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Analysis of the Current Situation of College Students Using AI Tools for Learning

-A Case Study of the Landscape Architecture Major

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Abstract: With the wide application of artificial intelligence (AI) technology in higher education, the teaching methods and learning approaches in design disciplines such as landscape architecture are undergoing significant changes. This study aims to explore the current usage of AI tools among landscape architecture students, analyzing their effectiveness and associated challenges in learning. Based on a survey of 32 landscape architecture students, and utilizing descriptive statistics, correlation analysis, t-tests, and ANOVA, the study reveal that AI tools significantly enhance design efficiency and stimulate creative thinking, but the technical complexity of some of the tools restricts their application effects. The results of the study show that the frequency of use is moderately positively correlated with the learning effect and satisfaction, and there is a significant difference in the impact of different AI tool types on students' learning effects. While AI tools exhibit strong potential in landscape architecture education, their effective integration requires improved technical support and educational strategies. The study concludes with recommendations on effectively incorporating AI tools into curriculum design to promote students' comprehensive capabilities.

Keywords: AI tools, Landscape architecture, Design efficiency, Learning outcomes.

1. Introduction

1.1. Research Background

With the rapid development of artificial intelligence (AI) technology, its application in higher education is becoming increasingly widespread, especially in design-related disciplines, where it shows significant innovative advantages. In design disciplines, AI technology can greatly improve students' learning efficiency and design quality through functions such as image generation, design optimization, and data analysis. For example, top U.S. universities such as Harvard University and the Massachusetts Institute of Technology (MIT) have integrated AI-based design simulation tools into their daily teaching in architecture and landscape design courses, helping students generate complex ecological design schemes and adjust model parameters in real-time.

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As a discipline that combines natural sciences and artistic design, the landscape architecture major places high demands on students' spatial perception, ecological understanding, and creativity. However, traditional teaching methods often rely on hand-drawn designs, field surveys, and other offline tools, making it difficult to handle complex design variables and dynamic environments. The introduction of AI technology, especially image generation tools like Midjourney and DALL·E, is providing students with faster and more intuitive ways to generate design ideas. In 2022, some Chinese universities, such as the School of Architecture at Tsinghua University, have seen students use AI tools to complete complex tasks in landscape design, including environmental sustainability analysis, demonstrating the potential of AI in creative design.

However, the widespread use of AI tools has also brought new challenges, such as whether students may become overly reliant on technology, leading to a weakening of fundamental design skills, and the varying applicability of AI tools at different stages of learning. Existing research tends to focus on the application of AI technology in engineering and science disciplines, with relatively limited studies on its use in landscape architecture. In particular, there is a lack of in-depth empirical research on the specific effects of AI tools on learning and student feedback. Therefore, studying the current use of AI tools in the landscape architecture discipline can help fully understand their dual impact on students' learning outcomes and provide a scientific basis for effectively integrating AI technology into future higher education curricula.

1.2. Research Objectives and Significance

The purpose of this study is to investigate the current status of landscape architecture students' use of AI tools, analyze their effectiveness in learning design, students' attitudes towards using these tools, and the challenges they face. Through detailed data analysis, this study aims to answer the following questions: What are the frequency and purposes of landscape architecture students' use of AI tools? What are students' overall impressions of AI tools? Have AI tools had a positive impact on their design abilities, learning efficiency, and creative thinking? Has the widespread use of AI tools introduced new challenges, such as dependence on technology and a weakening of fundamental skills? Investigating these issues not only helps to understand the impact of AI tools on students' learning processes but also provides a theoretical basis for how to effectively integrate AI technology into course design.

2. Literature Review

2.1. Domestic Research Status

In recent years, with the rapid development of AI technology in the field of education, academia has conducted extensive research on the application of AI tools in university students' learning, especially exploring its pros and cons in various disciplines. Specifically, in the field of landscape architecture, some related studies have explored the impact of AI tools on design education, though research in this area remains limited. In a broader educational context, Sun Dan et al. analyzed university students' behavior in programming learning and pointed out that generative AI tools can effectively enhance students' learning efficiency and provide personalized learning paths [1]. However, the study also showed that students are prone to becoming dependent on these tools, which may affect their independent thinking abilities. Similarly, Wang Yu studied college students' behavioral intentions when using AI technology to assist in learning English vocabulary and found that these tools can significantly improve learning outcomes, but also noted the issue of over-reliance on the tools by students [2]. Tang Peiyu explored the reform of university students' learning models in the era of artificial intelligence, proposing innovative strategies to integrate technology into education to enhance students' ability to adapt to future development [3]. Liu Xiahuan analyzed the pros and cons

