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The Main Factors Influencing the Higher-order Thinking Skills of Art Major Students Under the Smart Classroom Environment

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Abstract

A combination of data analysis and questionnaire survey methodologies are used to investigate the relationship between important elements influencing students' learning and the development of students' higher-order thinking skills (HOTS) in a smart classroom setting. For one semester, 120 art majors attended classes in smart classrooms. They answered questions about their preferences for smart classrooms, learning motivation, learning methodologies, peer interaction, and HOTS. The findings demonstrate a direct relationship between students' HOTS and peer interaction and learning motivation. These results indicate that, in order to enhance students' learning outcomes in an intelligent learning environment, educators should concentrate on enhancing peer connection and learning motivation in addition to smart classroom choices and learning tactics.

Keywords

Higher-order thinking skills, Art major, Smart classroom, Peer interaction, Learning motivation.

1. INTRODUCTION

The use of smart classrooms has drawn interest from academics and educators worldwide. In physics, a "smart classroom" is one that incorporates cutting-edge instructional technologies. In addition to offering formal educational learning experiences, this setting goes above and beyond what can be found in regular classrooms and defines the four qualities of smart classrooms. First of all, a smart classroom is a hybrid physical and virtual learning environment that is rich in technology. Personalized learning, group learning, exploratory learning, collaborative learning, mobile learning, and virtual learning are just a few of the educational activities that smart classrooms may facilitate with the help of information and communication technology tools, learning materials, and interactive assistance. Thirdly, in order to make the best possible teaching decisions, smart classrooms have the ability to save, gather, compute, and analyze student data. Fourthly, a smart classroom is an open environment that brings learners into a real learning environment [1]. Additionally, prior research has demonstrated that smart classroom settings can enhance academic achievement, encourage active learning, and increase students' enthusiasm to study. It is currently unknown, nevertheless, how smart classroom settings affect students' higher-order thinking abilities (HOTS).

2. RESEARCH FRAMEWORK

Previous research has explored various factors related to students' skills and knowledge achievements in other learning environments. Generally speaking, key factors that affect students' learning include classroom preferences, learning motivation, learning strategies, and peer interaction. Moreover, this study conducted experiments and surveys with art major students as the research group.

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2.1. Learning environment preferences

Learning environment preference refers to students' perception of a specific learning environment. Therefore, students' preferences for smart classrooms (SCP) are related to their perception of smart classrooms. Multidimensional scaling analysis is the process of locating, analyzing, and categorizing keywords in a low dimensional space in the form of points based on similar or different data between keywords, in order to demonstrate the relationships between each keyword [2]. For instance, it was discovered that in a classroom setting where both student-centered and teacher-centered teaching methods coexist, students' learning outcomes align with their environmental preferences. Additionally, it was found that students' preferences for mobile learning environments are related to HOTS.

2.2. Correlation parameter

learning motivation: Throughout the learning process, learning motivation (LM) encourages people to behave, assisting them in reaching objectives or satisfying needs or expectations.

learning strategy: An arrangement of procedures or actions that support the gathering, storing, and/or application of information is referred to as a learning strategy (LS).

Peer interaction: Peer interaction (PI) is a type of cooperative learning that improves the importance of student-teacher connection and has many positive effects on learning outcomes [3].

2.3. The relational model and hypotheses

After reviewing relevant research, we have come to the conclusion that students' preferences for their learning environment - LM, LS, and PI - can impact their performance in different learning environments, specifically related to skill and knowledge acquisition. Therefore, as depicted in Figure 6.1, we propose that factors such as SCP, LM, LS, and PI may influence students' HOTS during learning in smart classrooms. Our hypothesis is as follows:

Assumption 1 (H1): In a smart classroom environment, there is a positive correlation between SCP level and the degree of HOTS among college students.

Hypothesis 2 (H2): In a smart classroom environment, LM level is positively correlated with the degree of HOTS among college students.

Assumption 3 (H3): In a smart classroom environment, LS level is positively correlated with the degree of HOTS among college students.

Hypothesis 4 (H4): In a smart classroom environment, the PI level is positively correlated with the HOTS level of college students.

Hypothesis 5 (H5): In a smart classroom environment, there is a positive correlation between SCP level and LM level of college students.

