

Examining Higher-Order Thinking Skills among Art Students: A Demographic Perspective

Yang Yang & Yee Mei Heong*

Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn, Malaysia

*Corresponding Author

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ABSTRACT

This study examines the level of higher-order thinking skills (HOTS) among art students in higher education. HOTS, including analyzing, evaluating, and creating, are essential for fostering creativity and critical thinking in art education. However, limited empirical research has explored HOTS development among art students. This study investigates the level of HOTS among art students and examines differences based on gender, socioeconomic status (SES), and year of study. A quantitative research design was employed, involving 325 undergraduate art students from Dali University and Yunnan Arts University in China. A HOTS test adapted from the Synthesis Evaluation Analysis (SEA) test was used to measure analyzing (C4), evaluating (C5), and creating (C6). The findings indicate that the overall level of HOTS among art students remains relatively low, with no significant difference based on gender and SES. However, significant difference was found based on the year of study. These findings provide insights into students' cognitive development and highlight the need for instructional strategies that promote HOTS in art education.

Keywords: Higher-order thinking skills, Bloom's Revised Taxonomy, Art Education, Chinese university students

INTRODUCTION

In contemporary higher education, the cultivation of HOTS has become a core objective of university teaching (Zohar & Ben-Ari, 2022). HOTS refers to cognitive processes involving the analysis, synthesis, and evaluation of information (Gordon et al., 2022). These skills enable individuals to think critically, solve problems, and make decisions. In disciplines such as art education, these cognitive abilities are particularly important, as artistic practice requires not only technical proficiency but also conceptual thinking, interpretive capacity, and creative expression (Wang & Jiang, 2022).

Bloom's Revised Taxonomy, proposed by Anderson and Krathwohl (2001), provides a widely recognized framework for understanding different levels of cognitive development. In this taxonomy, the higher levels of cognition consist of analyzing, evaluating, and creating, which collectively represent higher-order thinking processes (Anderson & Krathwohl, 2001). Students with HOTS are generally better able to cope with obstacles, solve problems, and meet the demands of educational activities (Kwangmuang et al., 2021). In the process of artistic creation, where students analyze and evaluate their learning tasks, make decisions about creative approaches and materials, and synthesize different perspectives to create new artworks, HOTS can help students think creatively to solve problems (Sangiorgio, 2020).

Despite the recognized importance of HOTS in art education, many higher education institutions still emphasize technical skill training and the reproduction of established artistic forms (Vasil et al., 2019). Such instructional approaches may limit students' opportunities to engage in deeper cognitive processes such as critical reflection, conceptual analysis, and creative experimentation, resulting in insufficient development of students' HOTS during their university education (Pan, 2019). In many art learning contexts, students tend to rely heavily on imitation and teacher demonstration, while opportunities for independent analyzing, evaluating, and creative

exploration remain limited (Cui & Fan, 2026). As a result, students may demonstrate strong technical proficiency but lack originality, critical thinking, and problem-solving abilities. These challenges suggest that students' HOTS in art education may not be adequately developed.

Furthermore, empirical research examining HOTS among art students remains limited, particularly in higher education contexts. Existing studies have primarily focused on general education or STEM-related disciplines, while the cognitive development of art students has received comparatively less attention. Without a clear understanding of students' HOTS levels, it is difficult for educators to design effective instructional strategies to enhance students' thinking skills and creative performance. Therefore, understanding the current level of HOTS among art students is an important step in identifying potential gaps in art education and informing future pedagogical improvements.

In addition, students' cognitive development may be influenced by various demographic and contextual factors. Previous research has suggested that factors such as gender, academic year, and socioeconomic background can affect students' learning experiences and cognitive engagement (Langensee et al., 2024; Boman & Wiberg, 2024). Examining HOTS from these perspectives can provide a more comprehensive understanding of how different groups of students develop higher-order thinking within art education.

This study aims to examine the level of HOTS among art students based on Bloom's Revised Taxonomy. Specifically, this study analyses students' performance in the three levels of HOTS, namely analyzing, evaluating, and creating, and explores potential differences across gender, academic year, and SES. The objectives of this study are:

- (1) To identify the level of HOTS among art students based on demographic factors.
- (2) To analyze the difference in the level of HOTS among art students based on gender.
- (3) To analyze the difference in the level of HOTS among art students based on SES.
- (4) To analyze the difference in the level of HOTS among art students based on year of study.

By identifying patterns in students' cognitive development, this study seeks to provide empirical evidence that may contribute to improving instructional strategies in higher art education.

LITERATURE REVIEW

In contemporary higher education, HOTS are widely recognized as key competencies that promote students' cognitive development. HOTS generally refer to advanced cognitive processes that go beyond the mere recall and simple comprehension of knowledge, primarily encompassing abilities such as analyzing, evaluating, and creating, which enable learners to solve problems and think innovatively in complex situations (Anderson & Krathwohl, 2001). As an essential component of 21st-century core competencies, HOTS are closely related to critical thinking, creativity, and innovation, and are considered fundamental for students' success in academic and professional pursuits (Ragab et al., 2024). By developing HOTS, learners can effectively deconstruct information, make value judgments, and generate new ideas, thereby achieving deeper levels of learning.