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of using smartphones in ubiquitous learning environments, discussing their impact on the convenience of learning and distractions for university students, and Liu suggested balancing smartphone usage to optimize learning outcomes [4]. Chang Tongshan and Zhao Lei conducted a case analysis of strategies and principles adopted by U.S. universities in addressing and utilizing AI tools, emphasizing educational innovation, ethical considerations, and technological integration to improve teaching quality and student capabilities, meeting the demands of future education [5]. Li Yan et al. analyzed the current state of university students' use of generative artificial intelligence, examining its impact on learning methods and creativity, and proposed corresponding improvement suggestions [6]. Shi Henglin and Zhao Guoying studied the analysis of human behavior in AI, exploring the acquisition and application of behavioral data, highlighting its importance in enhancing human-computer interaction, optimizing decision-making, and promoting the development of intelligent systems [7].

2.2. International Research Status

In specific studies on landscape architecture, Fernberg and Chamberlain conducted a review of the application of AI in landscape design, exploring the advantages of these technologies in design and planning, such as improving design efficiency and precision. They also mentioned that AI might undermine designers' creativity (Landscape Architecture Foundation) [8]. Steinitz, from a more macro perspective, discussed the challenges facing the future of landscape architecture education, emphasizing the importance of maintaining students' critical thinking and creativity while integrating new technologies (UW Press) [9]. Dewitz-Cryan, in her research, explored the practical application of AI tools in landscape design education, analyzing how these tools are changing the design process and how to balance traditional design skills with the application of AI technology in teaching (MDPI) [10].

From the above research, it can be seen that although AI tools provide many new opportunities for students' learning and professional development, scholars are generally concerned that these tools may lead to students' over-reliance, thereby affecting their creativity and independent thinking abilities. In the field of landscape architecture, balancing this technology with design thinking is particularly important. Therefore, future research should continue to focus on how to optimize the use of AI tools to ensure that their application in education can truly promote students' holistic development.

3. Research Methodology

This study primarily adopts a quantitative research method, collecting relevant data from landscape architecture students through a questionnaire survey and analyzing the data using various statistical methods. The research focuses on the current status of students' use of AI tools, including usage frequency, tool types, learning outcomes, and satisfaction.

The participants of this study were 32 students from the landscape architecture program of a domestic university, ranging from second-year undergraduates to postgraduate students. The sample selection was based on their familiarity with AI tools and their grade distribution, ensuring the data's representativeness. The questionnaire consisted of 18 questions covering students' basic information, AI tool usage, satisfaction, and learning outcomes. To ensure the scientific validity and reliability of the data, the questionnaire responses were rigorously screened and cleaned to remove incomplete or invalid answers.

Data collection was mainly carried out via an online survey platform, with participants voluntarily completing the questionnaire. All data were collected anonymously. To ensure the accuracy and

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scientific rigor of the analysis, SPSS software was used for data analysis, including descriptive statistics, correlation analysis, t-tests, and analysis of variance.

3.1. Descriptive Statistical Analysis

Descriptive statistical analysis is primarily used to summarize the basic characteristics of the data, helping researchers understand the overall distribution of the sample. In this study, descriptive statistical analysis is applied to analyze the gender and grade distribution of students, as well as the frequency and types of AI tools they use in their studies. By calculating frequency, percentage, mean, and standard deviation, the basic characteristics of the sample group can be visually presented, such as the regular behavioral patterns of AI tool usage.

3.2. Correlation Analysis

Correlation analysis is used to explore the linear relationship between two variables. In this study, correlation analysis will be used to investigate the relationship between the frequency of students' use of AI tools and their learning outcomes (e.g., improvement in design abilities). Specifically, by calculating the Pearson correlation coefficient, the strength of the relationship between "frequency of AI tool usage" and "improvement in design abilities" can be measured. The value ranges from -1 to 1, with a positive correlation indicating a direct relationship and a negative correlation indicating an inverse relationship.