Hypothesis 6 (H6): In a smart classroom environment, there is a positive correlation between SCP level and LS level of college students.

Hypothesis 7 (H7): In a smart classroom environment, there is a positive correlation between LM level and LS level of college students. The research model and hypothesis proposed in Figure1.

Hypothesis 8 (H8): The level of SCP will be positively related to the degree of college students' PI within a smart classroom environment.

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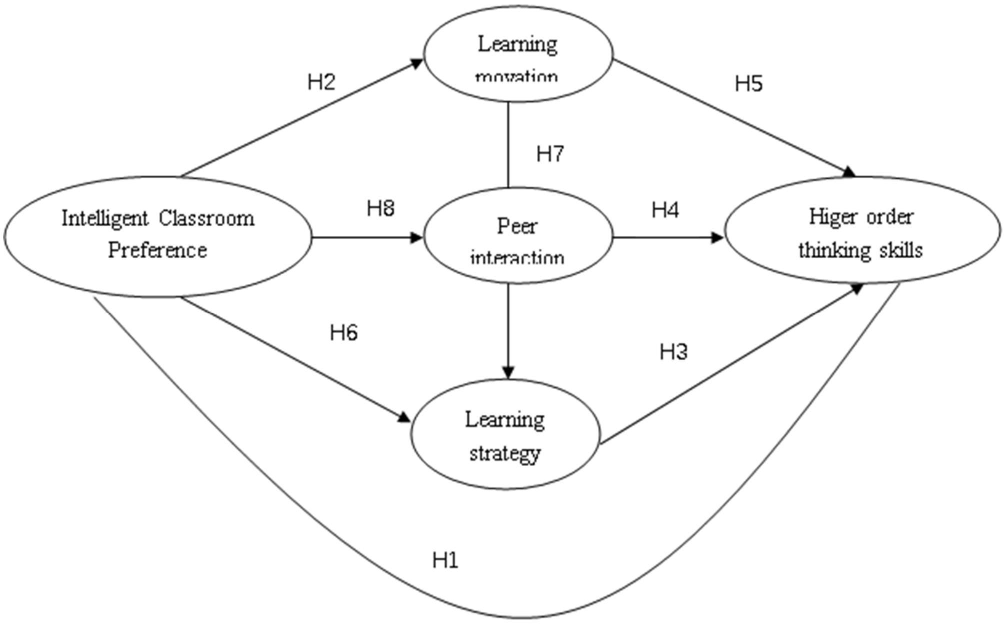

Figure 1. Proposed research model and hypotheses

3. METHOD

3.1. Participants

A survey was conducted on 120 art students from a certain university in China and their sketch courses as research subjects. This course and this university were chosen specifically for two reasons. Firstly, all art majors are required to take sketching, which ensures a sufficient number of samples can be collected. Secondly, the university places a strong emphasis on information technology and has established multiple smart classrooms. All university teachers have the opportunity to learn how to utilize smart classroom technology and are encouraged to apply it in their teaching practices [4].

3.2. Instrument

The measurement and evaluation of higher-order thinking focuses on the measurement and evaluation methods of thinking ability, with quantitative analysis as the main focus. The current framework for evaluating higher-order thinking abilities mainly refers to Bloom's classification of educational goals, Biggs' SOLO classification evaluation, and the International Student Assessment Project PISA test. Wang Yuzhen and others evaluated students' higher-order thinking level based on the PISA2018 reading literacy assessment question, and the Learning Motivation Strategy Questionnaire (MSLQ) to assess students' HOTS, PI, SCP, LM, and LS [5].

3.3. Data collection and analysis

Data was collected at the end of the semester, with the university having approved the study beforehand. The researcher introduced the research objectives to all 120 participants in the absence of the supervisor. ISA2015 and ATC21S measured students' collaborative problem-solving abilities using the "human-machine interaction" method and the "everyone interaction" method, respectively [14]. By conducting research on the assessment of learners' higher-order thinking abilities, a comprehensive and in-depth analysis of students' thinking processes can be conducted, thereby helping teachers assist students in developing their higher-order thinking abilities from a more scientific and reasonable perspective. The survey was administered during recess and subsequently imported into SPSS 22.0 and Smart PLS 3.2.8 for data analysis. The relationship between key influencing factors and student HOTS was analyzed through structural equation modeling [5].