Among various cognitive theories, Bloom's Revised Taxonomy provides a significant foundation for understanding higher-order thinking. This theory categorizes cognitive processes into six levels: Remember, Understand, Apply, Analyze, Evaluate, and Create, among which Analyzing (C4), Evaluating (C5), and Creating (C6) constitute the core of higher-order thinking (Anderson & Krathwohl, 2001). Specifically, analyzing involves breaking down information and identifying internal relationships; evaluating entails making judgments based on criteria; and creating refers to integrating existing knowledge to generate new and meaningful outcomes. This framework has been widely applied in educational research to assess students' cognitive levels and guide instructional design, thereby facilitating the development of HOTS.

The development of HOTS is influenced by multiple factors, including instructional approaches, learning environments, and individual differences. Among these, demographic variables such as gender, academic year,

and SES have received considerable attention in educational research. Some studies suggest that gender differences may exist in cognitive engagement patterns; for instance, female students may demonstrate stronger reflective and evaluative thinking (Albarracín-Vivo et al., 2024). However, such differences often stem more from sociocultural and educational contexts rather than inherent cognitive abilities. Academic year is also considered a factor related to cognitive development (Karakuş, 2024). Theoretically, students should progressively develop HOTS as they advance through their academic stages. However, existing research indicates that in disciplines predominantly focused on skills training, this developmental process does not necessarily follow a linear trajectory (Duan et al., 2025). Furthermore, SES may indirectly influence the extent to which students engage in higher-order thinking activities by affecting access to learning resources, educational support, and cultural experiences (Zhong et al., 2025).

METHOD

This study employed a quantitative research design to examine the level of HOTS among art students. The study focused on assessing students' performance across the three higher-order cognitive dimensions of Bloom's Revised Taxonomy: Analyzing (C4), Evaluating (C5), and Creating (C6). The study population consisted of 1,892 undergraduate students from the Faculties of Arts at Dali University and Yunnan Arts University in China. The study sample was selected using a random sampling method, resulting in 325 students participating in the research. The sample included both male and female students across four academic years (Years 1-4). In addition, students' SES was included as a demographic variable and measured based on self-reported monthly household income.

This study utilised an HOTS test as the research instrument. The test was adapted from the Synthesis, Evaluation, Analysis (SEA) Test, which was developed by the Evaluation Research Centre and the Foundations Department at the University of Virginia under the leadership of Carolyn M. Callahan. The instrument was designed to assess higher-order cognitive processes, including analyzing, evaluating, and creating. The adapted HOTS test consisted of 22 items divided into three sections corresponding to the three HOTS levels: Analyzing, Evaluating, and Creating. The test included both single-choice and short-answer questions to assess students' analytical reasoning, evaluative judgment, and creative thinking abilities. The test was administered using standardised procedures and supported by an answer key to ensure consistency in scoring. The "Creating" level in this study was assessed through open-ended short-answer tasks. It was to measure students' ability to generate original responses, propose ideas, and construct creative solutions, as outlined in Bloom's revised taxonomy. Although such tasks may not fully capture the complexity of artistic creativity in authentic studio practice, they were intended to evaluate cognitive aspects of creative thinking within the HOTS context.

To ensure content validity, the instrument was reviewed by three experts in thinking skills. A pilot study involving 35 students was conducted to assess the instrument's reliability. The reliability analysis using Cronbach's alpha yielded a coefficient of .71, indicating acceptable reliability for educational research. A Cronbach's alpha coefficient of .70 or above is generally considered acceptable for research purposes (Hair et al., 2019).

All collected data were analyzed using SPSS version 26. Descriptive statistical methods, including frequency and percentage, were used to identify the level of HOTS among art students based on demographic factors. Inferential statistical analyses were conducted to examine differences in HOTS based on gender, SES, and year of study. An independent-samples t-test was used to analyse differences by gender, while a one-way ANOVA was used to examine differences by SES and year of study.

RESULTS AND DISCUSSION

HOTS Levels based on Demographic Factors

Table 1 presents students' HOTS level. The results indicate that the overall HOTS level among art students is relatively low. The majority of students fall into the "Very Low" (57.2%) and "Low" (18.5%) categories, whereas only 11.4% reach the "High" (4.9%) or "Very High" (6.5%) levels. This suggests that most students are still at a basic or preliminary stage of HOTS development.

Examining each HOTS level in detail: Analyzing (C4): 52.3% of students are at a “Very Low” level, and 24.3% are at a “Low” level, indicating relatively weak abilities in information classification, relationship identification, and logical reasoning. Evaluating (C5): Students performed slightly better in the evaluating than in the analyzing. The proportion of students at the “Very Low” level is 55.1%, while 15.4% reach the “Very High” level. This is the highest percentage of “Very High” among the three HOTS levels (C4, C5, C6), suggesting that some students possess a certain degree of judgment ability, though the overall level remains low. Creating (C6): Student distribution is more dispersed, with 57.8% at the “Very Low” level and 11.4% at the “High” level, indicating that a few students may already demonstrate some creative capacity in artistic production or performance, but overall creative thinking still requires substantial improvement.