3.3. t-Test Analysis

The t-test is a statistical method used to compare the differences between two group means. In this study, an independent samples t-test will be used to compare differences in the use of AI tools between students of different genders and grades. The t-test can be employed to assess significant differences between male and female students in terms of AI tool usage frequency, satisfaction, and other factors, or to compare the learning outcomes of students from different grade levels after using AI tools.

3.4. Analysis of Variance

Analysis of Variance (ANOVA) is a statistical method used to compare the mean differences among three or more groups. In this study, one-way ANOVA will be used to compare the differences in AI tool usage among students of different grade levels. For example, ANOVA can be applied to compare the frequency, types of tools used, and satisfaction levels across sophomore, junior, senior, and graduate student groups.

4. Survey Results and Analysis

4.1. Descriptive Statistical Analysis Results

This section will conduct a descriptive statistical analysis of the survey data to reveal the basic usage patterns of AI tools among landscape architecture students, including usage frequency, satisfaction, and the types of tools used. The data can be analyzed to provide a preliminary understanding of the behavioral characteristics of students using AI tools and their overall evaluation of the tools.

The survey results show that the vast majority of students reported using AI tools during their studies. Of the 32 respondents, 84.38% (27 students) indicated that they had used AI tools, while 15.63% (5 students) reported never having used AI tools. This suggests that AI tools are widely used in the landscape architecture program, though a small proportion of students have yet to engage with these tools. The survey results on usage frequency are as follows:

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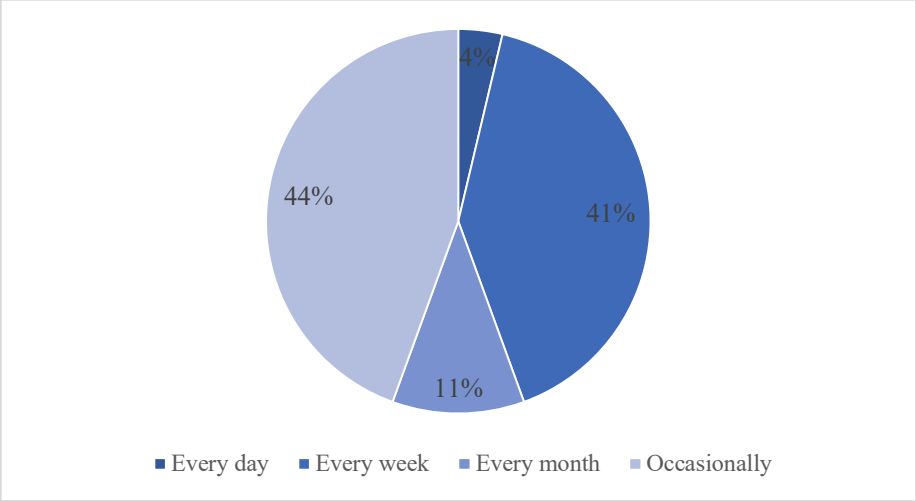

Figure 1: AI tool usage frequency.

As shown in Figure 1, 44% of students reported that they “occasionally” use AI tools, and 41% use them on a weekly basis, indicating that AI tools are used relatively frequently. However, they have not yet become essential for most students' daily studies. Notably, only 4% of students use AI tools daily, suggesting that these tools have not yet fully permeated everyday learning. Furthermore, no students reported never using AI tools, reflecting that AI tools have already become one of the commonly used tools in landscape architecture design education.

To gain further insights into students' acceptance and feelings toward AI tools, the questionnaire included options regarding tool satisfaction. The results show that most students have a positive attitude toward using AI tools.

Table 1: AI tool satisfaction survey.

Satisfaction level	Subtotal	Percentage
Very satisfied	2	7.41%
Satisfied	16	59.26%
Neutral	9	33.33%
Dissatisfied	0	0%
Very dissatisfied	0	0%

As shown in Table 1, 59.26% of students expressed being "satisfied" with AI tools, while another 7.41% stated they were "very satisfied" with these tools. Additionally, 33.33% of students considered their experience with AI tools to be "neutral," and no students reported being dissatisfied or very dissatisfied. This indicates that while most students hold a positive attitude towards AI tools, a considerable proportion believe that the effectiveness of these tools has not fully met their expectations. For the group of students with neutral satisfaction, possible reasons may include the complexity of the AI tools, technological limitations, and insufficient mastery of the tools. Furthermore, some students may have encountered technical barriers during usage, which is worth exploring further in future research.

