

**THE EFFECT OF AI-ASSISTED LEARNING
APPROACHES ON ACADEMIC PERFORMANCE,
ARTISTIC CREATIONS, AND MOTIVATION IN
ART EDUCATION AMONG PRIMARY SCHOOL
STUDENTS OF DIFFERENT GENDERS IN AN
INSTITUTION IN CHINA**

SU HANJUN

UNIVERSITI SAINS MALAYSIA

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STUDENTS OF DIFFERENT GENDERS IN AN
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by

SU HANJUN

**Thesis submitted in fulfilment of the requirements
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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
GAI	Generative Artificial Intelligence
AISCL	AI-assisted student-centred learning
AITCL	AI-assisted teacher-centred learning
PKT	PictureBook Knowledge Test
PCT	PictureBook Creation Test
IMMS	Instructional Materials Motivation Scale

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**KESAN PENDEKATAN PEMBELAJARAN BERBANTU AI
TERHADAP PRESTASI AKADEMIK, CIPTAAN ARTISTIK, DAN
MOTIVASI DALAM PENDIDIKAN SENI DALAM KALANGAN PELAJAR
SEKOLAH RENDAH DARIPADA JANTINA YANG BERBEZA DI SEBUAH
INSTITUSI DI CHINA**

ABSTRAK

Tujuan kajian ini adalah untuk meneroka kesan pendekatan pembelajaran berasaskan AI terhadap prestasi akademik, hasil seni, dan motivasi pembelajaran murid sekolah rendah merentasi jantina yang berbeza. Reka bentuk faktorial kuasi-eksperimen 2x2 telah digunakan. Pembolehubah bebas adalah dua pendekatan pembelajaran berasaskan AI: pembelajaran berpusatkan pelajar dengan sokongan AI (AISCL) dan pembelajaran berpusatkan guru dengan sokongan AI (AITCL). Jantina berperanan sebagai pembolehubah moderator, manakala pembolehubah bersandar adalah prestasi akademik, hasil seni, dan motivasi pembelajaran. Kajian ini melibatkan sampel seramai 256 murid sekolah rendah dari China yang dibahagikan secara rawak kepada dua kumpulan, di mana setiap kumpulan menggunakan salah satu daripada pendekatan pembelajaran berasaskan AI. Statistik deskriptif dan inferensi digunakan untuk menganalisis data. Ujian t, ANOVA, dan ANCOVA digunakan untuk menilai perbezaan signifikan dalam prestasi akademik, hasil seni, dan motivasi pembelajaran antara kumpulan, serta menilai kesan interaksi antara pembolehubah bebas terhadap

pembolehubah bersandar. Keputusan kajian ini menunjukkan bahawa kumpulan AISCL lebih baik berbanding kumpulan AITCL dari segi prestasi akademik, hasil seni, dan motivasi pembelajaran. Kedua-dua murid lelaki dan perempuan mencapai keputusan yang lebih baik apabila menggunakan AISCL. Selain itu, murid perempuan mengatasi murid lelaki dalam hasil seni sama ada menggunakan AISCL atau AITCL. Tiada kesan interaksi yang signifikan antara dua pendekatan pembelajaran dan jantina dari segi prestasi akademik dan hasil karya seni pelajar. Walau bagaimanapun, kesan interaksi terhadap motivasi pembelajaran menunjukkan bahawa AISCL mempunyai kesan yang lebih kuat ke atas pelajar perempuan. Secara keseluruhan, teknologi AI sebagai alat untuk membantu pembelajaran mempunyai potensi untuk membantu pelajar sekolah rendah dalam pembelajaran seni. Pada masa yang sama, ia perlu digabungkan dengan pendekatan pembelajaran yang berkesan seperti pembelajaran berpusatkan pelajar, dan perbezaan jantina perlu dipertimbangkan untuk mencapai hasil pembelajaran yang paling berkesan. Walaupun kajian ini memberikan pandangan yang bernilai, penemuannya adalah berdasarkan kepada konteks budaya dan pendidikan tertentu, yang boleh diperluaskan oleh penyelidikan masa hadapan untuk mengesahkan kebolegunaan hasil ini secara lebih meluas.

