditional textile techniques and design with great significance both in history and modern times, it comprises the use of knots to invent complex patterns rather than loom weaving or knitting. Macramé knots are extensively used in crafting items varying from utility purpose to those of ornamentation, decoration, furnishing, or as accessories, which uses different techniques of knotting to make them attractive and beautiful. Macramé has been in existence for a while and has been made with different kinds of cords, yarns and ropes and used in making a variety of items and also for developing activities especially those that involve production (Jonathan, Dutsenwai & Ada, 2015).

The modernization of technology has significantly accelerated the flow of information and has become a valuable tool for achieving educational goals more effectively and efficiently. In essence, attaining these goals relies heavily on the interactive process between teachers and students (Khalid *et al.*, 2014). Therefore, it is essential to cultivate a conducive and mutually supportive relationship between them. Education serves as a means for individuals to transform their attitudes and behaviors through learning. In today's modern era, active student participation in the learning process is crucial (Hunter, 2008). It enables students to independently

seek, comprehend, process, and interpret knowledge. However, solely relying on student activity can be problematic, especially for passive learners who may quickly lose interest and forget the material presented.

Numerous challenges arise in the learning process, one of which is the difficulty students face in fully understanding the material due to the limitations of the learning media used by instructors. To enhance the quality of education, it is necessary to adopt innovative approaches in the learning process. One effective strategy is incorporating interactive multimedia into education (Suhirman, 2014). The integration of interactive multimedia requires educators to be more creative in designing learning strategies. By leveraging modern technology, educators can select appropriate media to optimize the learning experience (Leow and Neo, 2014). However, the successful application of such technology largely depends on the availability and expertise of professionals in educational technology (Seels and Richey, 2012).

In response to these challenges, the development of interactive multimedia presents a promising solution for both in-class and out-of-class learning. Multimedia serves as a powerful tool that enables interactive presentations by combining text, graphics, animation, audio, and video. In the context of teaching macramé, interactive multimedia represents an innovative approach to enhancing the learning experience.

Definition of Terms

- **Cord:** This refers to the material used to tie the Macramé knots.
- **Course content:** This refers to modules, units, lectures, chapters, or sections, which are often called course content. It is a cohesive instructional unit organized around specific learning outcomes and includes learning activities and assessments designed to achieve those outcomes

- **Crafts:** This means the art works produced with knowledge and skills of an individual or a group. It can be grouped as accessories, design and décor.
- **Creativity:** This suggests the ability to invent new ideas, symbols. To rearrange established patterns.
- **Fibre:** This refers to the smallest unit of yarn.
- **Macramé:** This indicates the art of knotting without the use of gadgets to make decorative items such as jewellery, plant holders, etc.
- **Online:** This refers to activities that occur either synchronously (in real-time) or asynchronously through the World Wide Web or various Internet technologies.
- **Onsite:** This refers to meeting or activities conducted in person, where participants engage face-to-face, in the traditional classroom setting.
- **Project-based activity:** This refers to an activity that requires a lot of more practical sessions than theoretical knowledge en route to acquiring a skill.
- **Textile education:** This denotes the process of teaching and learning of Textiles.

MATERIALS AND METHODS

The population was sourced from Year One groups in the department of indigenous art and technology. As of the 2022/2023 academic year, the population for the study comprised 4 lecturers, 57 Year One students who offer Macramé under Fibre and Fabric at the Department of Indigenous Art and Technology at KNUST.

Using purposive sampling technique offered the researcher the opportunity to determine the data required and set out the modalities to identify the subjects (who are lecturers who teach Macramé) who could and were

willing to give the information by virtue of their knowledge and experience in the teaching and learning of Macramé in Textile in Ghana (Bernard, 2002; Lewis & Sheppard, 2006). According to Campbell, Quincy, Osserman & Pedderon (2013), purposive sampling enables researchers to enhance efficiency and optimize resource use by focusing on participants who can provide the most relevant information for answering the research questions. By carefully selecting participants based on their expertise, knowledge, or experiences, researchers can streamline data collection and ensure the richness and quality of the data obtained. Purposive sampling is commonly used in qualitative research, which seeks to understand complex social phenomena and explore a wide range of perspectives (Patton, 2002). Qualitative studies often emphasize depth rather than breadth, aiming to uncover detailed insights and contextual factors that might be missed with random sampling. Purposive sampling allows researchers to intentionally choose participants who can provide diverse viewpoints, ensuring thorough coverage of the research topic.