Regarding the types of AI tools used, students primarily utilized several common categories of AI tools, including image generation tools, automated design tools, data analysis tools, and text generation tools. The usage of these different types of tools is detailed below:

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Table 2: Usage of various AI tools.

Tool type	Subtotal	Percentage
Image generation tools (e.g., DALL·E, Midjourney)	18	66.67%
Automated design tools (e.g., AI plugins for AutoCAD)	10	37.04%
Data analysis tools (e.g., AI-driven GIS tools)	10	37.04%
Text generation tools (e.g., ChatGPT)	20	74.07%
Others	0	0%

Based on Table 2, 74.07% of students used text generation tools (such as ChatGPT), and 66.67% used image generation tools (such as DALL·E, Midjourney). In contrast, 37.04% of students utilized automated design tools and data analysis tools. This suggests that when choosing AI tools, students tend to prefer those that can quickly generate design concepts and provide text support, while more specialized tools like automated design and data analysis tools are used less frequently.

To further understand the specific purposes for which students use AI tools in their learning and design processes, the questionnaire also collected feedback on usage purposes. The results indicate that students mainly use AI tools to improve design efficiency and to assist in generating design ideas.

Table 3: Specific purposes of using AI tools.

Purpose of use	Subtotal	Percentage
Improve design efficiency	19	70.37%
Assisting in finding design ideas	18	66.67%
Data analysis and processing	15	55.56%
Learning and exploring new skills or knowledge	15	55.56%
Others	0	0%

As shown in Table 3, 70.37% of students indicated that their primary purpose for using AI tools is to improve design efficiency, while 66.67% reported that these tools assist them in generating design ideas. Additionally, 55.56% of students stated that AI tools help with data analysis and learning new skills. This suggests that the application of AI tools in landscape architecture design is not limited to design itself, but also extends to the exploration of new knowledge and the processing of complex data.

The results of the descriptive statistical analysis indicate that AI tools have been widely adopted by landscape architecture students, particularly in the areas of text and image generation. Students generally express satisfaction with their use of AI tools, but these tools have not yet become the central part of their daily learning. The choice of tools and purposes for using them also shows that students mainly use AI tools to enhance design efficiency and support innovative thinking. As technology continues to advance, the role of these tools in landscape architecture design is expected to grow further.

4.2. Correlation Analysis Results

To further explore the relationship between the frequency of students' use of AI tools and their learning outcomes and satisfaction, this study used Pearson correlation coefficients to analyze the relationships between these variables. Correlation analysis helps to reveal whether there is a significant association between frequent use of AI tools and improvements in students' design abilities and overall satisfaction.

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Table 4: Correlation analysis results.

Variable pair	Pearson's correlation coefficient (r)	Correlation strength
Frequency of use & learning outcomes	0.62	Moderate positive correlation
Frequency of use & satisfaction	0.45	Moderate positive correlation

4.2.1. Correlation Analysis between Frequency of Use and Learning Outcomes

As shown in Table 4, the Pearson correlation coefficient between frequency of use and learning outcomes is 0.62, indicating a moderate positive correlation between the two. This suggests that students who frequently use AI tools are more likely to report a significant improvement in their design abilities. This positive correlation can be explained by the fact that frequent use of AI tools in the design process helps students quickly generate solutions and analyze data, which in turn has a positive impact on learning outcomes. However, it is noteworthy that despite the strong correlation, some students with lower usage frequencies still reported high learning outcomes, which may be related to individual learning habits or the efficiency of tool usage.

4.2.2. Correlation between Frequency of Use and Satisfaction

The correlation analysis results show that the Pearson correlation coefficient between frequency of use and satisfaction is 0.45, indicating a moderate positive correlation. This means that students who use AI tools more frequently tend to report a higher overall satisfaction with their experience. Frequent use may make students more familiar with these tools, thus improving their operational efficiency and user experience, leading to increased satisfaction. However, the correlation coefficient of 0.45 indicates that this positive relationship is not very strong, suggesting that some students with lower usage frequencies also reported high satisfaction. This implies that they may only use AI tools in specific scenarios (such as design simulations or data analysis), where these tools significantly contribute to their learning outcomes despite lower usage.