Table 1: Students’ HOTS Level

HOTS level	Overall		C4 (Analyzing)		C5 (Evaluating)		C6 (Creating)	
	f	%	f	%	f	%	f	%
Very low	186	57.2	170	52.3	179	55.1	188	57.8
Low	60	18.5	79	24.3	48	14.8	40	12.3
Moderate	42	12.9	44	13.5	48	14.8	48	14.8
High	16	4.9	0	0.0	0	0.0	37	11.4
Very high	21	6.5	32	9.8	50	15.4	12	3.7

These findings indicate that the overall development of HOTS among art students remains limited. The predominance of lower-level performance suggests that many students may not yet have developed sufficient abilities in analytical reasoning, evaluative judgment, and creative thinking. This result aligns with previous research indicating that higher education in art disciplines often emphasizes technical skill acquisition rather than cognitive development (Maras & Shand, 2023). As a result, students may become proficient in technical execution but lack deeper conceptual understanding and critical engagement.

In terms of individual HOTS levels, students performed weakest in Analyzing (C4), suggesting difficulties with information decomposition, relationship identification, and logical reasoning. This may be attributed to skill-oriented curricula that prioritise technical reproduction over conceptual exploration and analytical thinking. When students are primarily trained to replicate techniques or follow established artistic conventions, opportunities for analytical thinking may be limited. Although students performed slightly better in Evaluating (C5), the overall level remained relatively low. This finding suggests that while some students may demonstrate basic judgment abilities, many still rely on intuitive or subjective preferences rather than structured evaluative criteria. Previous studies have noted that insufficient guidance in developing evaluation frameworks can hinder students’ ability to critically assess artistic works (Leonido et al., 2023).

Similarly, the findings in Creating (C6) indicate that students face challenges in transforming analytical and evaluative processes into creative outcomes. Creative thinking in art education requires not only technical proficiency but also opportunities for independent exploration, experimentation, and reflective thinking. However, teacher-centred instructional approaches and structured learning environments may limit students’ opportunities to develop originality and innovative thinking (Yao, 2023). Overall, the findings suggest that art students demonstrate relatively stronger abilities in understanding and reproducing artistic knowledge, but weaker performance in higher-order cognitive processes such as analyzing, evaluating, and creating.

Table 2 presents HOTS level among students based on gender. Overall, both male and female students exhibit relatively low HOTS levels, although female students show slightly higher performance across all levels. Among male students, 64.8% are at the “Very Low” level, whereas 54.3% of female students fall into this category. The proportion of students at “High” or “Very High” levels is 7.7% for males and 12.8% for females, indicating that female students have a marginally higher overall HOTS level.

Table 2: HOTS Level among Students based on Gender

HOTS Level		Male		Female	
		f	%	f	%
Overall	Very low	59	64.8	127	54.3
	Low	14	15.4	46	19.7
	Moderate	11	12.1	31	13.2
	High	3	3.3	13	5.5
	Very high	4	4.4	17	7.3
C4	Very low	50	54.9	120	51.3
	Low	23	25.3	56	23.9
	Moderate	11	12.1	33	14.1
	High	0	0.0	0	0.0
	Very high	7	7.7	25	10.7
C5	Very low	55	60.4	124	53.0
	Low	18	19.8	30	12.8
	Moderate	11	12.1	37	15.8
	High	0	0.0	0	0.0
	Very high	7	7.7	43	18.4
C6	Very low	59	64.8	129	55.1
	Low	8	8.8	32	13.7
	Moderate	12	13.2	36	15.4
	High	7	7.7	30	12.8
	Very high	5	5.5	7	3.0

In the Analyzing level (C4), 54.9% of male students were at the "Very Low" level, compared with 51.3% of female students, indicating a small gap. However, 10.7% of female students reached the "Very High" level, compared with 7.7% of male students. Gender differences were more pronounced in the Evaluating level (C5). Specifically, 60.4% of male students were at the "Very Low" level, while 53.0% of female students fell into this category. Notably, 18.4% of female students reached the "Very High" level, substantially higher than the 7.7% of male students, suggesting that female students performed better in judgment and critical thinking. In the Creating level (C6), 64.8% of male students were at the "Very Low" level compared to 55.1% of female students. Additionally, 12.8% of female students achieved a "High" level, clearly surpassing the 7.7% of male students.

The findings indicate that female students demonstrated slightly higher HOTS performance than male students, particularly in the Evaluating (C5) and Creating (C6) levels. This pattern is consistent with previous educational research suggesting that female students tend to display higher levels of reflective thinking, aesthetic sensitivity, and self-regulation in learning contexts (Zhang et al., 2023). These characteristics may support stronger evaluative judgment and facilitate the development of creative thinking, especially in art-related disciplines where reflection and interpretation play an important role (Pang et al., 2023).