RESULTS AND DISCUSSIONS

Findings from Observation and Interviews Conducted

Strengths Associated with Teaching and Learning of Macramé

The Department of Indigenous Art and Technology has established an effective teaching framework for the Macramé component of its curriculum. Based on interviews with lecturers, several key strengths in their instructional approach have been identified. Lecturers are well-trained and deeply knowledgeable about Macramé, which allows them to introduce advanced techniques like tapestry Macramé into the

coursework. Their extensive experience in the craft industry further enhances their teaching, as they are familiar with the suitable materials available in the market for student projects. Their teaching methods are highly organized and adhere closely to the semester's course outlines, ensuring thorough coverage of the planned content.

Students also find value in the practical demonstrations given by lecturers, as these allow them to observe and practice Macramé techniques directly, fostering a deeper understanding and improving their skills. Furthermore, the encouragement to use online resources is well-received by students, who explore tutorials to supplement their learning and enhance their creativity in Macramé. These observations highlight the effectiveness of the lecturers' teaching methods and the positive impact on student learning experiences. The combination of expert instruction, practical demonstrations, and the integration of online resources creates an engaging and comprehensive learning environment for Macramé. The alignment between lecturers' expertise and students' positive feedback underscores the success of the current instructional strategies and suggests a strong foundation for future innovations in teaching Macramé.

Weaknesses Associated with Teaching and Learning of Macramé

The instructional practices and resources available for teaching Macramé at the Fibre and Fabrics Section at DIAT face several challenges, as gathered from both interviews and observations made. Interviews conducted reveal that, creativity among students appears to be limited. Many students tend to replicate existing designs rather than exploring new ideas, indicating a potential gap in fostering creativity beyond mere imitation. This issue is compounded by the large class sizes, which significantly hinder

effective teaching and individual attention. The high student-to-lecturer ratio further reduces the ability to provide personalized guidance, essential for nurturing creativity and problem-solving skills.

The lack of dedicated studios, tools, materials, and equipment for Macramé poses another significant challenge. As Macramé is integrated into the broader Fibre and Fabric course, it receives limited time allocation within the timetable, restricting the opportunity for extensive practical sessions. The absence of a dedicated internship program means that students miss out on additional avenues to gain practical knowledge and skills in Macramé. Moreover, while lecturers are well-versed in traditional Macramé techniques, there is a noticeable gap in the incorporation of modern trends and advanced techniques such as tapestry Macramé. This lack of modernization in teaching methods could limit students' exposure to contemporary practices in the craft. Practical sessions are further constrained by limited teaching hours, preventing students from fully grasping concepts and techniques.

The absence of standardized teaching methods, particularly concerning the calculation of cord length or the amount of material needed for projects, results in inconsistencies in student work. Additionally, teaching is often abstract, with a stronger focus on the theoretical aspects of Macramé rather than practical application. This theoretical emphasis does not adequately address students' needs for understanding how to apply knots in their sketches and projects. The large class sizes and resource constraints also lead to a lack of visual aids and innovative teaching strategies. Reliance on physical demonstrations and online resources alone may not sufficiently cater to visual learners, thereby impeding their comprehension and learning experiences.

Opportunities and Threats of Teaching and Learning of Macramé at the Fibre and Fabrics Section at DIAT

The Fibre and Fabrics Section at the Department of Indigenous Art and Technology identified several opportunities to enhance the teaching and learning of Macramé through structured class schedules, the use of appropriate instructional design models, and the integration of technology. These insights were drawn from both interviews and observations, highlighting areas where educational strategies could be improved and opportunities for innovation could be harnessed.

