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Using Mobile Learning Application Technology to Enhance the Creativity and Academic Performance of Art Students at A Vocational and Technical College

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Abstract

Purpose of the Study: This study investigates the impact of structured digital engagement using the Xuexitong platform on design creativity, knowledge sharing, cooperative learning, and academic performance among vocational art students. **Research Methodology:** Employing a quasiexperimental design, the research divided a purposively selected sample of 60 students from a Chinese technical college into an experimental group (n=30), which utilized Xuexitong's interactive features for collaborative tasks, and a control group (n=30), which used the platform only for basic functions. Data were collected through pre and posttest surveys and academic assessments. This research applied descriptive/ MLR regression statistically method to analyze the data. **Results:** The results demonstrated a significant improvement ($p < 0.001$) across all measured variables for the experimental group, with notably higher posttest scores compared to the control group. **Conclusion:** The findings indicate that pedagogical integration of interactive digital tools—rather than their mere availability—is crucial for enhancing learning outcomes. The study concludes that structured use of educational platforms like Xuexitong, emphasizing collaborative and applied learning, effectively fosters creativity, knowledge sharing, and academic achievement in vocational art education. These results offer valuable insights for educators seeking to optimize technologyenhanced learning strategies.

Keywords: Structured Digital Engagement; Mobile Learning; Educational Technology; Vocational Art Education; Xuexitong Platform; Design Creativity

1. Introduction

Vocational education is critical for preparing students for industry demands, yet traditional teaching methods often struggle to enhance creativity and innovative thinking, particularly in artrelated fields. These programs tend to prioritize technical skills over fostering the original ideas and problemsolving abilities essential for success in creative industries. This gap creates a need for new pedagogical approaches that can simultaneously support technical learning and creative development. With the widespread adoption of educational technology, mobile learning applications like Xuexitong have emerged as potential tools to address this challenge. However, they are frequently underutilized, with many instructors limiting their use to administrative tasks rather than leveraging their full educational potential.

This study specifically investigates the impact of Xuexitong's educational features on the innovation ability of vocational art students. The application incorporates features rooted in Behavioral Reinforcement Theory, which are designed to enhance engagement and learning retention through progress tracking, interactive exercises, and automated feedback. The research employs an experimental design, comparing an experimental group that uses Xuexitong for structured afterclass design activities, knowledge sharing, and creativity exercises against a

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control group that uses the application for regular study purposes only. The objective is to determine if this active, structured use of the platform's features leads to significant differences in academic performance, design creativity, knowledge sharing, and cooperative learning.

The research is original in its focused application of reinforcement theory to digital creative learning and its direct comparison of two instructional approaches using the same application. It aims to fill a gap in understanding how specific digital learning features influence creativity and learning outcomes in vocational education, an area that has received limited attention compared to broader elearning adoption studies. The findings are expected to provide direct benefits to students by identifying effective digital strategies for skill development, while also offering educators and policymakers empirical evidence to inform teaching strategies and future curriculum reforms that better integrate technology.

Despite its potential contributions, the study acknowledges several limitations. Its findings may be constrained by a short fourweek experimental period, which might be insufficient to capture the longterm effects on creativity. Furthermore, the relatively small sample size of 60 students from a single institution and potential confounding variables like student motivation and instructor teaching styles may affect the results and limit the generalizability of the conclusions, suggesting a need for cautious interpretation of the outcomes within this specific context.

2. Literature Review

2.1 Design Creativity

Design creativity refers to an individual's ability to generate original, novel, and valuable ideas in artistic or designrelated tasks (Fan, 2017). The theoretical background is informed by Constructivist Learning Theory (Piaget, 1950) and Social Learning Theory (Bandura, 1977), which suggest creativity is developed through structured experiences and social interactions (Grawitch et al., 2011). This study is grounded in Behavioral Reinforcement Theory (Skinner, 1957), which posits that structured engagement and feedback mechanisms can reinforce creativitydriven behaviors, a principle supported by research on structured technology use (Fleming et al., 2020; Warren, 2016). Research indicates interactive digital platforms like Xuexitong can enhance creativity by providing collaborative environments and structured creative exercises (Xu et al., 2020; Ferial Khaddage et al., 2016). The effective integration of such app technology is crucial for creating these enriched learning environments (Gröger et al., 2013). Design creativity is measured through a student questionnaire adapted from previous research (Fan, 2017) and an Academic Test evaluating teamwork quality, contribution consistency, and the final project outcome, which reflects the practical application of innovation ability (Zhang et al., 2019).