Despite these differences, the overall gap between male and female students remains relatively small. This suggests that gender is not a decisive factor influencing HOTS development among art students. Similar findings have been reported in previous studies, which emphasize that learning experiences, curriculum design, and instructional approaches are more influential in shaping HOTS than demographic characteristics alone (Shubina et al., 2021; Janse et al., 2022). Therefore, improving instructional strategies and providing opportunities for deeper cognitive engagement may be more critical for enhancing HOTS among all students, regardless of gender.

Table 3 presents HOTS level among students based on year of study. Overall, students from all four grades exhibit relatively low HOTS levels, with the majority (over 60%) falling into the "Very Low" and "Low" categories. Only a small proportion of students reach "High" or "Very High" levels. The proportions of students at the "Very Low" level are 40.0% for first-year students, 65.5% for second-year students, 62.7% for third-year students, and 59.1% for fourth-year students. First-year students have a lower percentage in the "Very Low" category than

students in other grades. Additionally, the combined proportion of students reaching “High” or “Very High” levels in the first year is 14.2%, slightly higher than in other grades.

In the Analyzing level (C4), the proportions of students at the "Very Low" level were 45.9% in the first year, 56.7% in the second year, 53.0% in the third year, and 52.3% in the fourth year. The "Low" level remained similar across grades at around 23%. Notably, almost no students in the second, third, and fourth years reached the "High" level, with 0.0% in each case, suggesting that logical analysis and problem decomposition skills did not improve significantly with grade progression. In the Evaluating level (C5), minor differences were observed across grades. First-year students had the highest proportion of "Very High" scorers at 22.3%. Third- and fourth-year students reached 15.7% and 22.7%, respectively, indicating a slight improvement in evaluative thinking among upper-grade students, while second-year students were predominantly at the "Very Low" level at 66.4%. In the Creating level (C6), 12.9% of first-year students reached the "High" level, and 12.0% of third-year students did. Fourth-year students had the highest proportion at the "Very Low" level (63.6%), with no students achieving the "Very High" level (0.0%).

Table 3: HOTS Level among Students based on year of study

HOTS level		Year 1		Year 2		Year 3		Year 4	
		f	%	f	%	f	%	f	%
Overall	Very low	34	40	74	65.5	52	62.7	26	59.1
	Low	20	23.5	20	17.7	13	15.7	7	16.0
	Moderate	19	22.3	9	8.0	8	9.6	6	13.6
	High	6	7.1	5	4.4	2	2.4	3	6.8
	Very high	6	7.1	5	4.4	8	9.6	2	4.5
C4	Very low	39	45.9	64	56.7	44	53.0	23	52.3
	Low	20	23.5	26	23.0	22	26.6	11	25.0
	Moderate	18	21.2	13	11.5	7	8.4	6	13.6
	High	0	0.0	0	0.0	0	0.0	0	0.0
	Very high	8	9.4	10	8.8	10	12.0	4	9.1
C5	Very low	34	40	75	66.4	49	59.0	21	47.7
	Low	14	16.5	16	14.1	10	12.0	8	18.2
	Moderate	18	21.2	14	12.4	11	13.3	5	11.4
	High	0	0.0	0	0.0	0	0.0	0	0.0
	Very high	19	22.3	8	7.1	13	15.7	10	22.7
C6	Very low	35	41.2	73	64.7	52	62.7	28	63.6
	Low	15	17.6	11	9.7	10	12.0	4	9.1
	Moderate	19	22.4	11	9.7	9	10.9	9	20.5
	High	11	12.9	13	11.5	10	12.0	3	6.8
	Very high	5	5.9	5	4.4	2	2.4	0	0.0

The findings reveal that HOTS development across academic years does not follow a consistent upward trend. Instead, students’ performance shows a fluctuating pattern: relatively higher levels in the first year, a decline in the second year, a slight recovery in the third year, and a further decline in the fourth year. The relatively stronger performance among first-year students may be attributed to their initial curiosity, exploratory learning attitudes, and openness to new ideas when entering university (Qiao et al., 2022). At this stage, students are more likely to engage in broad thinking and creative exploration. The noticeable decline among second-year students, particularly in Analyzing (C4) and Creating (C6), may be associated with curriculum structures that emphasize technical skill development and task completion rather than conceptual understanding and cognitive exploration (Liu, 2024). This supports the view that instructional activities play a critical role in shaping cognitive development, as learning tasks often determine the level of thinking students employ (Anderson & Krathwohl, 2001).

A slight improvement observed among third-year students, especially in the Creating level, may be related to the introduction of more comprehensive assignments and project-based learning activities that require greater

independence and integration of knowledge (Xia, 2024). However, the decline in the fourth year suggests that external pressures such as graduation requirements, portfolio preparation, and employment concerns may lead students to prioritize outcomes over experimentation, thereby limiting opportunities for creative thinking and higher-order cognitive engagement (Zhao & Lin, 2022). Overall, these findings indicate that HOTS development does not naturally increase with academic progression. Instead, sustained instructional support and carefully structured learning experiences are necessary across all academic years to promote continuous development of HOTS (Chen et al., 2024).