During the Interviews conducted, Lecturers provided valuable perspectives on how to improve the Macramé curriculum, emphasizing the importance of structured class schedules. They noted that a well-organized timetable, free from scheduling conflicts, could significantly enhance student engagement and participation in practical Macramé activities. This structure allows for better planning and execution of class activities, ultimately leading to more effective learning outcomes (Prince, 2004).

Additionally, lecturers highlighted the potential benefits of improving the teaching of Macramé techniques. By providing a structured approach, these models help in systematically building foundational skills before advancing to more complex projects, ensuring a comprehensive learning experience. The integration of technology was also identified as a critical opportunity by lecturers. Incorporating videos and online resources into the curriculum can complement traditional teaching methods, offering students dynamic and accessible learning tools. These technological resources provide flexibility, enabling students to review and understand complex techniques at their own pace, which enhances their learning experience (Strayer, 2012).

Again, students also expressed enthusiasm for the practical demonstrations conducted by lecturers, which offer them hands-on experience and deeper understanding of Macramé techniques. These demonstrations are crucial for reinforcing theoretical knowledge and developing practical skills, as they provide real-time guidance and feedback from instructors. The combined insights from both interviews with lecturers and observations made with the teaching and learning suggest a multifaceted approach to enhancing the teaching and learning of Macramé.

Threats Associated with Teaching and Learning of Macramé

Interviews with lecturers have shed light on key obstacles within the current Macramé curriculum. One significant challenge is the informal learning environment that allows students to schedule their practical work flexibly. While this offers convenience, it poses difficulties for instructors who aim to observe and assess students' progress consistently. The flexibility can hinder the ability to provide timely feedback and support, impacting the overall effectiveness of the learning process (Nicol & Macfarlane-Dick, 2006).

Another concern raised by lecturers is the dependency on lecturer for assistance. While the hands-on involvement of lecturers in guiding students through practical aspects of Macramé is beneficial for providing immediate support and motivation, there is a risk that students may become overly reliant on this assistance. This dependency can limit their ability to develop independence and problem-solving skills, which are crucial for mastering Macramé techniques (Harbour *et al.*, 2015). Resource constraints also present ongoing challenges, as material and space limitations continue to affect the quality and execution of practical projects. The lack of dedicated studio space and

adequate materials impedes effective project execution, reducing the potential for comprehensive learning outcomes.

Additionally, lecturers noted the impact of large class sizes on the quality of instruction. Managing a large number of students makes it challenging to provide individual attention and tailored feedback, which are essential for supporting diverse learning needs and ensuring effective learning outcomes. Lecturers further highlighted that Macramé, being integrated into broader courses like Fibre and Fabrics, may not receive the recognition or support it requires within the educational system. This integration can limit the allocation of time and resources specifically for Macramé instruction, hindering efforts to enhance its teaching and learning.

Teaching Module for Developing the Interactive Multimedia

A teaching module was developed to serve as a guide on the teaching of macramé to Year One students using the components of the lesson plan. The components of the module were adapted from (Donnelly and Fitzmaurice, 2005; TVET Curriculum Development, 2022). The interactive multimedia video is a web-based learning platform which is designed and developed with HTML, PHP and SQL.

Level: Year One

Teaching Strategy: Understanding the diverse backgrounds and prior knowledge of students is essential for tailoring the Macramé content to meet their individual learning needs. This initial assessment provides a foundation for developing instructional strategies that build on students' existing skills while addressing any gaps in their understanding.

Course Description: The Basic Level of the course is designed to introduce students to the foundational aspects of Macramé. This includes a comprehensive overview of its history and origins, providing students with a contextual understanding of the craft. Emphasis is placed on mastering the basic techniques of knotting, which are essential for creating Macramé projects. Students will engage in hands-on practice, enabling them to develop and refine their knotting skills through repetitive exercises and practical application. This foundational stage ensures that students gain a solid grasp of the fundamental techniques and historical context, which will serve as a basis for more advanced work in subsequent levels.

This level integrates the elements of basic knowledge in Macramé, knotting techniques, and skill acquisition into a cohesive narrative.