2.2 Knowledge Sharing

Knowledge sharing involves the exchange of information, insights, and experiences among individuals to enhance collective understanding (Chen & Cheng, 2012). This concept is central to Collaborative Learning Theory (Vygotsky, 1978), which posits that learning occurs through active social interactions and the construction of shared knowledge. Digital platforms like Xuexitong facilitate knowledge sharing through discussion forums and peertopeer feedback systems (Qi & Wang, 2020), leveraging the capabilities of modern app technology (Tiron & Deliu, 2020). Social Learning Theory (Bandura, 1977) further suggests that students learn by observing and interacting with peers, and reinforcing these behaviors through structured digital engagement can enhance collaboration and creativity (Xu et al., 2020), thereby improving the group's collective innovation ability (Sheng et al., 2015). Furthermore, the integrity of shared information in such digital spaces is an important consideration (Lacity & Van de Walle, 2021). Knowledge sharing is measured using a student selfassessment questionnaire and an Academic Test that evaluates a team's performance on collaborative assignments.

2.3 Cooperative Learning

Cooperative learning is an instructional approach where students work in small groups to achieve shared learning objectives (Grawitch et al., 2011). It is based on Vygotsky's (1978) Collaborative Learning Theory, which emphasizes the crucial role of peer interactions in cognitive development. Research indicates that structured cooperative learning improves engagement, problemsolving skills, and knowledge retention (Fan, 2017). Digital tools like Xuexitong support cooperative learning by providing teambased project spaces, interactive discussion boards, and realtime feedback mechanisms, demonstrating the application of teaching technology (Donnelly, 2018; Hoopingarner, 2009). Social Learning Theory (Bandura, 1977) supports the idea that students develop collaborative skills by engaging in shared learning experiences (Qi & Wang, 2020), which can be effectively mediated through digital platforms (Yamazaki, 2019). This variable is measured through a student questionnaire on perceived group work effectiveness and an Academic Test evaluating

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teamwork quality and contribution consistency.

2.4 Difference of Using Xuexitong Application (AfterClass Function)

The utility and impact of the Xuexitong application for afterclass learning are not inherent to the platform itself, but are fundamentally determined by the pedagogical design of its use. A key difference lies in employing the platform for passive information distribution versus structured active collaboration. When used passively, the afterclass function serves as a digital repository where instructors upload materials like lecture notes, readings, or video recordings, and students access them individually. In this model, interaction is minimal, often limited to oneway communication from teacher to student. The platform acts merely as a convenience tool, extending access to resources but failing to leverage its potential to create an interactive learning community outside the classroom. This approach mirrors traditional homework, where the primary cognitive activities are individual consumption and memorization of information.

In contrast, the afterclass function can be transformed into a dynamic and collaborative learning space when used actively. This approach leverages specific features like discussion forums, group workspaces, and peer review tools to create structured tasks that require student interaction. For instance, instead of simply reading a chapter, students could be tasked with collaboratively solving a design challenge in their groups, posting their initial ideas for peer critique, or cocreating a mind map based on the lesson's key concepts. This shifts the cognitive load from passive reception to active knowledge construction, negotiation, and sharing. The "afterclass" period becomes an integral, social extension of the learning process, fostering continuous engagement and developing higherorder skills like critical thinking, creativity, and cooperative problemsolving. The difference, therefore, is not in the tool, but in its application—moving from a static content library to a vibrant, participatory learning environment.