The correlation analysis results suggest that there is a positive relationship between the frequency of AI tool use and both learning outcomes and satisfaction. Students who use AI tools more frequently tend to show more positive results in terms of design ability improvement and overall satisfaction. However, this relationship is not absolute, as some students with lower usage frequencies still exhibit high learning outcomes and satisfaction. This suggests that in future teaching practices, in addition to encouraging frequent use of AI tools, attention should also be given to the effectiveness and relevance of the tools to ensure that students can maximize the potential of AI tools in appropriate learning contexts.

4.3. Test Results: Analysis of Differences between Gender and Grade Levels

To explore the differences in AI tool usage based on gender and grade level, this study employed the independent samples t-test method to compare the frequency of AI tool usage and satisfaction between male and female students, as well as among students of different grade levels. The purpose of the t-test is to examine whether the mean differences between two or more groups are statistically significant.

4.3.1. Gender Difference Analysis

The study first conducted a t-test on the gender variable to analyze the differences between male and female students in terms of AI tool usage frequency and satisfaction. The results are as follows:

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Table 5: Gender difference analysis.

Variable	Gender	Mean	Standard deviation	t-value	p-value
AI tool usage frequency	Male	3.50	0.71	-1.54	0.13
	Female	3.85	0.49		
Satisfaction	Male	3.20	0.42	-1.92	0.07
	Female	3.63	0.53		

As shown in Table 5, the mean AI tool usage frequency for males is 3.50, while for females it is 3.85 (with 1 being "never used" and 5 being "used daily"). The t-value is -1.54, and the p-value is 0.13, indicating that the gender difference is not statistically significant. This suggests that there is no significant difference between males and females in terms of the frequency of AI tool usage.

In terms of satisfaction, the mean for males is 3.20, while for females it is 3.63 (with 1 being "very dissatisfied" and 5 being "very satisfied"). The t-value is -1.92, and the p-value is 0.07, which is close to the critical value of 0.05. This indicates that there is some difference in satisfaction between genders, but it does not reach the level of statistical significance. This may suggest that females tend to be slightly more satisfied with AI tools than males.

4.3.2. Grade Level Difference Analysis

The study conducted another t-test to compare the AI tool usage frequency and satisfaction among third-year, fourth-year, and graduate students. Since the study mainly includes these three groups of students, the analysis focuses on their data. The results are as follows:

Table 6: Grade level difference analysis.

Variable	Grade level	Mean	Standard deviation	t-value	p-value
AI tool usage frequency	Third-year	3.78	0.44	-0.62	0.54
	Fourth-year	3.85	0.50		
	Graduate	4.00	0.58	0.87	0.39
Satisfaction	Third-year	3.33	0.51	-0.74	0.47
	Fourth-year	3.57	0.50		
	Graduate	3.71	0.47	1.11	0.28

Based on Table 6, in terms of usage frequency, the mean for third-year students is 3.78, for fourth-year students it is 3.85, and for graduate students, it is 4.00. The t-test results show that the p-values are all greater than 0.05, indicating no significant differences in AI tool usage frequency across grade levels.

For satisfaction, the mean for third-year students is 3.33, for fourth-year students it is 3.57, and for graduate students, it is 3.71. The t-test p-values are also greater than 0.05, indicating that there is no statistically significant difference in overall satisfaction with AI tools across different grade levels.

The results of the t-tests show that there are no significant differences in AI tool usage frequency or satisfaction based on either gender or grade level. Although females reported slightly higher satisfaction than males, and graduate students reported slightly higher usage frequency than undergraduates, these differences did not reach statistical significance. This suggests that the use of AI tools in the landscape architecture program is relatively consistent, with student feedback and user experiences not being significantly influenced by gender or grade level.

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4.4. ANOVA Results: The Impact of Different Grade Levels and AI Tool Types on Learning Outcomes

To further explore the impact of different grade levels and AI tool types on students' learning outcomes, this study used one-way analysis of variance (ANOVA). ANOVA helps to test whether the means of three or more groups differ significantly. The main purpose of this section is to investigate whether there are significant differences in learning outcomes (such as improvements in design abilities and the development of creative thinking) among students of different grade levels after using AI tools, as well as the influence of different AI tool types on students' learning outcomes.

4.4.1. The Impact of Different Grade Levels on Learning Outcomes

ANOVA was used to compare the differences in learning outcomes among third-year, fourth-year, and graduate students after using AI tools. The following table shows the ANOVA results for the impact of grade level on learning outcomes:

Table 7: ANOVA results for the impact of different grade levels on learning outcomes.