**THE EFFECT OF AI-ASSISTED LEARNING APPROACHES ON
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STUDENTS OF DIFFERENT GENDERS IN AN INSTITUTION IN CHINA**

ABSTRACT

The aim of this study was to explore the impact of AI-assisted learning approaches on primary school students' academic performance, artistic creations, and learning motivation across different genders. A 2x2 quasi-experimental factorial design was employed. The independent variables were the two AI-assisted learning approaches: AI-assisted student-centred learning (AISCL) and AI-assisted teacher-centred learning (AITCL). Gender served as the moderator variable, while the dependent variables were academic performance, artistic creations, and motivation. The study involved a sample of 256 primary school students from China, who were randomly assigned to two groups, each learning under one of the AI-assisted approaches. Both descriptive and inferential statistics were applied to analyse the data. T-tests, ANOVA, and ANCOVA were used to assess the significant differences in academic performance, artistic creations, and learning motivation between the groups, as well as to evaluate the interaction effects between the independent variables on the dependent variables. The results of this study indicated that the AISCL group outperformed the AITCL group in terms of academic performance, artistic creations,

and learning motivation. Both male and female students achieved better results when using AISCL. In addition to this, female students outperformed male students in artistic creations whether using AISCL or AITCL. There was no significant interaction effect between the two learning approaches and gender in terms of students' academic performance and artistic creations, the interaction effect for learning motivation showed aiscl had a stronger impact on female students. Overall, AI technology as a tool to assist learning has the potential to help primary school students in art learning. At the same time, it also needs to be combined with effective learning approaches such as student-centred learning, and gender differences should be considered to achieve the most effective learning outcomes. While this study provides valuable insights, its findings are based on a specific cultural and educational context, which future research could expand upon to further validate the broader applicability of these results.

CHAPTER 1

INTRODUCTION

1.1 Overview

The advances in Artificial Intelligence (AI) and its application in art education is a growing field with the potential for improving student learning by creating personalised and immersive learning environments (Hwang & Chen, 2023). Over the past few years, AI has received a lot of attention by researchers (Looi, 2024; Wang et al., 2024; Jaramillo & Chiappe, 2024), and it is considered to be an effective method for “future learning and problem solving” (Baker et al., 2019). The relationships between learners, instructors, and institutions have changed due to this technology.

Novel research areas integrating AI and education have arisen as a result of the growing needs in education (Song and Wang, 2020). Artificial Intelligence in Education (AIED) research is progressing rapidly, and this area is also closely related to a wide range of disciplines and has received close attention from researchers (Chen et al., 2020; Mokmin & Masood, 2015). The application of artificial intelligence has positive impacts on learning analytics, pedagogical advances, and teaching (Chen et al., 2020). This boom is expected to give students more choices through personalised learning approaches, leading to better learning outcomes (Zhang & Aslan, 2021).

As an important part of education, some artists are already using AI in the process of creative assistance, making it known as a capable assistant (Chatterjee, 2022). At the same time, some researchers have gradually started to focus on the potential role of AI in art education. For example, in China, Yang (2020) created an

AI-based assessment model to improve teaching and learning in university art programmes. Most of the existing research focuses on the development of applications and the improvement of technology. In some studies, empirical tests were conducted to examine the effects.

As one of the most essential and fundamental stages of education, art education at the elementary level plays an irreplaceable and essential role for students, for example, developing students' intelligence, better understanding different cultures, and, to some degree, improving test scores (Gattis, 2016). However, there is currently very little use of AI in actual art classes (Kong, 2020). AI is also insufficient in elementary art learning today, especially in China. Chen et al. (2022) developed a digital art ability training system for children. The system provides offers AI-assisted guidance in colour recognition and drawing techniques. Sun et al. (2022) examined the pedagogical effectiveness of artificial intelligence for drawing. How to improve the quality of primary school art education with AI is a worthwhile research topic.

In today's rapidly developing world of information technology, change is everywhere. The traditional, teacher-centred learning and teaching approach is facing challenges (Akram et al., 2022). How to make new technologies better support learning and help prepare students to face the world of tomorrow is a topic which has received much interest in recent years.

Traditional primary art education in China takes place in art classrooms with relatively basic teaching methods (Wen, 2021). The approach to learning involves a rigorous curriculum that emphasises training in basic skills. The learning effectiveness

of this traditional approach to arts learning depends largely on the teachers' suggestions and instructions, which may limit students' exposure to different artistic perspectives and approaches. The same class often has up to several dozen students. It is a challenge for teachers to give different advice and guidance to each student's work in a large class.