3. Research Method and Materials

3.1 Research Framework

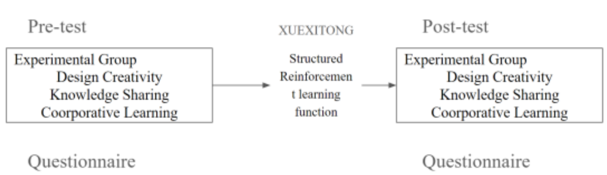

Figure 1: Research Framework

In this study, Xuexitong is a reinforcement tool that encourages students to actively participate in knowledge sharing, creative exercises, and collaborative learning. The organized use of afterclass design activities and interactive discussion boards acts as positive reinforcement, guiding students toward higher engagement and enhanced learning Academic (Sheng et al., 2015). Selfregulated learning behaviors, which are often weak among vocational art students, can be strengthened through consistent digital engagement that fosters habit formation and active participation (Qi & Wang, 2020).

Research indicates that digital reinforcement strategies, such as realtime feedback, automated progress tracking, and interactive assignments, significantly influence student motivation and knowledge retention (Xu et al., 2020). Applying Behavioral Reinforcement Theory, this study determines whether structured digital engagement through Xuexitong enhances students' learning Academic, creative thinking, and collaboration skills

3.2 Research Methodology

This research employs a quantitative approach, gathering data through a structured student survey and a multicomponent academic test to evaluate the intervention's impact. The methodology is framed by Behavioral Reinforcement Theory (Skinner, 1957), assessing whether structured digital engagement reinforces creativity and learning. In a quasiexperimental design, an Experimental Group uses Xuexitong for active, structured learning activities like afterclass design exercises, peer discussions, and collaborative projects. In contrast, a Control Group uses the application only for basic functions like accessing materials and submitting assignments. This controlled comparison aims to isolate the effects of active digital engagement on outcomes.

The academic test itself is a rigorous, 3hour assessment designed to measure design competency through three evaluated sections: Design Principles (20%), Onsite Scheme Design (40%), and Handdrawn Comprehensive Presentation (40%). To ensure validity and minimize bias, the test was graded independently by three instructors using established rubrics, with final scores determined through triangulation (Sheng et al., 2015). This comprehensive assessment provides a standardized measure to analyze differences in design creativity, technical proficiency, and learning

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Academic between the two groups before and after the intervention.

3.2.1 Validity of Research Instruments

Validity ensures that the research instruments accurately measure the intended variables and yield reliable results. This study employs content validity and expert validation methods to confirm the effectiveness of the academic performance tests and questionnaires. The validation process follows a structured expert review, ensuring alignment with educational standards and existing literature. Three educational experts in digital learning, vocational education, and assessment design evaluated the research instruments. The Item Objective Congruence (IOC) method was employed to ascertain content validity.

The validation process comprised multiple steps. First, the instruments were developed based on established validated frameworks. Next, three experts independently assessed each item to evaluate its clarity, relevance, and alignment with research objectives. Items with low consensus among experts were revised or removed to enhance accuracy. Ultimately, pilot testing confirmed that the instruments were clear and practical for the target population.

3.2 Population and Sample

This study focuses on a clearly defined population of vocational art students enrolled in a technical college in China. These students were specifically selected because their designrelated disciplines require the development of high levels of creativity, collaboration, and innovation, which are the core outcomes being measured. Furthermore, a key characteristic of this population is their use of the digital learning platform Xuexitong as part of their standard educational experience. This ensures that the research findings on structured digital engagement are valid and can be generalized to similar vocational education contexts where such technology is already integrated into the curriculum.

From this population, a sample of 60 students was selected using a purposive sampling technique. This method ensured that all participants were actively enrolled in relevant art courses and were existing users of the Xuexitong platform, making them appropriate subjects for the intervention. The sample size of 60 was determined to be statistically sufficient for detecting meaningful differences between groups; this calculation was made using Cochran's formula, based on a total program population of approximately 200 students. The sample was then divided into two equal groups: an experimental group (n=30) that engaged in structured, interactive activities on Xuexitong, and a control group (n=30) that used the platform only for basic, passive functions like accessing materials. This division allows for a robust comparative analysis of how different levels of digital engagement impact learning outcomes.

