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# ANALYSIS OF CONVENTIONAL METHOD OF TEACHING STUDIO-BASED PRACTICAL CLAY COURSES IN HIGHER EDUCATION DURING COVID-19

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## ABSTRACT

*The study examined the switch to online teaching of practical clay courses in Ghana during the COVID-19 pandemic. The aim of the study was to analyze traditional teaching methods and their impact on motivation, interest, digital literacy, self-regulation and task difficulty. Using a mixed methods design, the study collected quantitative data through 148 student questionnaires and qualitative findings from interviews with six class representatives. A five-point Likert scale (1= strongly disagree, 2=disagree, 3= no opinion, 4= agree, 5= strongly agree) was used to express the construct measurement. Results showed that studio-based clay instruction was challenged by technological advances and lack of physical interaction during lockdown. Students showed little interest in online practical activities and experienced stress and anxiety. There is a necessity for pedagogical reforms and recommended adopting online methods for teaching clay courses to ensure academic continuity and better adaptation to future crises.*

**Keyword:** *Online education, Clay courses, COVID-19, Pedagogical reforms, Digital literacy, Ghana*

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## INTRODUCTION

The COVID-19 pandemic disrupted global education systems, necessitating a swift transition to remote learning (Toueir, 2021). Universities worldwide, including those in Ghana, faced significant challenges as they shifted from traditional in-person instruction to online platforms (Nzimande, 2021). Studio-based disciplines, particularly clay courses, struggled with this transition due to their hands-on nature, which traditionally relies on physical presence in studio environments for skill acquisition (Domenico Cucinotta, 2020).

Studio-based learning is rooted in collaborative, student-centered, problem-based pedagogy (Demirkan, 2008). The studio setting facilitates interactive engagement between lecturers and students, fostering active participation and hands-on learning. Traditional clay instruction encompasses various techniques such as throwing, slab building, pinching, and coiling, all of which require direct manipulation of ceramic raw materials. The shift to online learning disrupted these processes, creating challenges in skill acquisition, engagement, and overall academic performance. Educational resilience, defined as the ability of a system to adapt to challenges while maintaining its core functions, became crucial in navigating these disruptions (Robinson, 2023). Resilient teaching strategies incorporate hybrid models, digital tools, and flexible instructional design to ensure continuity in education (Mokhtar, 2023). However, the digital divide in Ghana exposed disparities in access to technology, internet connectivity, and digital literacy, further complicating the adaptation of studio-based courses (Owusu-Fordjour, 2020).

Key factors influencing students' academic performance in studio-based clay courses include motivation, course interest, digital literacy, self-regulatory learning, and task difficulty (Glatthorn, 2005). Motivation plays a critical role in students' engagement and learning outcomes, as it drives persistence and effort (Alizedah, 2016). Course interest, influenced by instructional design and accessibility, impacts student retention and performance (Fryer, 2015). Digital literacy, defined as the ability to navigate and utilise digital tools effectively, is essential in adapting to online learning environments (Gilster, 1997). Self-regulatory learning, which involves goal setting, self-monitoring, and adaptive strategies, enhances academic success in virtual settings (Cazan, 2012). Task difficulty, shaped by the complexity of learning activities, can either motivate or hinder student engagement (Sadia, 2020).

### Students' Motivation

Motivation plays a critical role in students' engagement and learning outcomes, as it drives persistence and effort (Alizedah, 2016). In studio-based clay courses, students are often intrinsically motivated by their passion for creative expression and hands-on engagement. However, the shift to online learning diminished these intrinsic motivators, making it essential to incorporate extrinsic motivators such as structured feedback, digital collaboration, and hybrid instructional models to sustain student engagement.

### Course Interest

Course interest, influenced by instructional design and accessibility, impacts student retention and performance (Fryer, 2015). The practical nature of clay courses makes student engagement highly dependent on physical interaction with materials. The introduction of digital simulations, recorded demonstrations, and interactive online discussions can help maintain students' interest, even in remote learning settings.

### Digital Literacy

Digital literacy, defined as the ability to navigate and utilise digital tools effectively,

is essential in adapting to online learning environments (Gilster, 1997). Students in studio-based courses require digital competencies not only for communication but also for accessing instructional content and using digital design software that supplements hands-on techniques. Limited digital literacy can hinder students' ability to effectively engage with online learning platforms and digital tools essential for their coursework.

## Self-Regulatory Learning

Self-regulatory learning, which involves goal setting, self-monitoring, and adaptive strategies, enhances academic success in virtual settings (Cazan, 2012). In studio-based learning, students must develop self-discipline and time management skills to practice techniques independently. Structured online support, peer feedback, and virtual mentorship programs can enhance students' self-regulatory skills, ensuring continued learning even in remote environments.

### Task Difficulty

Task difficulty, shaped by the complexity of learning activities, can either motivate or hinder student engagement (Sadia, 2020). In clay courses, mastering techniques such as throwing or slab construction requires sustained practice. The transition to online learning made task completion more challenging, requiring educators to design alternative assignments that balance feasibility with skill development.

## Students' Academic Performance

Academic performance in studio-based courses is influenced by multiple factors, including motivation, course interest, digital literacy, self-regulatory learning, and task difficulty. The interplay of these factors determines how well students adapt to learning disruptions and their ability to achieve learning objectives. Effective online instructional strategies that integrate digital tools, hybrid learning models, and structured peer interactions can mitigate negative impacts on academic performance.

## Hypotheses

Based on the theoretical grounding and previous findings, the research proposed five hypotheses as follows: :

Hypothesis 1 (H1). Student motivation influenced and impacted the outcome of student's academic performance in studio-based clay courses.

Hypothesis 2 (H2). Course interest had a positive influence on students' academic performance in studio-based clay courses.

Hypothesis 3 (H3). Digital literacy had an influence and impact on students' academic performance

Hypothesis 4 (H4). Self-regulatory learning influences students' academic performance for academic purposes.