The general problem with these situations is that primary school students have poor learning effects and interest in art classes (Ying, 2023), and their learning and creative performance are not at a good level, even if it affects their learning motivation in art classes in general (Mo, 2022). The contemporary art world and technological landscape are undergoing rapid changes, making traditional art education curricula and teaching methods increasingly insufficient to equip students for adapting to this fast-evolving environment. This presents new challenges for students in art learning and has sparked growing interest among art educators in the potential of AI technologies.

AI is regarded as having potential in various domains of art education, such as art appreciation instruction. However, building an effective AI-assisted art learning system still faces numerous challenges, including technical barriers, accessibility issues, and ethical concerns. As revealed in the study by Wang et al. (2021), achieving this goal requires close collaboration between technologists and educational researchers. Future research should focus not only on enhancing AI's functionalities but also on addressing these challenges to ensure equitable and ethical use in educational settings (Leong et al., 2024; Akgun & Greenhow, 2022).

Therefore, this study explores how AI technology can be more effectively integrated into primary art education through different learning environments to enhance learning effects and motivation. In this thesis, we have chosen the topic of children's picture book creation, focusing on the application of generative AI technology and examining the effects from students' perspective. In addition, this study also grouped students according to gender to explore the connection between the effects of learning with different AI-assisted art learning approaches and children's gender. The aim of this study is to explore the effects of different learning approaches in primary school art education in the context of artificial intelligence technology in the new era in fostering creativity and skill development, thus preparing students for a future where technology and creativity intersect. The study integrated generative AI functions to form AI-assisted art learning approaches to help primary school students learn about picture books and the creative process. This study will provide a valid reference for students, teachers and related researchers.

1.2 Background of the Study

This section presents the background about this study. This includes AI application in art education, academic performance, creations and motivation in primary art education, and the preliminary study.

1.2.1 Primary School Art Education

In the past two decades, AI has developed and improved dramatically in various fields with the speedy growth of the new information technology such as the

Internet, Internet of Things, and big data (Roser, 2024). With the shift in educational needs of countries and the introduction of national policies in various countries, research and application in education are known as two of the most notable areas, Artificial Intelligence for Education (AIED) or Educational Artificial Intelligence (EAI). The report from Global Market Insights (2023), a renowned global market research and management consulting firm, states that the global market size for AIED reached \$4 billion by 2022. Growth is expected to continue over the next decade. The application and exploration of artificial intelligence technology in education is certainly worth looking forward to.

Despite being an essential part of education, however, AI in art education has rarely been considered in previous studies (Kong, 2020). As a branch of AI, GAI (Generative AI) is considered to have a considerable potential effect on traditional art courses (Hutson & Robertson, 2023). GAI tools, led by ChatGPT, Midjourney, and DALL-E 2, have made art creation progressively less difficult, which has led to extensive discussions. There is already a consensus that AI tools should not be a substitute for the learner in art learning, but should be seen as tools that enhance and complement the creative process. It is worth noting that the interdisciplinary integration of AI in art education, such as combining art, technology, and critical thinking, remains underexplored. Studies like Ankyiah and Bamfo (2023) suggest that fostering critical thinking through AI-integrated art projects could enhance students' ability to evaluate and interpret artworks while developing their technological literacy.

In addition to this, the associated ethical issues are extremely important. The IDEE (Identify, Determine, Ensure, Evaluate) theoretical framework, which is proposed by Su & Yang (2023) for using generative AI in education, particularly mentions ensuring ethical considerations on this point. For example, ethical concerns such as biases embedded in generative AI models or the risk of overdependence on AI tools need to be addressed systematically. This includes critically examining how these tools influence creativity, originality, and fairness in the learning process (Ferrara, 2023).

Therefore, how to integrate AI tools into art education deserves further research and development optimisation. Future research should focus on how interdisciplinary approaches could enable students to critically engage with AI technologies in art creation. In particular, the use of different learning strategies, reflecting the different positions and roles of AI technologies in the learning process, is a direction worth exploring and researching in the future.