Table 4 presents HOTS level among students based on SES. The SES categories used in this study were developed based on regional economic conditions in Yunnan Province, China. According to recent provincial statistical reports (Yunnan Provincial Bureau of Statistics, 2024), average household incomes in Yunnan remain lower than those in more economically developed regions of China. Therefore, the income classification adopted in this study was adjusted to reflect the local socioeconomic context and improve the relevance of the categorization for the target population. Overall, HOTS levels are relatively low across all income groups, but students from middle-income families (RMB 3001–7000) show comparatively better performance. Among students with household income below RMB 2000, 57.9% fall into the “Very Low” category, compared with 66.7% in the RMB 4001–5000 group and 62.5% in the above RMB 8000 group. This indicates that the differences in HOTS between low- and high-income groups do not follow a linear trend. Students in the RMB 6001–7000 group have the lowest proportion at the “Very Low” level (37.5%), with the combined proportion of “High” and “Very High” levels reaching 20.9%, the highest among all groups.

Table 4: HOTS Level among Students based on SES

HOTS level		Below RMB2000		RMB 2001-3000		RMB 3001-4000		RMB 4001-5000		RMB 5001-6000		RMB 6001-7000		RMB 7001-8000		Exceeding RMB 8000	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Overall	Very low	11	57.9	26	57.8	24	52.2	28	66.7	24	57.2	9	37.5	14	51.9	50	62.5
	Low	3	15.8	7	15.6	11	23.9	6	14.3	8	19.0	5	20.8	4	14.8	16	20.0
	Moderate	4	21.0	6	13.3	5	10.9	5	11.9	5	11.9	5	20.8	6	22.2	6	7.5
	High	0	0.0	2	4.4	4	8.7	0	0.0	2	4.8	3	12.5	2	7.4	3	3.8
	Very high	1	5.3	4	8.9	2	4.3	3	7.1	3	7.1	2	8.4	1	3.7	5	6.2
C4	Very low	11	57.9	24	53.4	23	50.0	24	57.2	22	52.3	10	41.6	10	37.1	46	57.5
	Low	7	36.8	9	20.0	14	30.4	11	26.2	7	16.7	5	20.8	8	29.6	18	22.5
	Moderate	0	0.0	6	13.3	6	13.0	4	9.5	7	16.7	7	29.2	4	14.8	10	12.5
	High	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Very high	1	5.3	6	13.3	3	6.6	3	7.1	6	14.3	2	8.4	5	18.5	6	7.5
C5	Very low	8	42.1	28	62.3	23	50.0	22	52.4	28	66.7	9	37.5	16	59.3	45	56.3
	Low	6	31.6	6	13.3	9	19.6	7	16.7	3	7.1	3	12.5	3	11.1	11	13.7
	Moderate	3	15.8	5	11.1	6	13.0	3	7.1	5	11.9	7	29.2	5	18.5	14	17.5
	High	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Very high	2	10.5	6	13.3	8	17.4	10	23.8	6	14.3	5	20.8	3	11.1	10	12.5
C6	Very low	10	52.7	23	51.1	22	47.9	31	73.9	24	57.2	11	45.8	14	51.9	53	66.3
	Low	1	5.3	7	15.6	11	23.9	3	7.1	3	7.1	4	16.7	2	7.4	9	11.2
	Moderate	4	21.0	7	15.6	5	10.9	4	9.5	6	14.3	3	12.5	8	29.6	11	13.7
	High	4	21.0	6	13.3	6	13.0	1	2.4	6	14.3	5	20.8	3	11.1	6	7.5
	Very high	0	0.0	2	4.4	2	4.3	3	7.1	3	7.1	1	4.2	0	0.0	1	1.3

In the Analyzing level (C4), most income groups had around 50% of students at the "Very Low" level. The RMB 6001 to 7000 group performed relatively better, with 41.6%, while the RMB 4001 to 5000 and the RMB 8000+ groups exceeded 55% at the "Very Low" level. In the Evaluating level (C5), the RMB 5001 to 6000 and RMB 6001 to 7000 groups had relatively high proportions of "Very High" scorers at 14.3% and 20.8%, respectively, indicating stronger critical thinking and judgment among upper-middle-income students. In contrast, low-income and high-income groups had over 55% of students at the "Very Low" level in this level, reflecting a significant

gap. In the Creating level (C6), students in the RMB 6001-7000 group showed the strongest performance, with 20.8% at the "High" level, well above the other groups. In contrast, students from households with incomes below RMB 2000 and above RMB 8000 had 52.7% and 66.3% at the "Very Low" level, respectively, indicating weaker creative thinking ability at both ends of the income spectrum.

The findings indicate that students' HOTS levels across different SES groups follow an inverted U-shaped pattern, with middle-income students performing relatively better than both lower- and higher-income groups. This suggests that family socioeconomic background may influence students' HOTS development, although the relationship is not linear. Students from middle-income families may benefit from a balanced learning environment that provides sufficient educational resources while maintaining independence and intrinsic motivation for learning (Chen et al., 2021; Tan et al., 2023). Such conditions may support the development of analytical, evaluative, and creative thinking skills.