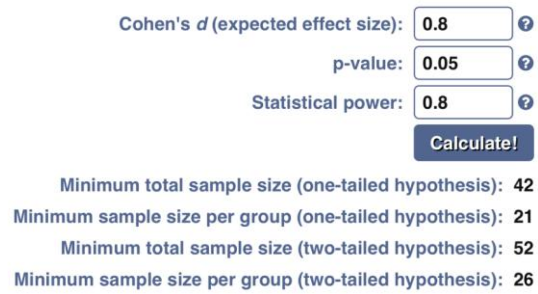

Figure 2: Sample size

Table 1: Sample Size

Category	Total Population	Sample Size (n)
Vocational Art Students	200	60
Experimental class		30
Control class		30

The minimum sample size for experimental class is 26, the research selects 30 student each for the experimental class for control and experimental class.

4. Result and Discussion

4.1 Descriptive Analysis

Table 2: Descriptive Pre Test

Variable Code	Mean	Standard Deviation	Variance
Pre_DC1	3.83	0.874	0.764
Pre_DC2	4.13	0.86	0.74
Pre_DC3	4.17	0.747	0.557
Pre_DC4	3.87	0.776	0.602
Pre_DC5	3.73	0.868	0.754
Pre_KS1	3.97	0.809	0.654
Pre_KS2	3.97	0.85	0.723
Pre_KS3	4.13	0.819	0.671
Pre_KS4	4.03	0.809	0.654
Pre_KS5	4	0.91	0.828
Pre_CL1	4.13	0.86	0.74
Pre_CL2	3.87	0.819	0.671
Pre_CL3	4.07	0.907	0.823

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Variable Code	Mean	Standard Deviation	Variance
Pre_CL4	3.9	0.803	0.645
Pre_LP1	3.87	0.73	0.533
Pre_LP3	4.1	0.803	0.645
Pre_LP4	4	0.871	0.759
Pre_LP5	3.97	0.85	0.723
Pre_CL5	3.73	0.785	0.616
Pre_LP2	4	0.788	0.621

The pretest descriptive results established a baseline for the four core variables, revealing that students began the study with moderately high and relatively homogeneous perceptions across all areas. For Design Creativity (DC), mean scores ranged from 3.73 to 4.17, while Knowledge Sharing (KS) means fell between 3.97 and 4.13, indicating a reasonably strong preexisting sense of peertopeer exchange. Collaborative Learning (CL) means ranged from 3.87 to 4.13, and Learning Performance (LP) from 3.87 to 4.10, suggesting students already had a positive view of collaboration and their academic ability. The relatively low variance and standard deviation values, mostly below 0.90, show that participant responses were consistent, though slightly more diverse perceptions were noted for certain knowledgesharing aspects, as indicated by a higher variance of 0.828 for Pre_KS5.

The posttest descriptive analysis reveals a significant positive shift across all measured variables following the intervention. Mean scores for Design Creativity (DC) rose substantially, ranging from 3.97 to 4.43, indicating enhanced perceived creative capabilities among students. Knowledge Sharing (KS) means increased to a range of 4.27 to 4.47, with decreased variance values suggesting greater consensus among participants regarding improved collaborative exchange. Similarly, Collaborative Learning (CL) means climbed to between 4.10 and 4.47, demonstrating strengthened teamwork skills. The most notable gains were observed in Learning Performance (LP), where posttest means reached up to 4.47, supported by the lowest variance value of 0.395 indicating nearly unanimous perception of improvement. Collectively, these results demonstrate a consistent upward trend across all variables, suggesting that the structured use of Xuexitong's features effectively contributed to enhanced skill development and positive selfperception in vocational art education.