Today, young children live in a world of changes and challenges. In addition to traditional learning styles and knowledge acquisition, new demands are being placed on students' creativity and digital competence (Tzafilkou et al., 2022). The application of digital technology, for example, embraces fundamentals of the visual arts and is an important part of the primary school art curriculum (Pavlou, 2019). There are now applications, such as digital painting and drawing, that reduce the cost of consuming materials and allow for unlimited experimentation. It is not even confined to the classroom and allows for learning and creation at any time, bringing a whole new

experience to children's artistic creations. The combination of art and technology has exploded with excellent job prospects and potential. Not only do these changes place demands on designers and students, but educators are also facing technological change in the educational dimension (Boyland, 2021).

The focus on new technologies is now increasing in the primary art curriculum. In the Compulsory Education Art Curriculum Standards (2022) in China, an important part of the 3-5 grade level is "Integrating Interdisciplinary Learning", which mentions "integrating art with nature, society, and technology". It states, "Integrate art with nature, society, and technology to solve problems creatively. Experimenting with technology in the art classroom can be a win-win situation for students by helping them develop creativity, critical thinking, and artistic skills while preparing them for success in the technology-rich world of work and art.

The challenge for teachers and researchers is to rethink the characteristics of effective and creative learning approaches from learner behaviour, teacher pedagogy and teaching strategies and to encourage the application of innovative pedagogical approaches in computer-assisted learning environments, such as experimenting with AI technologies in teaching to enhance further course outcomes (Tang et al., 2022). Teaching methods must be continually explored and adapted, and researchers compare and select appropriate teaching strategies and instructional environments, re-design courses, assess student outcomes, and subsequently redesign for continuous improvement to accommodate these irreversible changes.

Unlike STEM (science, technology, engineering and mathematics) subjects, these subjects have clear right or wrong answers, artistic creation is subjective and allows for more creativity and freedom of expression (Aguilera & Ortiz, 2021). Each students' work is based on his or her understanding, and the work that can be produced varies from student to student.

However, primary school art education in China is still facing many problems at present, such as few art learning resources and varying levels of education (Liu et al., 2022). The current teaching methods and techniques in the actual classroom are still rather outdated (Gao, 2019), mostly the traditional teacher-led classroom model, using paper and pencil and other tools for drawing and creating. These factors affect students' interest and motivation levels, affecting academic performance and the outcome of students' artistic creations.

As discussed later in the literature review section, the academic performance is one of the variables of greatest interest to researchers in AI-assisted education. The mastery of basic knowledge and theory is an integral part of any subject. Most of the current art education uses traditional teaching methods. Students learn knowledge and practice and create in the classroom. Surveys have shown that students, especially in primary and middle school age groups, often find art-related theoretical knowledge dull and hard to focus on during the learning process (Ankyiah & Bamfo, 2023). However, it is much hard for students to go deeper if they do not know enough about the basic knowledge and background.

At the same time, as in other subjects, each student has a different level of art foundation and a different ability and pace of learning (Moubayed et al., 2020), which makes a difference in the level of drawing in the same class, and the understanding and acceptance of art knowledge vary greatly. Even when the same techniques or learning methods are used, the results may vary for students at different learning levels. Due to class size constraints, a teacher typically has to deal with many students in a class. As a result, it becomes challenging to provide immediate and personalised guidance to students (Seo et al., 2021). This is where AI can play a role in offering personalised learning experiences; however, concerns remain about whether AI could limit the creativity of younger learners or overly standardise the learning process (Hasibuan & Azizah, 2023).

Artistic creation can help children express thoughts and ideas more precisely, their emotions and understanding of the world can be deepened in the process of creating. Artwork created by children can be used for various meaning-building purposes and is worthy of in-depth study. Artwork created independently by students is more than simple marks, lines, and meaningless illustrations; it is also feelings, thoughts, and expressions. The creations convey emotional, spiritual, and other messages. It can provide a window into their texts, self-perceptions, communities, and the wider world (Mantei & Kervin, 2014). Artwork in the art classroom is the best test for student learning. However, in practice, students often encounter problems such as the inability to draw, being inspired, and lacking creativity. Creativity is recognized as an essential skill for students in the 21st century (Piiro, 2011). Creativity has been

noticed and emphasized in education across the globe, and the development of creativity in students is believed to help student develop their potential (Wang, 2021).