In contrast, students from lower-income families may experience limited access to educational resources, learning materials, and enrichment opportunities, which can restrict their cognitive development and reduce opportunities to practice HOTS (Renzulli, 2021). On the other hand, students from higher-income families, despite having access to abundant resources, may rely more heavily on external support or structured guidance, potentially limiting opportunities for independent exploration and deep cognitive engagement (Song & Xue, 2022). Furthermore, SES differences appear more evident in HOTS, suggesting that the development of advanced cognitive skills may be more sensitive to environmental and contextual factors. These findings highlight the importance of providing supportive, inclusive learning environments that encourage independent thinking and creativity among students from diverse socioeconomic backgrounds.

The Difference in HOTS based on Gender

Before conducting inferential statistical analyses, the assumptions of normality and homogeneity of variance were examined. The results of the normality test indicated that the data were approximately normally distributed, as the skewness (0.764) and kurtosis (0.364) values fell within the acceptable range. In addition, Levene's test confirmed the homogeneity of variances. Therefore, independent-samples t-tests and one-way ANOVA were conducted to examine differences in HOTS by gender, SES, and year of study.

Table 5 presents the results of the independent samples t-test examining gender differences in HOTS among art students. The results indicated that there was no significant difference between male and female students across all HOTS levels. Specifically, no significant differences were found in overall HOTS scores ($t = -1.625$, $p = .105$), C4 (Analyzing) ($t = -1.001$, $p = .317$), C5 (Evaluating) ($t = -1.864$, $p = .064$), and C6 (Creating) ($t = -1.122$, $p = .263$). Although female students demonstrated slightly higher mean scores across all HOTS levels, the differences did not reach statistical significance. These findings suggest that gender does not significantly influence the development of HOTS among art students.

Table 5: Independent Samples t-Test for the Difference in HOTS based on Gender

Variable	Gender	N	Mean	SD	t	df	p
Overall HOTS	Male	91	17.45	8.52	-1.625	323	.105
	Female	234	19.27	9.28			
C4	Male	91	5.08	2.90	-1.001	323	.317
	Female	234	5.46	3.19			
C5	Male	91	6.22	3.57	-1.864	191.72	.064
	Female	234	7.09	4.21			
C6	Male	91	6.15	4.15	-1.122	323	.263
	Female	234	6.72	4.11			

*Significant at $p < .05$

The absence of significant gender differences may be attributed to the nature of art education, which emphasizes creativity, expression, and cognitive engagement regardless of gender. In contemporary higher education settings, male and female students typically receive similar instructional experiences, access to resources, and opportunities for participation in creative activities (Nakano et al., 2021). Such equal learning conditions may reduce gender disparities in HOTS, as students are exposed to comparable academic expectations and learning environments. Furthermore, previous research suggests that gender differences in cognitive abilities tend to be minimal in higher education contexts where learning opportunities are equitable, and that males and females are more alike than different in most psychological and cognitive domains (OECD, 2025). These perspectives support the findings of this study, indicating that gender may not be a significant factor influencing HOTS among art students. Additionally, art education naturally promotes divergent thinking, imagination, and creativity, which are key components of HOTS (Peng, 2025). Such learning environments encourage students to explore multiple perspectives and generate innovative ideas, which may further reduce potential gender-based differences. Therefore, in creative academic settings, male and female students may demonstrate comparable levels of HOTS. Thus, gender differences in HOTS may not be pronounced in art education environments that emphasize creativity and open-ended learning.

The Difference in HOTS based on SES

Table 6 presents the results of a one-way ANOVA examining differences in HOTS based on students' SES. The results indicated that there was no significant difference across SES groups in overall HOTS scores ($F = .912$, $p = .497$), C4 (Analyzing) ($F = 1.183$, $p = .312$), C5 (Evaluating) ($F = .638$, $p = .724$), and C6 (Creating) ($F = 1.355$, $p = .224$). The findings suggest that students from different socioeconomic backgrounds demonstrated similar levels of HOTS.

Table 6: One-Way ANOVA for the Difference in HOTS based on SES

Variable	SS Between	df	SS Within	df	F	p
Overall HOTS	529.826	7	26306.471	317	.912	.497
C4	79.722	7	3052.586	317	1.183	.312
C5	73.905	7	5243.092	317	.638	.724
C6	160.205	7	5352.375	317	1.355	.224

*Significant at $p < .05$

The absence of significant differences based on SES may be explained by the fact that, in higher education contexts, students generally have relatively equal access to teaching resources, curricula, and institutional support services, which helps reduce the impact of socioeconomic disparities on learning outcomes (Wanti et al., 2022). At the same time, in art education, students' learning processes are often centred on creativity and personal expression rather than material resources (Lukaka, 2023). Students are encouraged to engage in inquiry-based learning and problem-solving tasks, which depend more on students' talent, cognition, and effort than on socioeconomic advantages (Gomez, 2025). Therefore, such pedagogical characteristics may help minimize the influence of SES on the development of HOTS. These findings may further explain the non-significant results in the present study, indicating that at the tertiary level, SES may play a less prominent role in shaping cognitive outcomes, and that effective teaching methods and learning environments may play a more critical role than socioeconomic background in fostering students' HOTS, particularly in creative disciplines such as the arts.