Hypothesis 5 (H5). Task difficulty influenced students' academic performance

## Conceptual Framework

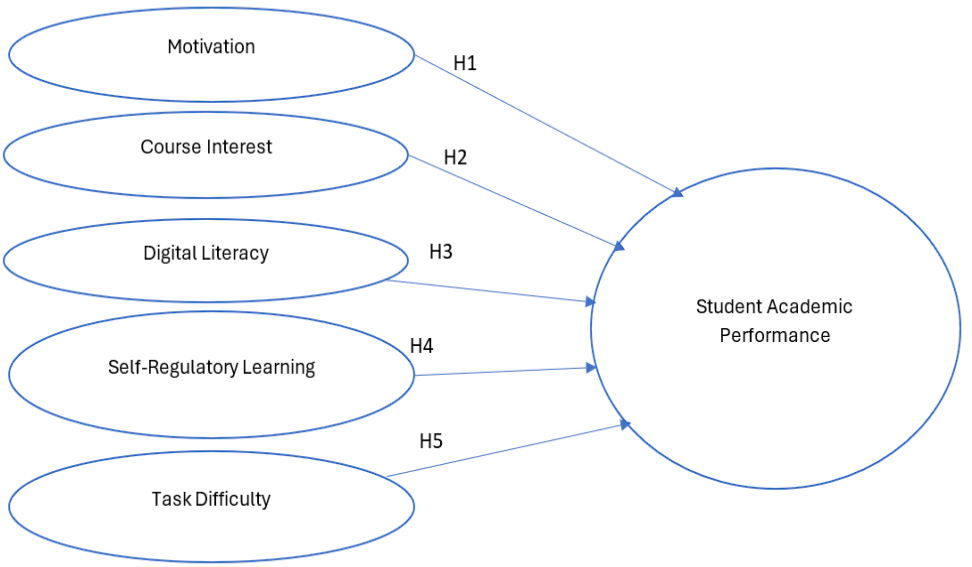



**Figure 1. Conceptual framework**

The conceptual framework includes variable such as students' motivation, course interest, digital literacy, self-regulatory learning and task difficulty was used as scales to measure and to test the learning outcome of the students' academic performance. The major actors in the framework are the students study studio-based clay course in tertiary institutions. Lecturers demonstrate the forming technique to students on the potter's wheel in the studio and after, allows student to try their hands on the process.

Students go through the studio-based clay course by choosing a project executed by groups or individually. Learning objectives, tasks, resources, and evaluations for students were all centred on helping them develop precisely defined skill sets that are relevant to their future careers. To verify the validity of the conceptual framework that links students' academic performance, the study carried out a mixed approach which combines analysis of quantitative and qualitative data. As indicated in the Figure.1, students' motivation, course interest, digital literacy, self-regulatory learning and task difficulty was tested to analyse the conventional method of teaching studio-based practical clay courses. Students' academic performance is the dependent variable. The unique aspect of the study was that the variables were applied to test students' academic performance immediately after the pandemic whereby online teaching at the tertiary level was the only channel available.

This study examines the impact of these variables on students' academic performance in studio-based clay courses during the

COVID-19 pandemic. It explores the effectiveness of online learning adaptations, identifies barriers to digital engagement, and proposes strategies to enhance studio-based instruction in virtual settings. The findings aim to contribute to the development of resilient educational frameworks that support skill-based disciplines in times of crisis.

**Methods and Procedures**

The various instruments that were adopted and used for data collection includes observation, questionnaires and interview. The study was limited geographically to four tertiary institutions in Ghana, who offered studio-based clay courses. A total of 154 students of studio-based clay course participated in this study. There were two sections to the questionnaire. The demographic profile questions, which included gender, age, and institution, were in the first section.

The five latent variables, which were assessed using a 5-point Likert scale, were represented by 30 items or indicators in the second section. Constructs that needed to be measured for a quantitative analysis were included in the questionnaire. Items used for construct measurements were stated using a five-point Likert scale that was established as follows: 1= strongly disagree, 2=disagree, 3= no opinion, 4= agree, 5= strongly agree.

The questionnaire included five major constructs in addition to demographic data: which was tested to know its impact on students learning performance. Google Form was used for the questionnaire design, while the items were distributed randomly to avoid bias. The study used qualitative data collected through interviews that was undertaken on purpose with all class representatives of the selected tertiary institutions to have a better understanding of how the COVID-19 pandemic has affected their learning and students' academic performance. Due to their prior experience with both face to face and virtual learning environments before and after the lockdowns, the study selected these class representatives and students as the best candidates for responding to the research questions.

Snowballing was a technique used to gain access to some students in which possible participants were asked to recommend other potential participants who the researcher did not know about. Accordingly, the results were based on the opinions of a relatively small number of willing clay class representatives. Participants had firsthand experience with the practical aspect of the studio-based clay course. Secondly, the research's conclusions were limited to the tertiary educational institutions surveyed.

Thirdly, the study synthesized the viewpoints of six studio-based clay class representatives and represented the sample group's observations regarding the theory and practice gaps they shared. Lastly, the outcomes were not meant to represent the curriculum and teaching methods of all studio-based clay courses; rather, they were influenced by particular practices that were observed for this study at the selected tertiary institutions in Ghana studying studio-based clay courses.

## Population and sampling

*T*he target population for the study comprised second-year students enrolled in studio-based clay courses. A total of 154 students participated in the study, selected through purposive sampling to ensure a representation of students with experience in both in-person and online learning environments. This selection criterion was essential in capturing students' perspectives on how digital adaptation influenced their learning outcomes.

**Table 1. Population**

| Target Population | Target population | Accessible Population |
|---|---|---|
| *Class representatives of the various tertiary institutions* | *6* | *6* |
| *Students of University of Education, Winneba* | *44* | *41* |
| *Students of Takoradi Technical University* | *4* | *4* |
| *Students of Dr. Hilla Limann Technical University* | *5* | *5* |
| *Students of Kwame Nkrumah University of Science and Technology* | *100* | *98* |
| **Total** | **159** | **154** |

Purposive sampling was employed to ensure that participants were specifically chosen based on their relevance to the research. This approach enabled a focused investigation without involving the entire student population, thus optimising time and resources while ensuring a representative sample. The study specifically targeted students enrolled in studio-based clay courses at selected tertiary institutions, as they were best positioned to provide valuable data on learning adaptation, engagement, and instructional effectiveness. The criteria for selection were aligned with Kusi (2012), who defines sampling as the process of selecting subjects from a population to generate findings applicable to the entire group. A small number of students (three from UEW and two from KNUST) were excluded due to inconsistent responses, ensuring data integrity.