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4. RESULT

4.1. Confirming the measure model

The proposed research model was validated using partial least squares (PLS) method. PLS is suitable for the sample size of this study and is also well-suited for testing theory in the early stages of development. Standardized root mean square residual (SRMR) was introduced as a measure of PLS-SEM goodness of fit, which can be used to avoid model specification errors. Generally speaking, values less than 0.08 are considered a good fit. In this study, the SRMR value of the model was 0.06, therefore, the goodness of fit of the proposed model has been validated as acceptable [6].

The evaluation of the measurement model's determination is based on its reliability, convergence validity, and discriminant validity. As shown in Table 1, the average variance extraction values of all factors exceed 0.6, indicating sufficient convergence validity.

Table 1. Results of the measurement model

	Discriminant validity				
	HOST	LM	LS	PI	SCP
HOTS	0.906				
LM	0.653	0.926			
LS	0.417	0.651	0.936		
PI	0.732	0.301	0396	0.936	
SCP	0.266	0.621	0.343	0.311	0.867

As shown in Table 1, SCP has both direct and indirect effects on LS, with LM mediating the indirect effects. In addition, although SCP has no direct impact on HOTS, there are three indirect paths from SCP to HOTS, with LM, LS, and PI serving as partial mediators, though these interactions may be more difficult for a single entity (such as an organism) to influence than they would be for multiple entities. In fact, some authors have suggested that LC. In addition, LM has both direct and indirect effects on HOTS. The path from LM to HOTS reflects indirect effects through LS and PI, indicating that the combination of LS and PI can also regulate the relationship between LM and HOTS.

5. DUCESSION

This research shows that in the smart classroom environment, PI and LM are directly related to the HOTS of art majors. This result can be interpreted as smart class is a student-centered learning environment. It can be seen that PI and LM are the two main factors affecting students' enthusiasm for learning in smart classrooms. The findings suggest that in smart classroom environment teachers, teachers should work to improve students' PI and LM to improve students' HOTS [7].

Table 2. Analysis of indirect and total effects between key factors

	Patch	Effect value	Account
Direct effect	SCP-HOTS		0.00
Indirect effect	SCP-LM-HOTS	0.124	0.232
	SCP-LS-PI-HOTS	0.057	
	SCP-LM-LS-PI-HOTS	0.0051	
Total effect			0.232

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The finding that SCP does not directly affect HOTS aligns with prior research. Previous studies have shown that students' preference for a mobile learning environment indirectly impacts HOTS through student interaction. This outcome can be attributed to the fact that HOTS reflects students' learning outcomes, which are directly linked to cognitive activities. This discovery suggests that the research was carried out in a smart classroom setting, which differs from previous learning environments. In smart classrooms, students are more engaged in independent learning activities. The link between students' LS and their PI means that LS indirectly influences HOTS through PI. This study also revealed that SCP has a positive influence on LM and LS, with LS significantly impacting PI. Additionally, the connection between SCP and HOTS hinges on learning motivation, the combination of learning motivation, strategies, and peer interaction, as well as the combination of learning strategies and peer interaction.

6. DUCESSION

Given the significance of Higher Order Thinking Skills (HOTS) and the widespread adoption of smart classrooms in higher education, it's crucial to explore the correlation between HOTS and the primary factors influencing art students' learning in a smart classroom setting. To address this, the study introduces a research model and employs a survey to gather data from 120 art majors with prior experience in smart classroom environment. Using structural equation modeling analysis method, this paper probes into the relationship between four key factors (SCP, LM, LS and PI) that affect the learning of art majors and students' HOTS. The key results of this study indicate that students' problem-solving skills and learning motivation have a direct impact on their higher-order thinking skills in smart classrooms. Conversely, students' self-control and learning strategies do not directly influence higher-order thinking skills [8].

While the current research holds great importance, it is not without limitations. It is important to highlight that our study only focused on four key factors influencing the learning of art majors using structural equation modeling analysis. Furthermore, this article is confined to a single subject area within the smart classroom environment. We encourage future research to encompass a broader range of disciplines and relevant factors, including the learning styles and methods of art majors, and also teaching strategies and methods.

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