The Difference in HOTS based on Year of Study

Table 7 presents the results of the one-way ANOVA examining differences in HOTS across students' year of study. The results revealed significant differences in overall HOTS scores ($F = 3.614$, $p = .014$), C5 (Evaluating) ($F = 3.644$, $p = .013$), and C6 (Creating) ($F = 3.385$, $p = .018$). However, no significant differences were found in C4 (Analyzing) ($F = 1.034$, $p = .378$). Post hoc analysis using Tukey HSD indicated that first-year students

demonstrated significantly higher scores than second-year students in overall HOTS and evaluating skills. In addition, first-year students also demonstrated significantly higher creative thinking scores than third-year students. No other significant pairwise differences were identified. These findings suggest that HOTS levels did not increase progressively across academic years. Instead, the results indicate a non-linear pattern of HOTS development among art students.

Table 7: One-Way ANOVA for the Differences in HOTS based on Year of Study

Variables	Year 1 Mean (SD)	Year 2 Mean (SD)	Year 3 Mean (SD)	Year 4 Mean (SD)	F	p	Post Hoc (Tukey)
Overall HOTS	21.41 (8.83)	17.29 (8.75)	18.08 (9.99)	18.67 (7.84)	3.614	.014*	Year 1 > Year 2
C4	5.81 (2.99)	5.03 (3.22)	5.35 (3.37)	5.32 (2.48)	1.034	.378	No significant
C5	7.84 (3.92)	6.00 (3.72)	6.72 (4.41)	7.32 (4.04)	3.644	.013*	Year 1 > Year 2
C6	7.76 (4.03)	6.27 (4.22)	6.01 (4.22)	6.03 (3.51)	3.385	.018*	Year 1 > Year 3

*Significant at $p < .05$

One possible explanation is that first-year students may possess greater openness, curiosity, and willingness to explore new ideas when they first enter university (Zeng et al., 2025). During the early stage of university education, students are often more intrinsically motivated and less constrained by academic expectations or professional pressures. These characteristics may positively influence evaluative ability and creative thinking (Urban et al., 2021). However, as students progress academically, senior students may become increasingly focused on meeting academic performance requirements, completing portfolios, preparing for internships, and fulfilling graduation expectations. As a result, their attention may gradually shift from exploratory learning toward more practical or outcome-oriented tasks (Jackson, 2024).

Secondly, within the context of contemporary Chinese higher education, the increasing employment pressure faced by graduating students may further contribute to this phenomenon. In recent years, employment competition among Chinese university graduates has intensified significantly, particularly in creative and art-related industries where job opportunities are relatively limited and highly competitive (Ning et al., 2024). As students approach graduation, concerns related to employment, career uncertainty, and financial pressure may increase psychological stress. Under such circumstances, students may prioritize employability, technical competence, and short-term practical outcomes over creative exploration or reflective thinking (Wang et al., 2024). This may partially explain why senior students in the present study did not demonstrate higher HOTS levels than first-year students.

In addition, these findings may also reflect certain limitations within current higher art education curricula. In art education contexts, students are often required to develop high levels of professional and technical skills, and some university learning environments may continue to emphasize knowledge reproduction, technical training, and standardized assessment rather than sustained critical inquiry and creative development (Wang et al., 2023). Prolonged exposure to highly structured disciplinary training may unintentionally reduce opportunities for divergent thinking and exploratory learning. Such conditions may limit the development of HOTS.

However, the absence of significant differences in the analyzing level (C4) may indicate that analytical skills tend to stabilize earlier in students' academic development and are less sensitive to incremental academic progression compared to higher-order cognitive skills such as evaluating and creating. This may also suggest that while basic analytical abilities can be acquired at a relatively early stage, more advanced cognitive processes require longer-term educational exposure and practice (Siregar, 2025). Overall, these findings highlight the complexity of HOTS development in higher education, which may not necessarily progress in a linear manner. The development of HOTS may be influenced by curriculum structure, learning motivation, psychological pressure, and broader social factors experienced at different stages of learning. Therefore, higher art education institutions should continuously create supportive learning environments across all stages of study in order to promote students' engagement in creativity, reflection, and critical thinking.

LIMITATION

This study has several limitations that should be acknowledged. First, the sample was limited to undergraduate art students from two universities in Yunnan Province, China. These two institutions were selected because the number of higher art education institutions in Yunnan is relatively limited, and the selected universities are considered among the most representative art institutions in the province. Therefore, the findings may not be fully generalizable to students from other regions, universities, or educational contexts. In addition, participation in the study was voluntary, which may have introduced self-selection bias. Students with stronger academic motivation, greater interest in HOTS, or more positive learning attitudes may have been more willing to participate in the research, potentially influencing the overall findings and limiting representativeness.