The final study sample consisted of 148 students and 6 class representatives, which is considered statistically representative of the population. Given the study's focus on digital adaptation, topics under studio-based clay courses were selected purposively, with an emphasis on those aimed at developing computational thinking skills. This deliberate selection ensured that the research captured essential aspects of how students navigated learning challenges in both traditional and digital environments.

## The Sources of Data Collected

This relates to the kind of data the researcher gathered and the methods by which they were examined to get the study's conclusions. For this study, two categories of data were gathered. The research employed both primary and secondary data. Directly gathered data are considered primary data collected from source.

The primary data included information that were collected from the lecturers and students of the selected clay course tertiary institutions in Ghana with the aid of observation, questionnaire and interview as data collection tools. Secondary data is data collected from books, lecture notes, slide presentations, previously released materials, including academic records from students, conference proceedings, online resources, and course outline of the clay programme.

## Data Collection

A combination of structured questionnaires, classroom observations, and semi-structured interviews was employed to gather comprehensive data.

A structured questionnaire was developed based on insights from the literature review, consisting of two sections: demographic data and variables related to student motivation, course interest, digital literacy, self-regulatory learning, and task difficulty. Responses were measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaire was administered online via Google Forms to facilitate immediate response collection. Out of 153 distributed questionnaires, 148 were successfully retrieved, ensuring a high response rate.

Observations were conducted to validate student responses and gain deeper insights into the learning process. Using a checklist adapted from Kawulich (2012), the researcher documented instructional strategies, engagement levels, and student interactions. Observations focused on non-verbal cues, participation levels, and challenges faced in clay-based instruction to supplement the questionnaire findings.

Additionally, semi-structured interviews were conducted with six class representatives from the selected institutions to explore key themes regarding student motivation, digital adaptation, and academic performance. Interview questions focused on course interest, digital literacy, self-regulatory learning, task difficulty, and overall evaluation of academic performance. The researcher used follow-up questions where necessary to ensure clarity and depth in responses.

**Table 4. Copies of questionnaire administered, and the number retrieved**

| Students | Questionnaire Administered | No. Retrieved |
|---|---|---|
| *University of Education, Winneba* | *44* | *41* |
| *Takoradi Technical University* | *4* | *4* |
| *Dr. Hilla Limann Technical University* | *5* | *5* |
| *Kwame Nkrumah University of Science and Technology* | *100* | *98* |
| **Total** | **153** | **148** |

## RESULTS

A total of 148 students of studio-based clay courses completed the survey. Demographic data in terms of gender, age and institution were as follows:

102 Males and 46 Females from Kwame Nkrumah University of Science and Technology, Dr. Hilla Limann Technical University, Takoradi Technical University and University of Education, Winneba.

## Descriptives analysis of variables

**Descriptives**

| | Mean | SE | Median | SD | Variance | IQR | Range | Minimum | Maximum | Skewness | SE | Kurtosis | SE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Motivation Factor* | *19.0* | *0.410* | *20.0* | *4.98* | *24.8* | *7.00* | *20.0* | *5.00* | *25.0* | *-1.010* | *0.199* | *0.305* | *0.396* |
| *Digital Literacy factor* | *18.1* | *0.363* | *19.0* | *4.42* | *19.5* | *4.00* | *20.0* | *5.00* | *25.0* | *-1.059* | *0.199* | *1.676* | *0.396* |
| *Task Difficulty Factors* | *18.5* | *0.360* | *20.0* | *4.38* | *19.2* | *4.00* | *20.0* | *5.00* | *25.0* | *-1.097* | *0.199* | *1.211* | *0.396* |
| *Course Interest Factors* | *17.1* | *0.419* | *18.0* | *5.10* | *26.0* | *8.00* | *20.0* | *5.00* | *25.0* | *-0.436* | *0.199* | *-0.431* | *0.396* |
| *Self-Regulatory Learning Factors* | *23.5* | *0.436* | *24.0* | *5.31* | *28.2* | *5.00* | *24.0* | *6.00* | *30.0* | *-1.263* | *0.199* | *1.720* | *0.396* |
| *Academic Performance* | *15.8* | *0.300* | *16.0* | *3.65* | *13.3* | *3.25* | *16.0* | *4.00* | *20.0* | *-1.243* | *0.199* | *1.567* | *0.396* |

*SE= Standard Error, SD=Standard Deviation, IQR=Inter Quartile Range*

**Table 2 describes the score analysis of various**

variables in relation to sociodemographic traits. Males had higher mean 19.4 (±4.77) in relation to their motivational action than that of the females 17.9 (±5.48). For Digital Literacy, females had a mean score of 16.6 (±5.11) compared to males with 18.6 (±4.05). Task Difficulty scores were 17.8 (±4.42) for females and 18.8 (±4.36) for males. Course Interest scores were lower for females at 15.3 (±4.73) than males at 17.7 (±5.09). In Self-Regulatory Learning, females scored 22.4 (±5.65), while males scored 23.9 (±5.6). Academic Performance showed females with a mean of 14.8 (±3.49) and males with 16.2 (±3.65). Statistical tests indicated significant differences in Digital Literacy (p=0.016), Course Interest (p=0.010), and Academic Performance (p=0.045) between genders