Credit Hours: 2

Time: 2 hours

Space: Lecture Hall and Studio

Semester: One and Two

Weeks: 10 weeks

Tools and Materials Needed: Mounting frame or boards, pins/clip, scissors, tape measure, cord, yarn and its variations (that is, any cord/yarn that does not slip)

Resources: Projector, Visual Aids, Interactive Multimedia Videos, Computer

Content Delivery: Lecturers, Demonstration, Tutorials, Practical, Group work

Learning Outcome: By the end of the semester, the students will demonstrate proficiency in identifying the basic knots, their symbols and the ability to tie knots in 2-Dimensional projects.

Learning Indicator:

- Students will interpret knowledge by giving insights into the history and origin of Macramé.
- Students will be expected to acquire basic knotting skills in Macramé.
- Accurately tie each of the fundamental knots.
- Identify and utilize these knots in their project sketches.
- Develop a foundational understanding of how different knots contribute to overall Macramé designs.
- Students will have deepened their understanding of the basic knots, their symbols and how to gather the knots for a 2-Dimensional project.

Course Content:

a. Introduction to Macramé:

- Overview of Macramé
- Importance of Macramé in Textile Education with relevance to the economy, society and individual.
- Introduction to the types of basic knots (using the traditional and technological approach).

b. History of Macramé:

- Explore the historical roots of Macramé
- Study ancient civilizations' contributions to Macramé
- Understand the evolution of Macramé in modern aesthetics

c. Symbols to Represent Knots:

- Introduction to knot symbols
- Explanation of symbols for basic knots (Square Knot, Clove-Hitch Knot, etc.)

- Interpretation of knot symbols in projects

d. Knot Illustration:

- Graphical illustrations of fundamental knots
- Step-by-step instructions for tying basic knots
- Knot illustration: mini projects

e. Video Demonstration:

- Access pre-recorded instructional videos for knot tying
- Interactive tutorials for practicing knotting techniques
- Demonstration of basic knots

Instructional Activities: (Demonstrations, Tutorials and Guided Practice)

- i. The lecturer provides step-by-step demonstrations of the basic knots, symbols that represent the knots and how to indicate the symbols in sketches or drawings.
- ii. Interactive Knotting Planning Exercise: Students engage in an interactive knot planning exercise where they are given Macramé projects with specific requirements of each basic knot.
- iii. Working individually or in groups, students should be able to tie all the basic knots with the help of the tutorials provided both online and through demonstrations.
- iv. Engage students in class discussions about their experiences with the gatherings of the basic knots, encouraging them to explain their knowledge and skills acquired in Macramé.
- v. Incorporate these knots into design sketches by emphasizing how each knot can be visualized and represented in project planning.

Video Demonstration:

To enhance the learning experience for students in the Macramé course, we are integrating an innovative instructional approach utilizing interactive videos. This shift from traditional lecture-based teaching to a student-centric model is designed to foster a more engaging and self-directed learning environment (Bergmann and Sams, 2012). The Interactive videos developed by the researcher will allow students to preview and practice knotting techniques through tutorials before attending in-person classes. This proactive approach enhances foundational skills, enabling mastery of Macramé patterns (Johnson and Renner, 2020). The strategy empowers students to progress autonomously, revisit concepts as needed, and receive personalized feedback and support from the instructor. This shift results in heightened engagement and improved learning outcomes to facilitate students to engage in out-of-class learning as well as in-class activities with the basic knots in Macramé. A particular strength of this study is that it focuses on the students' practical ability to understand the tying of the basic knots. Amid evolving classroom technologies, the integration of detailed demonstrations on basic Macramé knots within interactive videos becomes imperative. These videos serve as a valuable resource for students, compensating for insufficient classroom time which is allocated for the teaching and learning. Figures 4.6 to 4.8 illustrate the interface of the interactive video in the app and its components designed to enhance the teaching and learning of Macramé.