Second, although the instrument demonstrated acceptable reliability for exploratory educational research, the Cronbach's alpha coefficient was slightly below the commonly recommended threshold. This suggests that several questionnaire items may require further refinement and validation to improve internal consistency in future studies. Furthermore, the "Creating" level was measured primarily through open-ended short-answer tasks designed to assess creative cognition within the HOTS framework. While these tasks were appropriate for evaluating students' abilities to generate ideas, construct responses, and demonstrate higher-order cognitive processing, they may not fully capture the complexity of authentic artistic creativity in practical, studio-based, or performance-oriented contexts.

Finally, the study employed a quantitative cross-sectional design rather than a longitudinal approach. As a result, the observed differences across academic years cannot be interpreted as evidence of actual developmental changes in HOTS. Quantitative findings alone may also be insufficient to explain the deeper motivational, curricular, psychological, and environmental factors influencing students' HOTS performance. Therefore, future studies are encouraged to adopt longitudinal mixed-methods approaches and incorporate qualitative methods, such as interviews, focus groups, classroom observations, or reflective journals, to provide more comprehensive insights into how HOTS develop throughout university education.

CONCLUSION

This study examined the level of HOTS among undergraduate art students based on Bloom's Revised Taxonomy, focusing on the three HOTS levels of Analyzing, Evaluating, and Creating. The findings reveal that art students' overall HOTS level remains relatively low. The majority of students fell into the "Very Low" or "Low" categories, with only a small proportion reaching "High" or "Very High" levels. Among the three HOTS levels, students demonstrated the weakest performance in analyzing, with more than half at the "Very Low" level, indicating significant deficiencies in information decomposition, logical reasoning, and relationship identification. Performance in Creating was the second weakest, suggesting that most students struggle to transform analytical and evaluative abilities into original outcomes. The Evaluating showed slightly better performance, but it was still insufficient. These results suggest that current art education curricula may overemphasize skill acquisition and reproductive learning while neglecting the systematic cultivation of analytical reasoning, evaluative judgment, and creative thinking.

Regarding demographic differences, no significant gender difference was found in overall HOTS or in any of its three levels. Although female students scored slightly higher across all HOTS levels, the differences did not reach statistical significance. This indicates that in higher education contexts where access to resources and instructional experiences are relatively equitable, gender may not be a determining factor in HOTS development. Similarly, SES did not show significant associations with HOTS performance. Students from different income levels demonstrated no significant differences in overall HOTS or across the three levels, suggesting that at the tertiary level, effective teaching methods and learning environments may play a more critical role than family economic background in fostering students' higher-order thinking, particularly in creative disciplines such as the arts.

In contrast, a significant difference was found across years of study in overall HOTS, as well as in the HOTS levels of Evaluating and Creating. However, the pattern of differences did not demonstrate a progressive increase in HOTS as students advanced academically. This finding suggests that the development of HOTS among art students may follow a non-linear pattern rather than a continuous linear progression throughout university

education. However, no significant differences were found in the Analyzing level across academic years, indicating that basic analytical skills may stabilize relatively early in students' academic development, whereas higher-order cognitive abilities such as Evaluating and Creating may require longer-term educational exposure and structured learning experiences. These findings suggest that the development of HOTS in art education is complex and cannot be assumed to improve automatically through academic progression alone.

The findings of this study provide several implications for art education. First, educators should integrate instructional strategies that emphasize critical thinking, reflective learning, and creative problem-solving. Second, curriculum design should move beyond technical skill training and incorporate activities that promote analyzing, evaluating, and creative production. Third, learning environments should encourage independent exploration and experimentation to foster deeper cognitive engagement. Despite its contributions, this study has several limitations. The research used a quantitative approach and focused on students from two universities, which may limit the generalizability of the findings. Future studies may incorporate qualitative approaches such as interviews, focus groups, classroom observations, or reflective journals to explore why students' HOTS levels do not consistently improve across academic years despite prolonged exposure to art education. Qualitative data may provide deeper insights into students' learning experiences, changes in motivation, curriculum structures, employment pressures, and psychological factors influencing HOTS development. Overall, this study highlights the importance of fostering HOTS in art education and provides empirical evidence to support instructional improvements in higher education.

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Author Contribution

The authors confirm contribution to the paper as follows: study conception and design: Yang Yang; data collection: Yang Yang; analysis and interpretation of results: Yang Yang; draft manuscript preparation: Yang Yang, Yee Mei Heong. Both authors reviewed the results and approved the final version of the manuscript.

Ethical Approval

This study was approved by the Research Ethics Committee (REC) of Universiti Tun Hussein Onn Malaysia (UTHM).

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The research involved a questionnaire survey, and all collected data were completely anonymous, with no personally identifiable information recorded. The study adhered to the principles of the Declaration of Helsinki and complied with all relevant institutional and ethical guidelines throughout the research process.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Data Availability Statement

The questionnaire data used in this study are not publicly available due to participant privacy. Anonymized data may be obtained from the corresponding author upon reasonable request.

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