**Table 2. Score Analysis of Students Learning Experience and Academic Performance**

| Variables | Levels | Motivation m (±SD) | Digital Literacy m (±SD) | Task Difficulty m (±SD) | Course Interest m (±SD) | Self-Regulatory Learning m (±SD) | Academic Performance m (±SD) |
|---|---|---|---|---|---|---|---|
| *Gender* | *Female* | *17.9(5.48)* | *16.6(5.11)* | *17.8(4.42)* | *15.3(4.73)* | *22.4(5.65)* | *14.8(3.49)* |
| | *Male* | *19.4(4.77)* | *18.6(4.05)* | *18.8(4.36)* | *17.7(5.09)* | *23.9(5.6)* | *16.2(3.65)* |
| | *t/F; p* | *-1.62; 0.106* | *-2.43; 0.016* | *-1.23; 0.222* | *-2.61; 0.010* | *-1.50; 0.137* | *-2.02; 0.045* |
| *Age* | *Below 20 years* | *18.1(4.45)* | *17.8(4.21)* | *18.4(4.20)* | *16.6(5.04)* | *23.6(4.42)* | *15.4(3.24)* |
| | *21 – 25 years* | *18.9(5.56)* | *17.8(4.75)* | *18.3(4.77)* | *16.9(5.44)* | *22.9(6.25)* | *15.7(4.13)* |
| | *26 – 30 years* | *22.8(1.36)* | *20.8(2.70)* | *20.5(2.50)* | *18.9(2.84)* | *28.8(2.58)* | *17.6(2.29)* |
| | *Above 30 years* | *20.7(3.78)* | *18.7(3.78)* | *19.3(3.88)* | *19.3(4.68)* | *26.2(2.48)* | *17.7(1.97)* |
| | *t/F; p* | *17.30; <.001* | *4.04; 0.021* | *2.47; 0.091* | *2.06; 0.137* | *4.24; 0.016* | *3.93; 0.022* |
| *Institution* | *Dr. Hilla Limann Technical University* | *24.2 (1.10)* | *18.2(3.56)* | *21.2(2.39)* | *22.4(1.67)* | *28.2 (1.30)* | *18.0(1.41)* |
| | *KNUST* | *18.0(5.02)* | *17.7 (4.77)* | *18.1 (4.75)* | *15.9 (5.12)* | *22.6 (5.71)* | *15.4 (3.95)* |
| | *Takoradi Technical University* | *20.8 (1.26)* | *18.5 (3.70)* | *22.3 (2.50)* | *22.8 (1.50)* | *28.3 (1.50)* | *17.0 (1.41)* |
| | *University of Education Winneba* | *20.7 (4.62)* | *19.0 (3.62)* | *19.0 (3.44)* | *18.6 (4.39)* | *24.6 (4.01)* | *16.5 (3.03)* |
| | *t/F; p* | *23.541; <.001* | *0.832; 0.509* | *4.355; 0.034* | *24.376; <0.001* | *18.506; <0.001* | *3.923; 0.039* |

**M= Mean, SD= Standard Deviation**

This table presents a comprehensive analysis of various academic factors across different sociodemographic traits, including gender, age, and institution. With gender, the data shows higher scores for male students. Males score higher in all categories, with statistically significant differences in digital literacy (p=0.016), course interest (p=0.010), and academic performance (p=0.045). This suggests a gender gap in these areas with males having a higher or greater advantage. There is a general trend of older students performing better across most categories. The 26-30 age group consistently shows the highest scores, with statistically significant differences in motivation (p<0.001), digital literacy (p=0.021), self-regulatory learning (p=0.016), and academic performance

(p=0.022). This might indicate that mature students bring more focus and self-regulation to their studies. Institutional differences are notable across all factors. Dr. Hilla Limann Technical University and Takoradi Technical University generally show higher scores compared to KNUST and University of Education Winneba. Statistically significant differences are observed in motivation (p<0.001), task difficulty (p=0.034), course interest (p<0.001), self-regulatory learning (p<0.001), and academic performance (p=0.039). This suggests that institutional factors, such as teaching methods, resources, or student support systems, plays a crucial role in student outcomes.

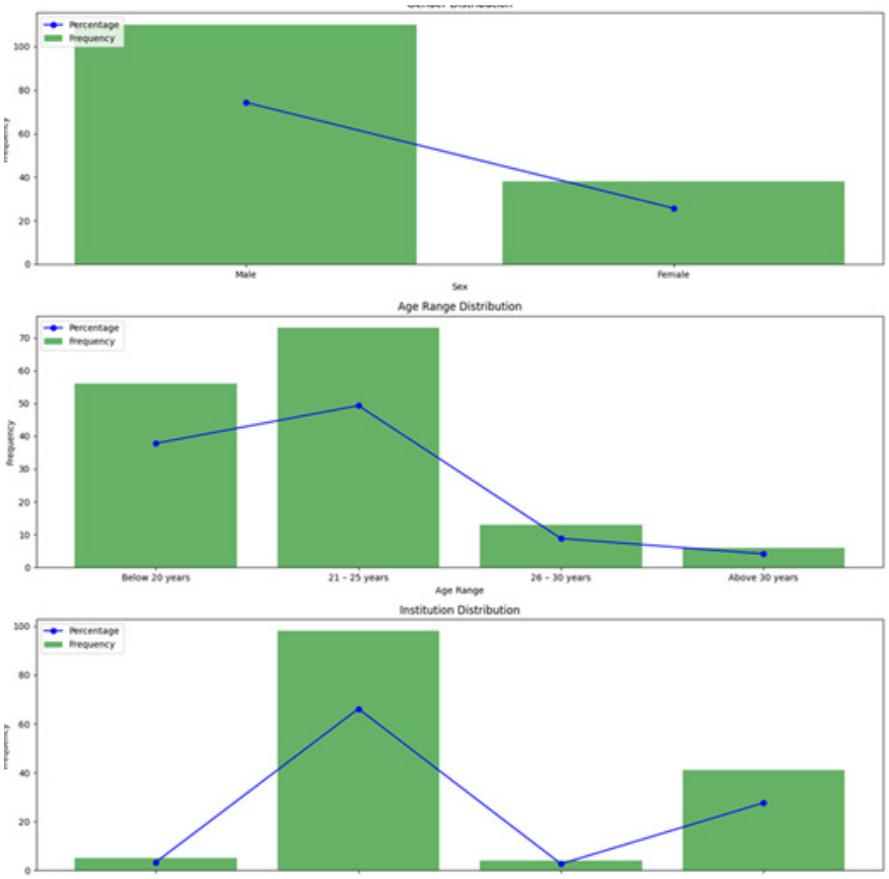
The data reveals interactions between demographic factors and academic performance. For instance, while males generally outperform females, older students tend to perform better regardless of gender. Institutional differences appear to have a strong influence across all age groups and genders.