Table 3: Desciptive Analysis (PostTest)

Variable Code	Mean	Standard Deviation	Variance
Post_DC1	4.2	0.714	0.51
Post_DC2	4.27	0.828	0.685
Post_DC3	4.43	0.774	0.599
Post_DC4	4.2	0.805	0.648
Post_DC5	3.97	0.85	0.723
Post_KS1	4.27	0.785	0.616
Post_KS2	4.3	0.75	0.562
Post_KS3	4.47	0.819	0.671
Post_KS4	4.27	0.74	0.547
Post_KS5	4.37	0.765	0.585
Post_CL1	4.47	0.776	0.602
Post_CL2	4.17	0.834	0.695
Post_CL3	4.23	0.774	0.599
Post_CL4	4.3	0.702	0.493
Post_CL5	4.1	0.662	0.438
Post_LP1	4.27	0.785	0.616
Post_LP2	4.4	0.724	0.524
Post_LP3	4.47	0.629	0.395
Post_LP4	4.37	0.718	0.516
Post_LP5	4.13	0.86	0.74

features effectively contributed to enhanced skill development and positive self-perception in vocational art education.

Table 4: Paired Samples T-Test

			statistic	df	p	Mean difference	SE difference
PreDC	PostDC	Student's t	7.35	29	<.001	0.267	0.0363
PreKS	PostKS	Student's t	9.17	29	<.001	0.313	0.0342
PreCL	PostCL	Student's t	8.25	29	<.001	0.313	0.038
PreLP	PostLP	Student's t	9.43	29	<.001	0.34	0.0361

The paired samples ttest results show statistically significant improvements across all four core variables from pretest to posttest, with pvalues less than 0.001 in each case. DC recorded a mean increase of 0.267, with a tvalue of 7.35, indicating a robust effect of the intervention on creativityrelated capabilities. KS showed the largest mean difference of 0.313 (t = 9.17), reflecting that structured peer interaction and knowledgesharing tasks had a particularly strong impact. CL also improved by 0.313 (t = 8.25), suggesting enhanced collaborative learning practices. LP registered the highest mean gain at 0.340 (t = 9.43), implying that improvements in creativity, knowledge exchange, and teamwork translated into tangible academic performance benefits. The consistently high tvalues and small standard errors across variables confirm that these improvements were not due to random variation but rather a systematic effect of the intervention.

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Table 5: Academic Test Score

Score Interval	Performance Level	PreTest Count	PostTest Count	Change
100-85	Excellent	0	6	6
84-75	Good	8	16	8
74-60	Pass	22	8	14

The pretopost analysis clearly indicates that the experimental group achieved meaningful learning gains across all skill dimensions. The observed improvements are not only statistically meaningful but also educationally relevant, as they reflect both conceptual mastery and practical execution—key outcomes for success in designrelated fields. These results align with the descriptive and ttest findings from earlier sections, reinforcing that the instructional intervention yielded comprehensive skill development across theoretical, applied, and presentation domains

5. Conclusion

5.1 Differences in Academic Performance Between Control and Experimental Groups (RQ1)

A significant difference in academic performance was found between the control and experimental groups ($p < 0.001$). The experimental group, which used Xuexitong's structured interactive features—such as collaborative design exercises, peer discussions, and feedback mechanisms—achieved substantially higher posttest scores than the control group, which used the platform only for passive tasks. This confirms that the pedagogical integration of digital tools, rather than their mere availability, drives improved learning outcomes.

5.2 Changes in Experimental Group Across Key Constructs (RQ2)

The experimental group showed statistically significant improvements ($p < 0.001$) across all constructs: design creativity, knowledge sharing, cooperative learning, and academic performance. Collaborative activities like peer critiques and group challenges enhanced creative problemsolving and knowledge exchange. These gains translated into stronger performance in both theoretical understanding and practical application, demonstrating that structured digital engagement fosters synergistic improvements across multiple learning dimensions.