Some studies have reported that divergent thinking, which is related to students' creativity, is generally on the rise, but there is a significant drop in the fourth grade, which is called the "fourth-grade slump" (Torrance, 1967). Therefore, it is worthwhile to select fourth-grade students as research subjects to explore how better to introduce new technologies into art classroom educational activities so that students can learn in a more effective way and increase their level of spontaneous creativity.

Learning motivation is "the key to successful learning" (Maslow, 1997). The use of technology, the quality of learning materials, the learner's ability, and the learner's motivation all affect the final learning outcome (Pawar & Ayarekar, 2022). Considering the significance of motivation for effective study, selecting appropriate strategies to enhance motivation for learning is an important area of concern for researchers. Strong motivation drives active and highly engaged learning behaviours, also considered "an important prerequisite for effective learning" (Huang et al., 2023).

In traditional teaching and learning applications, students are less engaged because there is less autonomy in terms of control, and most of the manipulation is demonstrated by the teacher, resulting in less interaction between the teacher and the child. Prameswari et al. (2020) noted that demotivation among art learners can also lead to a gradual decline in art activities. These results may suggest the importance of intervention methods. How to design instruction to enhance motivation has been one of the main focuses of educational research over recent years. This involves

identifying and studying learners' cognitive models and learning processes. There is a need to identify differences in learning patterns and thinking across learners and how it affects knowledge acquisition.

1.2.2 Preliminary study

A preliminary study was conducted in 2023 to identify the problems and needs encountered by primary art education in China. Eleven grade 4 students and three teachers from a primary school in China participated in this survey. In addition, some perceptions and preferences related to artificial intelligence technology were also investigated. The survey had three main objectives:

1. To find out about the difficulties and issues the primary school students and teachers face while learning art courses.
2. To find out about the students' and teachers' instructional needs while learning art courses.
3. To determine the students' and teachers' views, preferences and expectations for the AI-assisted art learning.

The questionnaire was divided into two versions: a student version and a teacher version (Appendix A). Each version contains similar questions with different words in detail. Each questionnaire version was divided into three parts based on primary objectives. The survey was administered in an online format. The soft copy link to the survey was sent via WeChat. After completing the questionnaires, there was also a brief communication with some of the testers. A brief summary of preliminary study is presented in Table 1.1.

Table 1.1 Overview of preliminary study findings

Category	Students' answer	Teachers' answer
Difficulties and issues	"not good at drawing", "don't know what to draw", "don't know how to draw"	more concerned with students' creativity and expression in the creative process, classroom time is relatively tight
Instructional needs	more and newer drawing tools to help them create	"a wealth of art teaching aids and resources", "small class size," "abundant opportunities for interaction", "active communication"
Views, preferences, and expectations	not familiar with AI, but in general, there was a positive attitude and a willingness to try; hope AI can "improve my ideas", "inspire me to create", "show me how to realise my ideas"	have some knowledge of AI, but are not familiar with it, willing to try; hope AI can "inspire students to create", "improve students' ideas", but not to "draw for students directly"

The first part consisted of short-answer questions to find out what the students and teachers considered the problems encountered in art learning. 82 % of the students were not satisfied with their work and studies and considered themselves "not good at drawing". Specifically, the most frequently mentioned problem is that they often "don't know what to draw", always lack inspiration, and often take up a lot of time for thinking, conception; they also "don't know how to draw", many students lack basic art-relevant knowledge, which often leads to difficulties in drawing process. Some students also mentioned that in many cases they had good ideas but were limited by the level of their drawings to be able to show their ideas fully.

In contrast to the students' perspectives, the teachers paid less attention to the level of the students' drawing; for example, the problem of "poor drawing", which was mentioned by most of the students, was not mentioned by the teachers. All three art teachers said that they were more concerned with students' creativity and expression in the creative process, as well as their personal progress and growth. At the same time, two teachers mentioned a lack of creativity in students' work compared to students in kindergarten and the lower elementary grades. These factors also affect students' learning outcomes and motivation. These findings emphasise the need to incorporate creativity-promoting tools, such as generative AI, into arts education in order to bridge these gaps. Another teacher added that classroom time is relatively tight and that there are always a few students who are not able to complete and turn in their work on time.