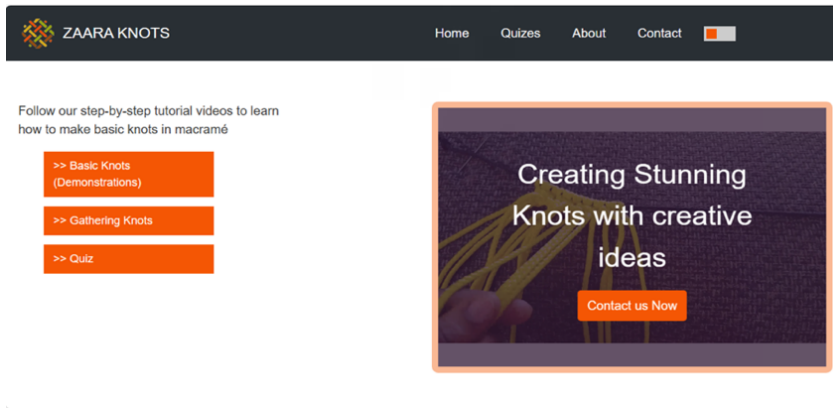


Figure 1: Interface of the Interactive Multimedia Video

Source: (Researcher Own Construct, 2024)

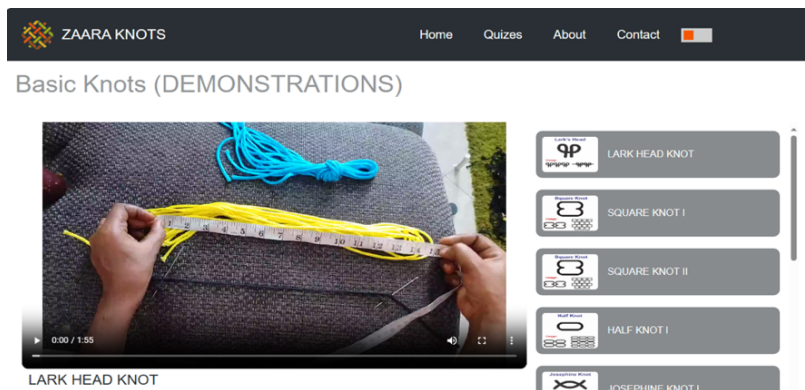


Figure 2: Demonstration of the basic knots on the web interface.

Source: (Researcher Own Construct, 2024)

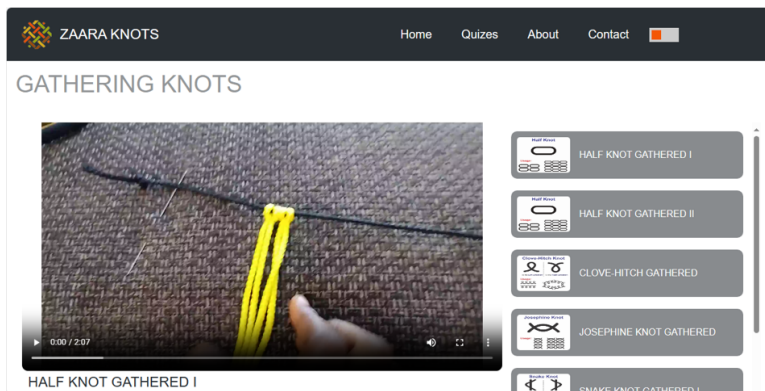


Figure. 3: Demonstration on how-to gather knots.

Source: (Researcher Own Construct, 2024)

Analysis of Feedback: (Application and Practice)

- In pairs or small groups, students tie all the basic knots considering all relevant factors.
- Evaluate students' ability to tie each knot correctly.
- Assess the incorporation of knots in design sketches for accuracy and creativity.
- Encourage creative discussions and problem-solving within groups to promote team work.
- Have students share their experience on how to utilize the media for instruction

Encourage constructive feedback and reflection on the challenges and insights gained during the practical projects

EXPERIMENTAL PROCEDURE:

Stage One: The history of Macramé was introduced through a brief lecture. Symbols representing the basic knots were projected to illustrate and demonstrate how to tie the knots. The interactive multimedia video developed by the researcher was used to show the process of tying these knots. A shadow effect in the video highlighted the movements involved in knot-tying, which students were encouraged to imitate while learning. This visual aid helped enhance students' understanding of Macramé knot-tying techniques.