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**Table 3. Characteristics of the participants**

| **Variables** | | **F (%)** |
|---|---|---|
| *Sex* | *Male* | *110 (74.3)* |
| | *Female* | *38 (25.7)* |
| *Age* | *Below 20 years* | *56 (37.8)* |
| | *21 – 25 years* | *73 (49.3)* |
| | *26 – 30 years* | *13 (8.8)* |
| | *Above 30 years* | *6 (4.1)* |
| *Institution* | *Dr. Hilla Limann Technical University* | *5 (3.4)* |
| | *Kwame Nkrumah University of Science and Technology* | *98 (66.2)* |
| | *Takoradi Technical University* | *4 (2.7)* |
| | *University of Education Winneba* | *41 (27.7)* |

**Note: f = Frequency, %= Percentage**




| *Dr. Hilla Limann Technical University* | *Kwame Nkrumah University of Science and Technology* | *Takoradi Technical University* | *University of Education Winneba* |
|---|---|---|---|

The demographic data reveals gender distribution with more males than females, comprising roughly 75% of the sample, while females represent only about 25%. Age-wise, the population is predominantly young, with the 21-25 year age group being the largest at approximately 50%, followed closely by those below 20 years at around 40%. Older students aged 26-30 and above 30 make up much smaller portions, at about 8% and less than 5% respectively, reflecting a typical undergraduate age distribution. Institutionally, there's a clear dominance of Kwame Nkrumah University of Science and Technology (KNUST), representing about 65% of respondents, followed by the University of Education Winneba at roughly

30%. Dr. Hilla Limann Technical University and Takoradi Technical University have minimal representation, each accounting for less than 5% of the sample. This data paints a picture of a predominantly male, young adult student population, heavily weighted towards KNUST. These demographic imbalances, particularly in gender and institutional representation, should be carefully considered when

interpreting any broader findings from this sample, as they may not fully represent the wider student population in Ghana.

## Analysis of Variance

**One-Way ANOVA (Welch's)**

| | F | df1 | df2 | p |
|---|---|---|---|---|
| *Motivation Factor* | *23.541* | *3* | *14.44* | *<.001* |
| *Digital Literacy factor* | *0.832* | *3* | *9.13* | *0.509* |
| *Task Difficulty Factors* | *4.355* | *3* | *9.86* | *0.034* |
| *Course Interest Factors* | *24.376* | *3* | *12.42* | *<.001* |
| *Self-Regulatory Learning Factors* | *18.506* | *3* | *13.35* | *<.001* |
| *Academic Performance* | *3.923* | *3* | *11.30* | *0.039* |

**Group Descriptives**

| | Institution | N | Mean | SD | SE |
|---|---|---|---|---|---|
| *Motivation Factor* | *Dr. Hilla Limann Technical University* | *5* | *24.2* | *1.10* | *0.490* |
| | *KNUST* | *98* | *18.0* | *5.02* | *0.507* |
| | *Takoradi Technical University* | *4* | *20.8* | *1.26* | *0.629* |
| | *University of Education Winneba* | *41* | *20.7* | *4.62* | *0.721* |
| *Digital Literacy factor* | *Dr. Hilla Limann Technical University* | *5* | *18.2* | *3.56* | *1.594* |
| | *KNUST* | *98* | *17.7* | *4.77* | *0.482* |
| | *Takoradi Technical University* | *4* | *18.5* | *3.70* | *1.848* |
| | *University of Education Winneba* | *41* | *19.0* | *3.62* | *0.565* |
| *Task Difficulty Factors* | *Dr. Hilla Limann Technical University* | *5* | *21.2* | *2.39* | *1.068* |
| | *KNUST* | *98* | *18.1* | *4.75* | *0.480* |
| | *Takoradi Technical University* | *4* | *22.3* | *2.50* | *1.250* |
| | *University of Education Winneba* | *41* | *19.0* | *3.44* | *0.536* |
| *Course Interest Factors* | *Dr. Hilla Limann Technical University* | *5* | *22.4* | *1.67* | *0.748* |
| | *KNUST* | *98* | *15.9* | *5.12* | *0.517* |
| | *Takoradi Technical University* | *4* | *22.8* | *1.50* | *0.750* |
| | *University of Education Winneba* | *41* | *18.6* | *4.39* | *0.686* |
| *Self-Regulatory Learning Factors* | *Dr. Hilla Limann Technical University* | *5* | *28.2* | *1.30* | *0.583* |
| | *KNUST* | *98* | *22.6* | *5.71* | *0.577* |
| | *Takoradi Technical University* | *4* | *28.3* | *1.50* | *0.750* |
| | *University of Education Winneba* | *41* | *24.6* | *4.01* | *0.627* |

**Group Descriptives**

| | Institution | N | Mean | SD | SE |
|---|---|---|---|---|---|
| *Academic Performance* | *Dr. Hilla Limann Technical University* | *5* | *18.0* | *1.41* | *0.632* |
| | *KNUST* | *98* | *15.4* | *3.95* | *0.399* |
| | *Takoradi Technical University* | *4* | *17.0* | *1.41* | *0.707* |
| | *University of Education Winneba* | *41* | *16.5* | *3.03* | *0.474* |

The Analysis of Variance (ANOVA) results reveal significant differences in motivation Factor ($F = 23.541$, $p < .001$), Task Difficulty Factors ($F = 4.355$, $p = .034$), Course Interest Factors ($F = 24.376$, $p < .001$), Self-Regulatory Learning Factors ($F = 18.506$, $p < .001$), and Academic Performance ($F = 3.923$, $p = .039$. Digital Literacy factor ($F = 0.832$, $p = .509$) appears to not show statistically significant difference. There was indication underlining Dr. Hilla Limann Technical University and Takoradi Technical University performance over KNUST and University of Education Winneba across most factors, with KNUST consistently showing the lowest mean scores. This may be due to the highly unequal sample sizes, ranging from 98 students at KNUST to only 4 at Takoradi Technical University.

**Independent Samples T-Test**

| | | Statistic | df | p | Mean difference | SE difference |
|---|---|---|---|---|---|---|
| *Motivation Factor* | *Student's t* | *-1.62* | *146* | *0.106* | *-1.52* | *0.933* |
| | *Welch's t* | *-1.52* | *57.5* | *0.135* | *-1.52* | *0.999* |
| | *Mann-Whitney U* | *1781* | | *0.173* | *-1.000* | |
| *Digital Literacy factor* | *Student's t* | *-2.43* | *146* | *0.016* | *-1.99* | *0.817* |
| | *Welch's t* | *-2.17* | *54.0* | *0.034* | *-1.99* | *0.914* |
| | *Mann-Whitney U* | *1526* | | *0.013* | *-2.000* | |
| *Task Difficulty Factors* | *Student's t* | *-1.23* | *146* | *0.222* | *-1.01* | *0.823* |
| | *Welch's t* | *-1.22* | *63.6* | *0.228* | *-1.01* | *0.829* |
| | *Mann-Whitney U* | *1805* | | *0.209* | *-1.000* | |
| *Course Interest Factors* | *Student's t* | *-2.61* | *146* | *0.010* | *-2.46* | *0.942* |
| | *Welch's t* | *-2.70* | *68.9* | *0.009* | *-2.46* | *0.908* |
| | *Mann-Whitney U* | *1496* | | *0.009* | *-3.000* | |
| *Self-Regulatory Learning Factors* | *Student's t* | *-1.50* | *146* | *0.137* | *-1.49* | *0.995* |