The second part of the survey was in the form of short-answer questions about the instructional needs of students and teachers. Students and teachers were asked, "What tools do you think could possibly help you learn / teach better?" Some of the fourth graders did not quite understand this question and mentioned that they would like more and newer drawing tools to help them create freely. However, when they later saw the presentation of the AI tools, more specific new ideas were proposed. Art teachers, on the other hand, mentioned that they would like to have "a wealth of art teaching aids and resources," such as accompanying teaching textbooks or software; "small class sizes," with small groups of 10-15 students, or multiple teachers working together to tutor students; "abundant opportunities for interaction with ample class time, allowing students ample time to complete their creations inspired by the teacher".

Also, "active communication with classmates and openness of speech." However, the teachers also mentioned that due to the large size of the class, there are different levels of drawing and a great deal of individual variability. Although the best way is to teach students according to their abilities. However, it is almost impossible for the current art classroom to achieve this with only one teacher. These insights informed the design of AI-assisted art learning approaches. For example, AI-assisted learning can integrate functions to meet the needs of students at different learning progressions and levels in order to improve teachers' ability to manage classroom differences and provide targeted instruction.

The third part was a multiple-choice survey of students' and teachers' views, preferences, and expectations about AI-assist art learning. Firstly, the students and teachers were surveyed about their level of understanding regarding AI. Among the students, except for one student who said he knew a lot about AI, half of the students chose "Have heard of it, but not very familiar" and half chose "Completely unfamiliar". All teachers chose the "Have heard of it, but not very familiar" option. Regarding GAI tools such as ChatGPT and Midjourney, about one-third of the students and teachers indicated that they had "I've heard of them but haven't used them", while the remaining two-thirds indicated that they had "I have never heard of them", and only one student selected "Yes", but also did not use it during the creation process. In general, students and art teachers in primary schools in China have some knowledge of AI, but are not familiar with it, and many students are not familiar with it at all.

Next, some videos introducing AI and GAI were shown to students and teachers to provide an initial introduction to AI technology and related uses. After getting a preliminary understanding through the videos, most students and teachers were evenly split between those who said, "I'm very interested and want to try it right away!" and "Somewhat interesting, I might try it if I have a chance". However, two students and teachers said "They seem okay, I'm not particularly interested".

Students and teachers were then prompted to try out the AI tools. More than 80% of the students found the experience "Very interesting, I want to keep exploring them" and " Quite fun, I'm willing to use them occasionally in the future", with two-thirds of the teachers making the same comments. The remaining students and teachers said " They're okay, but I might not use them actively". Overall, there was a positive attitude and a willingness to try it out, but a few students expressed a lack of interest. Also, teachers mentioned that during the preliminary study, although students were not grouped by gender to answer the questions, they seemed to show gender differences in interest, and in general seemed to be more interested by male students. For example, teachers observed that male students generally showed more enthusiasm for AI tools during the exploration sessions, especially when interacting with generative AI apps such as Midjourney. In contrast, female students were more hesitant to participate initially, but once they began experimenting with AI tools, they also showed continued interest. However, in daily art classes, female students are usually more active.

Finally, students and teachers were asked "How do you think these AI features could be used in art creation?". All three teachers mentioned to "inspire students to create" and two chose to use it to "improve students' ideas"; 73 % of students thought it could be used to "improve my ideas" and 55 % to "inspire me to create", while 36 % wanted to use it to "show me how to realise my ideas". It is worth noting that 45 % of students chose the option "draw for me directly". As a learning tool, it is widely recognised by researchers and educators that AI should not be used as a direct replacement for students' creativity, but rather as an assistant and guide for learning. Therefore, "to directly assist me in drawing" is not the way educators expect to use it. Researchers and educators must pay special attention to designing instruction, correctly guiding students, and making AI an effective tool for helping students learn art.

Overall, students often encountered difficulties in art learning and are not satisfied with their own learning, and teachers and students have put forward their own views on instructional needs. The majority of students and teachers do not know enough about AI technology, but have some interest in it. Despite the relatively limited sample size, in general, the preliminary study identified gaps in primary school students' art knowledge and art-making levels, instructional needs, and different understandings of AI technologies, providing a foundation and valuable insights for the design of subsequent AI-assisted art learning.