Students were then given access to the interactive video link to practice tying the basic knots on their own. Materials were provided for them to practice both the 'basic knots' and the 'gathering of knots,' as detailed on the website (www.zaaraknots.com), which helped them better understand the knot-tying process before the next class.



Figure 4: Demonstration of Basic knots projected in class

Out-of-class learning: The interactive multimedia video content was available on the website (www.zaaraknots.com). Video lectures provided students with a thorough understanding of the basic knots and actively engaged them in the activity. Students had the opportunity to share their thoughts, questions, or comments on the video using their mobile phones. They reviewed the video content and provided feedback on what they had learned by leaving comments on the website before attending the next lecture.

Students who encountered difficulties with the out-of-class video learning were encouraged to participate and practice during in-class sessions.

Onsite learning: This part of the programme emphasized the discussion and practice of the basic knots. Students worked in pairs or small groups to practice the assigned knots, which helped enhance their motivation and engagement.



Figure 5: Onsite learning in small groups.

During the subsequent class meeting, students practiced tying the knots together to reinforce what they had learned from the interactive multimedia video. Each student created a sampler, as shown in Plate 4.40

to demonstrate their understanding of knot-tying. The combination of interactive videos and hands-on practice in class enabled students to learn and differentiate between various knots.

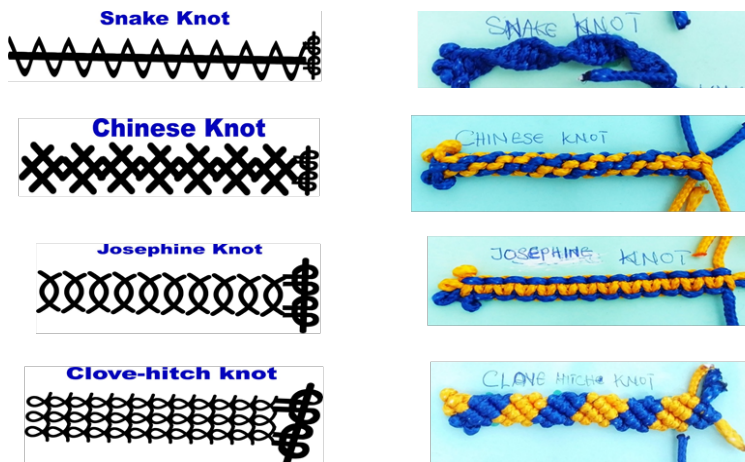


Figure 6: Samples of Basic Knots tied by students.

Stage Two: Students created samples of the basic knots and practiced gathering the knots when a patterned was given for them to follow. This stage focused on reinforcing their knot-tying skills.

Stage Three: Students identified the basic knots using symbols and were asked to match the symbols with the knots they had tied, as shown in Plate 4.40. This stage included diagrams and written explanations of the

knots to be used in their project. Each student was tasked with creating a plan that included sketches and knot symbols for a project. The

project involved designing and sketching a pair of slippers, as detailed in Plate 4.42.

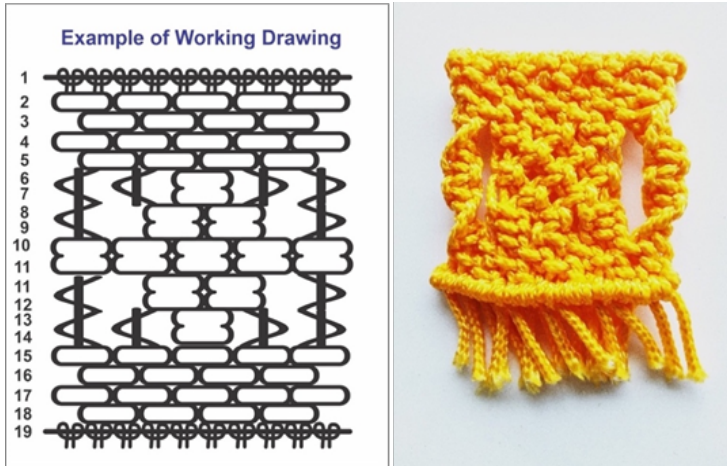


Figure 7: Sample of Gathering Knots

DISCUSSION OF FINDINGS

The data presented summarizes the results of a paired samples analysis examining the impact of the intervention which was

conducted on students' learning outcome for Year One. The analysis compares pre-intervention and post-intervention scores within a sample of students, to assess the effectiveness of the intervention.