| | | Statistic | df | p | Mean difference | SE difference |
|---|---|---|---|---|---|---|
| *Academic Performance* | *Welch's t* | *-1.43* | *59.7* | *0.158* | *-1.49* | *1.040* |
| | *Mann-Whitney U* | *1752* | | *0.136* | *-1.000* | |
| | *Student's t* | *-2.02* | *146* | *0.045* | *-1.38* | *0.680* |
| | *Welch's t* | *-2.07* | *67.1* | *0.042* | *-1.38* | *0.664* |
| | *Mann-Whitney U* | *1501* | | *0.009* | *-1.000* | |

**Note.** $H_a\ \mu_{Female} \neq \mu_{Male}$

There was a significant difference between genders (t = -2.43, p = 0.016) in terms of digital literacy, with males (M = 18.6, SD = 4.05) scoring higher than females (M = 16.6, SD = 5.11). This suggests that male students in this sample have better digital literacy skills. Course Interest Factors also demonstrate a significant gender gap (t = -2.61, p = 0.010). Males (M = 17.7, SD = 5.09) report higher course interest compared to females (M = 15.3, SD = 4.73). Academic Performance exhibits a significant difference (t = -2.02, p = 0.045), with males (M = 16.2, SD = 3.65) outperforming females (M = 14.8, SD = 3.49). This suggests that male students in this sample are achieving higher academic results.

While not statistically significant, there are notable trends in other factors. Motivation Factor shows non-significant difference (t = -1.62, p = 0.106) favouring males. Non-significant difference (t = -1.23, p = 0.222) in task difficulty, with males reporting slightly higher perceived task difficulty. Self-Regulatory Learning Factors show a non-significant difference (t = -1.50, p = 0.137), with males scoring slightly higher.

**Linear Regression**

**Model Fit Measures**

| | | | | Overall Model Test | | | |
|---|---|---|---|---|---|---|---|
| **Model** | **R** | **$R^2$** | **Adjusted $R^2$** | **F** | **df1** | **df2** | **p** |
| *1* | *0.878* | *0.771* | *0.763* | *95.8* | *5* | *142* | *<.001* |

**Omnibus ANOVA Test**

| | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| *Motivation Factor* | *1.93* | *1* | *1.93* | *0.612* | *0.435* |
| *Digital Literacy factor* | *7.50* | *1* | *7.50* | *2.380* | *0.125* |
| *Task Difficulty Factors* | *27.79* | *1* | *27.79* | *8.816* | *0.004* |
| *Course Interest Factors* | *2.43* | *1* | *2.43* | *0.770* | *0.382* |

**Omnibus ANOVA Test**

| | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| *Self-Regulatory Learning Factors* | *310.39* | *1* | *310.39* | *98.456* | *<.001* |
| *Residuals* | *447.67* | *142* | *3.15* | | |

*Note. Type 3 sum of squares*

**Model Coefficients - Academic Performance**

| Predictor | Estimate | SE | t | p |
|---|---|---|---|---|
| *Intercept* | *0.8298* | *0.7168* | *1.158* | *0.249* |
| *Motivation Factor* | *-0.0370* | *0.0473* | *-0.783* | *0.435* |
| *Digital Literacy factor* | *0.0863* | *0.0559* | *1.543* | *0.125* |
| *Task Difficulty Factors* | *0.1801* | *0.0607* | *2.969* | *0.004* |
| *Course Interest Factors* | *0.0353* | *0.0403* | *0.877* | *0.382* |
| *Self-Regulatory Learning Factors* | *0.4339* | *0.0437* | *9.923* | *<.001* |

## Assumption Checks

**Collinearity Statistics**

| | VIF | Tolerance |
|---|---|---|
| *Motivation Factor* | *2.59* | *0.386* |
| *Digital Literacy factor* | *2.84* | *0.352* |
| *Task Difficulty Factors* | *3.30* | *0.303* |
| *Course Interest Factors* | *1.97* | *0.508* |
| *Self-Regulatory Learning Factors* | *2.51* | *0.398* |

**Normality Test (Shapiro-Wilk)**

| Statistic | p |
|---|---|
| *0.959* | *<.001* |

The model demonstrates a strong fit, with $R^2 = 0.771$, indicating 77.1% of the variance in academic performance explained by predictors. The overall model is highly significant ($F(5,142) = 95.8$, $p < .001$) explaining the effects of the predictors on academic performance. Self-Regulatory Learning Factors emerge as the strongest and most significant predictor ($\beta = 0.4339$, $p < .001$), followed by Task Difficulty Factors ($\beta = 0.1801$, $p = 0.004$) with both showing positive relationships with academic performance. Digital Literacy factor also shows a positive trend ($\beta = 0.0863$, $p = 0.125$), but not statistically significant. Course Interest Factors ($\beta = 0.0353$, $p = 0.382$) and Motivation Factor ($\beta = -0.0370$, $p = 0.435$) do not significantly predict academic performance in this model. The Variance Inflation Factor (VIF) values for predictors are below 5, indicating no severe multicollinearity issues. Shapiro-Wilk test ($p < .001$) suggests a deviation from normality in the residuals.

# RESULTS

This section consists of the presentation of findings in the conventional method of teaching studio-based clay courses during the crisis of Covid 19 pandemic. In March 2020, tertiary institutions that offer studio-based clay courses suspended its lectures for three weeks, and then they started offering classes online. As per the reports of all participants

(n = 6), it was not anticipated that the social distancing measures would persist beyond the 2020 school year.

Nevertheless, as the virus spread throughout the nation and the world, the selected tertiary institutions switched to offering all other courses online except studio-based clay course which became a challenge. The majority of participants emphasized the element of surprise.

This originally resulted in a rearranging of work at various levels, including keeping in touch with their lecturers, selecting communication channels, and even making household adjustments. For almost all students, this was their first experience with online education and, at this initial stage, they received little in terms of guidance from their lecturers. Therefore, the results reflected the opinions of a limited selection of clay class representatives who willingly agreed to take part in the interview. The participants comprised a deliberate subset of clay students enrolled in studio-based clay courses who had firsthand experience with the practical aspects of their curriculum. The research was therefore restricted to the perceptions of six class representatives.