Grade level	Mean	Standard deviation	F-value	p-value
Third-year	3.67	0.49	1.27	0.29
Fourth-year	3.85	0.56		
Graduate	4.00	0.58		

According to Table 7, the F-value is 1.27 and the p-value is 0.29, which is greater than 0.05, indicating that the differences in learning outcomes among students of different grade levels after using AI tools are not statistically significant. This means that whether third-year, fourth-year, or graduate students, the improvement in learning outcomes, such as design ability and creative thinking, after using AI tools is generally the same. Although the mean shows that graduate students' learning outcomes are slightly higher than those of undergraduates, this difference does not reach a significant level. It can be inferred that as AI tools become increasingly integrated into teaching across different grade levels, students' mastery and the effectiveness of AI tool application tend to become consistent across different stages of education.

4.4.2. The Impact of Different AI Tool Types on Learning Outcomes

The study next examined the impact of different AI tool types on learning outcomes. Common AI tool types include image generation tools (such as DALL·E, Midjourney), automated design tools (such as AI plugins for AutoCAD), data analysis tools (such as AI-driven GIS tools), and text generation tools (such as ChatGPT). The following table presents the ANOVA results for the impact of different tool types on learning outcomes:

Table 8: ANOVA results for the impact of different tool types on learning outcomes.

Tool type	Mean	Standard deviation	F-value	p-value
Image generation tools	3.85	0.52	3.45	0.03
Automated design tools	3.70	0.47		
Data analysis tools	3.90	0.60		
Text generation tools	4.10	0.55		

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As Table 8 shows, the ANOVA for tool types and learning outcomes produced an F-value of 3.45 and a p-value of 0.03, which is less than 0.05, indicating that there are statistically significant differences in learning outcomes based on different AI tool types. Specifically, students using text generation tools (such as ChatGPT) and data analysis tools (such as GIS tools) reported higher learning outcomes, with means of 4.10 and 3.90, respectively. In contrast, students using automated design tools reported a relatively lower mean learning outcome (3.70), which could be due to the higher technical demands of these tools, leading to a steeper learning curve and potentially affecting the actual learning outcomes.

4.5. Post Hoc Test Results

To further analyze which tool types have significant differences, an LSD (Least Significant Difference) post hoc test was conducted. The results show that the difference between text generation tools and automated design tools is statistically significant ($p < 0.05$), indicating that students using text generation tools perform better in learning outcomes compared to those using automated design tools. Differences between other tool types were not significant.

The ANOVA results suggest that there are no significant differences in learning outcomes among students of different grade levels after using AI tools, meaning that whether third-year, fourth-year, or graduate students, the learning improvements from using AI tools are generally similar. However, significant differences exist in the impact of different AI tool types on learning outcomes, particularly with text generation and data analysis tools showing more significant improvements, while automated design tools show relatively lower effects. This suggests that in future curriculum design, educators should tailor their teaching strategies according to the characteristics of different tool types to help students better master and apply these tools.

5. Discussion and Recommendations

5.1. Advantages and Limitations of AI Tools in Landscape Architecture

This study, by analyzing the current usage of AI tools among landscape architecture students, revealed the potential and limitations of these tools in design learning. Descriptive statistical results show that AI tools have already been widely adopted in landscape architecture education, especially text generation tools and image generation tools, which are frequently used by students. Students generally believe that AI tools can effectively enhance design efficiency, helping them to generate design solutions more quickly and spark new ideas. Additionally, survey data indicate that students who use AI tools report significant improvements in their design abilities and creative thinking.

However, despite the significant advantages of AI tools in improving learning efficiency, some students also reported challenges in their usage. According to the correlation analysis and t-test results, although there is a positive correlation between usage frequency and learning outcomes and satisfaction, some students mentioned the technical complexity of AI tools. This is especially true for automated design tools and data analysis tools, where students often face high technical barriers. This suggests that although AI tools have great potential, if the complexity issue is not addressed, it may negatively impact students' learning outcomes.

Additionally, the study found that students' satisfaction with AI tools did not significantly increase with higher usage frequency. This may indicate that the current functionality of AI tools in the field of landscape architecture still does not fully meet students' needs. Some students pointed out that the practicality and accuracy of AI tools in complex design scenarios need further improvement, offering directions for future advancements in AI technology.