Table 4.1: Means and Standard Deviations Analyses of Survey Responses on Engagement and Motivation on the teaching and learning of Macramé (N = 57)

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Engagement Scale (Pre-Test)	1.5990	57	.27191	.03602
	Engagement Scale (Post-Test)	2.5915	57	.46168	.06115
Pair 2	Motivation Scale (Pre-Test)	1.3333	57	.33068	.04380
	Motivation Scale (Post-Test)	2.4561	57	.57378	.07600
Pair 3	Teaching and Learning Outcome (Pre-Test)	2.9323	57	.53203	.07047
	Teaching and Learning Outcome (Post-Test)	5.0476	57	.92885	.12303

The sample size for year one respondents was 57 students. Participants’ level of engagement increased from pre-intervention (M = 1.5990) to post-intervention (M = 2.5915) representing an approximately 1-point increase in mean scores. There was also an increase in the standard deviation from a pretest figure of 0.27191 to a post-test figure of 0.46168, signifying a wider variability amongst respondents’ scores.

For motivation, the participant level increased from a pre-intervention mean score of 1.3333 to a post-intervention mean of 2.4561. This represents a greater 1-point increase in mean scores. The standard deviation of scores

also showed an increase, signifying a wider variation in test scores (Pre-intervention SD = 0.33068; Post intervention SD=0.57378).

The intervention also resulted in an increase in scores in relation to teaching and learning outcomes. The preintervention mean score was 2.9323 and the post-intervention score jumped to 5.0476. Additionally, as was the trend, the standard deviation also increased from 0.53203 to 0.92885.

Therefore, the trend was an increase in mean scores across the 3 variables with an increase in the standard deviation of scores.

Table 4.2: Paired T-test for Year One on Zaara Hybrid model

Paired Samples Test		Paired Differences					t	Df	P-value
Pair	Variables	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Engagement Scale	0.99	0.502	0.665	0.859	1.126	14.94	56	<0.001
Pair2	Motivation Scale	1.12	0.686	0.091	0.941	1.305	12.36	56	<0.001
Pair 3	Teaching and Learning Outcome	2.12	1.046	0.139	1.838	2.393	15.27	56	<0.001

The statistical difference between the two means for engagement scale $t(56) = 14.93, p < .001$ while for motivation is $t(56) = 12.36, p < .001$ which shows there is a statistical difference between the ‘before’ and ‘after’ the intervention. The overall (teaching and learning) results $t(56) = 15.27, p < .001$ indicate significant improvements in engagement and motivation following the intervention, with all p-values less than 0.001, demonstrating the effectiveness of the intervention.

CONCLUSIONS

The Fibre and Fabrics Section of the Department of Indigenous Art and Technology, KNUST, should consider incorporating Macramé instruction via interactive multimedia videos into their teaching to enhance effective teaching and understanding to ensure that graduates are on par with established Macramé professionals, thus bridging existing knowledge gaps. In the long term, the Ministry of Education should encourage and support the Commission for

Technical Vocational Education and Training to introduce specific courses or units in their programs that expose prospective educators to Macramé and other innovative approaches, addressing the needs of today's diverse learning environments. While the study may not have explicitly measured student engagement and the DIY approach, the interactive multimedia video itself aligns with the principles of self-directed learning. Therefore, future studies can incorporate engagement metrics, such as tracking student interaction with multimedia content or gathering student reflections on their DIY experiences.

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Conflict of Interests

The authors declare that they have no competing interests.

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