1.3 Problem Statement

Problems faced by primary school students in art learning are identified through the preliminary investigation. The fourth grade is a critical period in the development of creativity, which may be influenced by a variety of factors such as peer relationships, educational styles, etc., and students may experience a slump in creativity in the fourth grade, a phenomenon known as the 'Fourth-Grade Slump' (Torrance, 1967). At this stage, students may be more inclined to follow the behavioural patterns of their peers, resulting in a temporary decline in creativity. Many pupils are dissatisfied with their own creative and learning processes in the actual art learning process (Solano, 2023). Many students think they are "not good enough" and lack confidence (Greene et al., 2018). They often feel that they "do not know what to draw", "do not know how to draw", and "do not know why to draw this way" when they are drawing. The reason for these dissatisfactions is that many students lack inspiration and imagination (Li, 2024); in the traditional classroom, students find art-related knowledge dull, and their learning foundation is not solid, further affecting creativity (Alter et al., 2009). At the same time, it is difficult for students to get timely, one-on-one counseling (Seo et al., 2021; Elsoud, 2021), which has a negative impact on learning motivation and effectiveness.

In the context of arts education, it is critical to understand the current state of these developments. Recognising periods of potential decline in student learning and creativity allows educators to implement targeted interventions to sustain and enhance arts learning development (Suantini et al., 2023). Incorporating AI tools into arts

education can provide personalised learning experiences, offer new avenues for creative expression, and address challenges found in traditional arts education.

Researchers have gradually begun experimenting with AI technology's application in education and have found positive effects on learning from different perspectives (Zafari et al., 2022). Several studies have shown that through the improvement of motivation for primary school students, there is also an indirect impact on academic performance and creativity levels (Huang et al., 2022, Martín-Núñez, 2023).

However, most researchers in the field of education nowadays are focusing on the development of technology and the exploration of future directions, as found through the review of literature. For example, Grassini (2023) explores the possible impact of using ChatGPT in settings of educational practice. In addition, some researches have begun to explore AI in art education (Chiu, 2022; Tang et al., 2022), but the actual application of the research has not been sufficiently investigated, especially regarding the impact of the technology on students' creativity and motivation to learn, but most of the research subjects have been chosen to be college students, and there are few studies on primary school students.

Gender differences are also a worthy subject in technology-assisted modern learning (Cai et al., 2017). It was found that allowing primary school students to use AI image processing functions in painting freely produced gender differences in learning attitudes and willingness to sustain learning (Sun et al., 2022). In detail, when students were allowed to use it freely, it stimulated boys' interest in learning but

decreased girls' continuous learning intention, and Sun et al. mentioned that since AI technology was still new to students, the learning experience was like an "adventure out of the comfort zone of the usual drawing environment". This phenomenon has been explained by gender differences in behaviour based on social psychology and gender roles (Ramkissoon & Nunkoo, 2010). However, there is still a gap in the specific differences and explanations of gender in terms of creative and academic performance in artistic learning. When using AI in drawing studies, developers are advised to pay special attention to female students.

Research has found that student-centred learning environment using multimedia-mediated learning modules helps increase learner motivation compared to teacher-centred teaching and learning environment (Y. W. Li et al., 2014), highlighting the importance of shifting the focus from the teacher to the student. By doing so, learner understanding and motivation can be improved. However, despite this, student-centred learning is not without its critics. This shift can only be successful if both the teaching and learning communities understand and support this approach to learning. At the same time, student-centred learning is usually researched and developed in Western educational contexts, and the results may vary for different regions and in different national contexts (O'Sullivan, 2004).

However, especially for younger children, it is not only for learners to learn how to use AI, but also, importantly, how to correctly guide students to use AI technology through instructional design to achieve better learning results. Proper instructional design is crucial in fostering initial interest in AI, increasing students'

understanding of learning, and fostering the willingness to learn over time (Lin et al., 2021).

Therefore, the two different AI-assisted art learning approaches, AISCL (AI-assisted student-centred learning) and AITCL (AI-assisted teacher-centred learning) were designed and developed in this study to investigate the effect on students' academic performance, artistic creations, and learning motivation.

1.4 Research Objectives

The following are the research objectives of this study.

1. To design and develop two different AI-assisted art learning approaches (Student-centred Learning and Teacher-centred Learning) that is intended to deliver the content of picture book creation of the primary school art course.