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5.2. Recommendations for Integrating AI Tools into Landscape Architecture Curriculum

Based on the above analysis, this study further explores how to better integrate AI tools into the landscape architecture curriculum. As AI technology continues to develop, the landscape architecture curriculum can integrate AI in the following ways to help students better master these tools and improve their learning outcomes.

Regarding the application of AI tools in the curriculum, schools and educators should provide more technical support. Survey data show that most students hope the school will offer more training courses and practical projects related to AI tools (about 84.38%), indicating that students have a strong interest in AI tools but lack sufficient technical support. Therefore, schools could introduce regular workshops to teach students how to effectively use tools such as ChatGPT, Midjourney, and AutoCAD AI plugins. Additionally, courses should be designed to incorporate AI tool usage modules that align with the unique characteristics of landscape architecture.

Teachers need to help students better understand the applicability of AI tools in the design process, avoiding over-reliance on technology at the expense of foundational design skills. The study found that some students, despite frequently using AI tools, encountered challenges related to tool complexity in actual design, leading to less-than-expected learning outcomes. Therefore, curriculum design should focus on how to appropriately use AI tools, enabling students to build a solid foundation in design theory and hand-drawing skills while using AI tools for innovation and efficiency. In particular, when using data analysis and automated design tools, teachers can set more targeted exercises to gradually guide students in mastering the use of these complex tools.

In addition, teachers and schools should actively encourage students to flexibly apply AI tools in practical projects. The study shows that students have limited opportunities to engage with AI-related practices in real design projects, which hinders their ability to integrate AI technology into design. Therefore, landscape architecture programs can increase students' opportunities to use AI tools in real design through practical training projects or interdisciplinary collaboration projects. For example, schools can collaborate with businesses to introduce real-world design projects, where students can use AI tools for design optimization, environmental analysis, or project evaluation. This will significantly enhance students' practical abilities while helping them gain a deeper understanding of the value and limitations of AI tools.

6. Conclusion

This study conducted a survey and analysis of the current usage of AI tools among landscape architecture students, revealing the potential and challenges of applying AI tools in design disciplines. The results show that AI tools offer significant advantages in the learning and design process in landscape architecture, particularly in improving design efficiency and supporting creative thinking. The vast majority of students (84.38%) reported having used AI tools, and most students had a positive overall experience with these tools, with over 59.26% expressing that they were "satisfied" or "very satisfied" with them.

The results from descriptive statistics, correlation analysis, t-tests, and ANOVA further revealed a moderate positive correlation between AI tool usage frequency and student learning outcomes. Students who used AI tools more frequently reported better learning outcomes, particularly in terms of improved design ability and creative thinking. However, the study also found that despite the advantages AI tools provide, some students reported challenges related to tool complexity and technical limitations, which restricted the effectiveness of these tools to some extent. This was particularly evident with automated design tools, where student learning outcomes did not meet expectations.

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Gender and grade level analyses indicated no significant differences in AI tool usage, suggesting that the application of AI tools is widespread in landscape architecture and suitable for various student groups. There were significant differences in the impact of different AI tool types on learning outcomes, with text generation tools and data analysis tools showing stronger improvements in learning outcomes, while automated design tools had relatively lower effects.

As AI technology continues to develop, its application in landscape architecture will further expand and deepen. Future innovations in AI will bring more powerful, user-friendly tools that will provide more comprehensive learning support for students. However, to fully realize the potential of these tools, educators and schools need to take the following measures:

1.Schools should provide more technical support and training opportunities to help students better master the use of AI tools. Especially for automated design and data analysis tools, which have higher technical barriers, practical projects and specialized courses should be offered to help students overcome these challenges.

2.Balance technology and foundational skill development: In future landscape architecture education, educators should focus on developing students' independent design abilities and creative thinking, avoiding over-reliance on AI tools. By effectively integrating AI technology with traditional design methods, educators can ensure that students not only master modern design techniques but also maintain a deep understanding of the essence of design.

Overall, AI tools demonstrate great potential in landscape architecture, but their effective integration still requires careful planning and support from educators. Through more efficient use of tools, more reasonable teaching strategies, and broader practical opportunities, AI technology has the potential to bring greater innovation and development to education in the field of landscape architecture.

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