## Motivation for studio-based clay courses

Students expressed enthusiasm due to the practical nature of the course, highlighting the opportunity to create tangible works and learn new skills. Some students appreciated the hands-on approach.

UEW class rep 1 stated that:

*Learning studio-based clay course motivates me because it will allow me to make clay works.*

TTU class rep 1 also affirmed that:

*My preference is to copy my lecturer as he demonstrates skills in teaching clay practical.*

*S*ome participants perceive studio-based learning offers unique advantages. This perception serves as motivating factor, which indicates that students see the relevance of studio-based learning to their education.

*What motivates me is that studio-based clay learning is advantageous for students. I get to see my ideas come to life instead the other courses were we just read from textbooks without have any hands-on experience and the truth is that I'm less enthused about those courses as compared to studio-based clay learning. (UEW class rep 2)*

While some students highlighted enthused, they are when it comes to studio-based clay courses, others highlighted external factors that negatively impact their motivation, and this has to with the closure of the university because of the covid-19 pandemic.

*Now there is no motivation because of the closure of universities. (Dr. H. L. Class Rep.1)*

Despite this challenge befalling the students, some show willingness to study but their resilience is also hindered by the lack of resources.

*I try to learn by planning, but the resources are not available. (KNUST Class Rep.1)*

## Knowledge on the use of digital tools for learning

Several respondents indicated a lack of familiarity and confidence in the usage of digital tools for learning, especially for practical courses.

UEW Class Rep.1 indicated that:

*I understand how to utilize internet tools to research topics, but not to use it for studio practical.*

TTU class rep.1 also confirmed that:

*Understanding how to use online platforms is not taught. The fact that we would need to switch to online learning surprised me.*

This assertion is supported by Dr. H. L. Class Rep.1 who also stated that:

*I don't know how to use computer to learn.*

Also, KNUST class rep.1 stated that:

*It will be difficult for me to use the current online learning tools.*

One respondent expressed scepticism about the quality of online learning and underscored that face-to face education is superior.

*Compared to a face-to-face education, I believe an online course's quality could be lower. (UEW Class Rep.2)*

## Difficulty in the transition to online learning

Students expressed mixed emotions associated with the transition to online learning since it was new to them.

*I had assumed that we could carry on in the classroom, even with masks, sanitizers, and physical distance, among other measures. (UEW Class Rep.1)*

This response indicates that some students were unprepared for the shift to online learning and would have preferred to continue with in-person classes, even with safety measures in place. It suggests a reluctance to fully embrace online learning.

UEW Class Rep.2 also indicated that:

*I'm worried about the future and feel unsafe.*

This assertion was also supported by TTU Class Rep.1:

*That was an extremely terrible and depressing time.*

Some students were worried about how the transition will impact on collaborative learning. The transition showed the concerns about how there was going to be a loss of peer-to-peer learning opportunities in online environment and lack of guidance from lecturers.

*I think some of us will find it difficult to learn from each other for online courses. (KNUST Class Rep.1)*

*The lecturers did not call to teach us on how to learn with computer. (KNUST Class Rep.1)*

Despite the recognition of the challenge of transition, some students expressed willingness to adapt to this change.

*It is difficult to learn online course, but I can learn if I have to. (Dr. H. L. Class Rep.1)*

*I know it's difficult and I have no option but to adapt to this current change (UEW Class Rep.1).*

## Self-Regulation in Learning Studio Sessions

The transition to online learning posed significant challenges, particularly for students in studio-based courses where hands-on practice and face-to-face interactions are integral to the learning experience. The responses from various students illustrate the multifaceted difficulties they encountered.

UEW class rep. 1 expressed that:

*I still recall my initial concerns about using slides to answer questions on throwing. I lost hope. I recognized I would have to reconsider at this point.*

The emotional and cognitive overload from the abrupt shift to online courses was evident in the experience of UEW Class Rep.2, who said:

*You know, we didn't even really have time to consider the many online courses and I am feeling overwhelmed.*

For some students the lack of IT skills proved to be a significant barrier to participating in online learning. TTU Class rep.1 highlighted:

*My luck of IT abilities prevented me from learning even though course plan was already in progress.*

One student lamented the loss of in-person interactions, a vital aspect of studio-based learning.

*Before we would go to the studio, look at students work and ask them how they did it. Now we can't interact in this way (KNUST Class Rep. 2).*

Also, during students' motivation and mental health were also affected, both of which are essential for successful academic self-regulation. These difficulties are highlighted in several student answers.

*The zeal to learn is not there anymore, I just have to wait for COVID 19 to go away (DR. H.L class rep 1)*

similarly, UEW class rep. 2 highlighted that:

You know, we didn't even really have time to consider the many online courses and I am feeling overwhelmed.

Do you think students perform better in online course or in face-to-face academically?

## Students' academic performance in online and face-to-face courses

The transition to online learning brought to light several access and infrastructure issues that significantly impacted students' academic performance. students struggled to participate in online courses due to a lack of computers or poor internet connectivity, especially those in remote areas. This digital divide created unequal learning opportunities and was a significant barrier to educational equity.

UEW class rep 1 stated that:

*Some students were not able to access online lectures due to lack of computer or resided in distant places with poor internet access.*

Also, frequent power outages and disruptions in the electrical supply further hindered students' ability to engage consistently with online learning platforms. This instability caused interruptions during live lectures and difficulties in meeting assignment deadlines. This was confirmed by TTU class rep 1:

*Online learning becomes challenging when there are power outages or disruptions in the electrical supply.*

Courses that required hands-on or practical work, such as those involving studio use, faced substantial setbacks. The closure of essential facilities like the clay studio meant that students could not engage in necessary practical learning activities, leading to poor academic achievement in these disciplines.

DHLTU Class Rep.1 stated that:

*Clay studio was closed so there was no teaching and learning hence poor academic achievement.*

The shift to online learning also had an impact on students' motivation, engagement, and capacity to evaluate their academic progress. The lack of face-to-face contacts between students and teachers caused their desire and work ethic to drop. With no actual classroom to give structure and responsibility, many students found it difficult to remain motivated and engaged.