5.3 Extent of Difference in Academic Performance Between Groups (RO1)

The research finding confirms to an overwhelming extent that a significant difference in academic performance exists between the control and experimental groups. The extremely high statistical significance ($p < 0.001$) indicates that the difference is not random but a definitive result of the intervention. The experimental group did not just perform slightly better; they achieved "substantially higher posttest scores." Therefore, the objective is met completely and conclusively, demonstrating that the use of Xuexitong's interactive features causes a profound and significant improvement in academic performance compared to its use for passive tasks alone.

5.4 Extent of Change Across Key Constructs Within the Experimental Group (RO2)

The findings confirm to a full and comprehensive extent that significant changes occurred across all targeted constructs for the experimental group. The improvement was not partial or isolated to one area; it was statistically significant ($p < 0.001$) for every single variable: design creativity, knowledge sharing, cooperative learning, and academic performance. The use of the term "synergistic improvements" indicates that the changes were not merely concurrent but interconnected and mutually reinforcing. Thus, the objective is met completely, demonstrating that using the structured features of the Xuexitong application leads to a profound, synergistic improvement in all measured learning dimensions.

6. Implication for Practice

Based on the most significant outcomes of the study, it is advised that instructors introduce a continuous cycle of goalsetting and feedback within Xuexitong to maintain student motivation. This method builds on students' strong selfdirected learning efforts by encouraging them to set individual goals, monitor their progress through the platform's task functions, and receive formative feedback. In doing so, it reinforces the connection between sustained effort and achievement.

To further strengthen the culture of collaboration, structured peerlearning frameworks should be institutionalized. For instance, rotating peer mentor roles can be introduced, enabling students to take turns leading discussions and sharing expertise. This practice not only develops facilitation skills but also ensures systematic knowledge exchange. Additionally, archiving these shared resources in Xuexitong's repository would create a lasting

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base of collaborative learning and intellectual generosity.

Instructors should also adopt hybrid approaches that combine Socratic dialogue with projectbased learning to maximize engagement. Leveraging Xuexitong's polling and discussion tools to spark problemcentered debates tied to active projects can keep discussions purposeful and inclusive, enhancing conceptual understanding while validating diverse viewpoints.

Finally, the curriculum should incorporate authentic, realworld assessments, such as live client briefs or community design projects. This recommendation builds on students' confidence in applying their abilities and creates an essential feedback loop between academic learning and professional practice. By embedding such tasks, educators ensure the transfer of creativity and knowledge to realworld contexts.

7. Future Study and Limitations

Future research should expand upon this study by increasing the scope and duration of investigation. To enhance the generalizability of the findings, multiinstitutional studies across diverse geographical regions, academic disciplines, and student populations are needed. Furthermore, employing longitudinal designs that track participants over multiple semesters would reveal whether the observed improvements in creativity, knowledge sharing, and cooperative learning are sustained over time and translate into longterm benefits like professional readiness and employability.

Additional research should also focus on understanding the specific mechanisms that drive engagement and learning within digital platforms. This involves using detailed analytics to identify which interaction patterns and platform features—such as gamification or personalized feedback—are most strongly linked to performance gains. Comparative studies between Xuexitong and other international learning platforms would provide valuable evidence to help educators make informed decisions about tool selection and integration, ultimately contributing to bestpractice guidelines for maximizing the pedagogical value of digital learning environments.

One key limitation is the study's timeframe, which lasts only four weeks. Longterm engagement and practice influence Creativity and learning Academic, and a brief experimental period may not adequately capture the longterm effects of using Xuexitong's educational, structured reinforcement features. If the study were extended, students might significantly improve their design creativity and knowledge sharing due to continuous reinforcement and deeper engagement with the learning process.

Differences in institutional teaching styles, student backgrounds, and access to technology could influence how effectively mobile learning applications enhance innovation and learning Academic. External factors, such as student motivation, prior digital learning experiences, and instructor teaching styles, may also be confounding variables. These factors are challenging to control but could affect how students engage with digital learning tools and demonstrate creative advancements

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