2. To investigate the effect of two different AI-assisted art learning approaches, AISCL (AI-assisted student-centred learning) and AITCL (AI-assisted teacher-centred learning), on students' academic performance.

3. To investigate the effect of two different AI-assisted art learning approaches, AISCL and AITCL, on students' artistic creations.

4. To investigate the effect of two different AI-assisted art learning approaches, AISCL and AITCL, on students' learning motivation.

5. To investigate the interaction effect of two different AI-assisted art learning approaches, AISCL and AITCL, on students' academic performance, picture book creation, and learning motivation among students of different genders.

1.5 Research Questions

We conducted an assessment study to investigate the effects of students' academic performance, artistic creations, and learning motivation using the AI-assisted art learning website with student- and teacher-centred learning. At the same time, we analyzed the interaction between different genders.

This study attempts to answer the following research questions:

1. What is the effect of using two different AI-assisted art learning approaches to academic performance for primary school students of different genders?

i. Is there any significant difference in academic performance between students using AI-assisted student-centred learning (AISCL) and AI-assisted teacher-centred learning (AITCL)?

ii. Is there any significant difference in academic performance between students of different genders using AISCL?

iii. Is there any significant difference in academic performance between students of different genders using AITCL?

iv. Is there any significant difference in academic performance between male students using AISCL and AITCL?

v. Is there any significant difference in academic performance between female students using AISCL and AITCL?

2. What is the effect of using two different AI-assisted art learning approaches to artistic creations for primary school students of different genders?

i. Is there any significant difference in artistic creations between students using AI-assisted student-centred learning (AISCL) and AI-assisted teacher-centred learning (AITCL)?

ii. Is there any significant difference in artistic creations between students of different genders using AISCL?

iii. Is there any significant difference in artistic creations between students of different genders using AITCL?

iv. Is there any significant difference in artistic creations between male students using AISCL and AITCL?

v. Is there any significant difference in artistic creations between female students using AISCL and AITCL?

3. What is the effect of using two different AI-assisted art learning approaches to learning motivation for primary school students of different genders?

i. Is there any significant difference in learning motivation between students using AI-assisted student-centred learning (AISCL) and AI-assisted teacher-centred learning (AITCL)?

ii. Is there any significant difference in learning motivation between students of different genders using AISCL?

iii. Is there any significant difference in learning motivation between students of different genders using AITCL?

iv. Is there any significant difference in learning motivation between male students using AISCL and AITCL?

v. Is there any significant difference in learning motivation between female students using AISCL and AITCL?

4. The interaction effects of using two different AI-assisted art learning approaches (AISCL & AITCL) on primary school students' academic performance, artistic creations, and learning motivation among students of different genders.

i. Is there an interaction effect between the two AI-assisted art learning approaches (AISCL & AITCL) and gender on students' academic performance?

ii. Is there an interaction effect between the two AI-assisted art learning approaches (AISCL & AITCL) and gender on students' artistic creations?

iii. Is there an interaction effect between the two AI-assisted art learning approaches (AISCL & AITCL) and gender on students' learning motivation?

1.6 Research Hypotheses

Based upon the literature reviews, alternate directional hypotheses were designed for this study. The probability level of 0.05 is used to test statistical significance.

A. The effect of using two different AI-assisted art learning approaches to academic performance for primary school children of different genders.

H₀.A.1: There is no significant difference between AI-assisted student-centred learning (AISCL) and AI-assisted teacher-centred learning (AITCL) in students' academic performance.

H₀.A.2: There is no significant difference between students of different genders using AISCL in academic performance.

H₀.A.3: There is no significant difference between students of different genders using AITCL in academic performance.

H₀.A.4: There is no significant difference between male students using AISCL and AITCL in academic performance.

H₀.A.5: There is no significant difference between female students using AISCL and AITCL in academic performance.

B. The effect of using two different AI-assisted art learning approaches to artistic creations for primary school children of different genders.

H₀.B.1: There is no significant difference between AISCL and AITCL in students' artistic creations.

H₀.B.2: There is no significant difference between students of different genders using AISCL in artistic creations.

H₀.B.3: There is no significant difference between students of different genders using AITCL in artistic creations.

H₀.B.4: There is no significant difference between male students using AISCL and AITCL in artistic creations.