UEW class rep 2 confirmed that:

*As a result of the pandemic, I believe that students work ethic and motivation significantly decreased, and many of us expressed dissatisfaction*

The general dissatisfaction with the online learning format suggests that it did not meet students' expectations or needs as effectively as face-to-face learning. This dissatisfaction could stem from the lack of personal connection and immediate feedback that traditional classroom settings offer.

KNUST class rep 1 stated that:

*I did not do well academically because of the lockdown.*

The lock down and the following move to online instruction caused a disruption to conventional evaluation techniques. While some students said they received no assessment at all, others claimed they encountered modifications or delays in the evaluation procedure. Uncertainties regarding their academic performance and advancement resulted from this absence of a regular and trustworthy assessment.

## DISCUSSIONS

The present study investigated the influence of five key factors on students' academic performance in studio-based clay courses: motivation, course interest, digital literacy, self-regulatory learning, and task difficulty. Our findings reveal a complex interplay between these factors and academic outcomes, particularly in the context of the COVID-19 pandemic and the subsequent shift to online learning.

Contrary to our expectations, student motivation (H1) did not emerge as a significant predictor of academic performance in our quantitative analysis ($\beta = -0.0370$, $p = 0.435$). This finding contrasts with previous research that has emphasized the crucial role of motivation in academic achievement (Alizedah, 2016); (Borah, 2021). However, our qualitative data offers a more nuanced perspective. Students expressed high intrinsic motivation for the hands-on aspects of studio-based clay courses, aligning with the conceptualization of motivation as energized, directed, and sustained behaviour ( (Borah, 2021). As one UEW class representative stated, "Learning studio-based clay course motivates me because it will allow me to make clay works." This enthusiasm for practical learning suggests that motivation may play a more complex role in academic performance than our quantitative measures captured.

The COVID-19 pandemic emerged as a significant external factor impacting student motivation. As noted by a DHLTU class representative, "Now there is no motivation because of the closure of universities." This finding underscores the importance of considering contextual factors when examining the relationship between motivation and academic performance, particularly in times of crisis or significant educational disruption. Regarding course interest (H2), our quantitative analysis revealed a positive, albeit non-significant, relationship with academic performance. This trend aligns with Fryer and Hiroyuki's (2021) findings of a strong long-term relationship between students' prior domain interest, course interest, and academic outcomes. The qualitative data further supports this, with students expressing a strong preference for the practical, hands-on nature of studio-based clay courses. However, the transition to online learning posed significant challenges to maintaining course interest. As one UEW class representative noted, "Compared to a face-to-face education, I believe an online course's quality could be lower." This sentiment highlights the potential impact of learning modalities on students' course interest and engagement, which may indirectly affect academic performance.

Digital literacy (H3) showed a positive, though not statistically significant, relationship with academic performance. Notably, we observed a significant gender gap in digital literacy scores (male: $18.6 \pm 4.05$, female: $16.6 \pm 5.11$,

p = 0.016), which may have contributed to the observed gender difference in academic performance (p = 0.045). This finding aligns with Claro's (2018) assertion that digital literacy is increasingly crucial for academic success in the current technological landscape. The qualitative data further underscored the challenges students faced in adapting to online learning platforms, particularly for practical courses. As one UEW class representative stated, "I understand how to utilize internet tools to research topics, but not to use it for studio practical." This highlights the need for targeted digital literacy interventions, especially in the context of online and hybrid learning environments for studio-based disciplines.

Self-regulatory learning (H4) emerged as the strongest predictor of academic performance in our study (β = 0.4339, p < .001). This finding strongly supports previous research emphasizing the crucial influence of self-regulatory behaviours on academic achievement, particularly in virtual learning environments (Gonzalez-N, 2021). The ability to plan, monitor, and adjust learning strategies appears to be especially critical in the context of studio-based clay courses, where the transition to online learning posed significant challenges. As one UEW class representative expressed, "You know, we didn't even really have time to consider the many online courses, and I am feeling overwhelmed." This emotional and cognitive overload likely hindered students' ability to effectively self-regulate their learning, contributing to the observed variations in academic performance.

Task difficulty (H5) also showed a significant positive influence on academic performance (β = 0.1801, p = 0.004). This aligns with Yoshinori O's (2018) assertion that when a task is perceived as difficult yet doable, students are more likely to put in effort and persist. However, the qualitative data revealed that the transition to online learning increased the perceived difficulty of clay-forming tasks. As one UEW class representative stated, "I still recall my initial concerns about using slides to answer questions on throwing. I lost hope. I recognized I would have to reconsider at this point." This suggests that while an optimal level of task difficulty can foster engagement and motivation, the sudden shift to online instruction may have pushed some tasks beyond students' perceived capabilities, potentially hindering academic performance.

The lack of engagement or participation in course-related activities, such as pinching, coiling, throwing and hand-building techniques in the clay studio setting during the COVID-19 lockdown, caused the students' disinterest to flare. Additionally gone were the aspects of interpersonal contact, a sense of community, personal relationships, and parental, family, close friend, and lecturer supervision. The same problems went unnoticed because the researcher developed a social bond with the students in the studio setting. Furthermore, a great deal of changes in education have caused students to experience tension, worry, anxiety, and fear. It should be mentioned that anxieties regarding what lies ahead in terms of learning studio-based clay courses might also be brought up while discussing insecurity.

## CONCLUSION

In conclusion, our study provides valuable insights into the complex factors influencing academic performance in studio-based clay courses, particularly in the context of the COVID-19 pandemic and the shift to online learning.

These findings have important implications for educators and administrators in studio-based disciplines. Developing targeted interventions to enhance students' self-regulatory skills, optimizing task difficulty, and addressing digital literacy gaps could significantly improve academic outcomes. Moreover,

strategies to maintain student motivation and course interest in virtual or hybrid learning environments are crucial for ensuring the quality and effectiveness of studio-based clay education in times of crisis or educational transition.

Future research should focus on developing and evaluating such interventions and investigating the long-term impacts of the pandemic on students' motivation, course interest, and learning strategies in practical disciplines. Additionally, exploring the potential moderating effects of gender, cultural background, and prior experience on the relationships between these factors and academic performance could provide further insights for tailoring educational approaches in studio-based courses.

By addressing these complex interrelationships and adapting pedagogical strategies accordingly, educators can better support students' academic success in studio-based clay courses, even in the face of significant educational disruptions.

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