Project-Based Learning for Quality Art Teacher Development in the Age of AI

Zhiyuan Zhou

School of Education, Wuhan College of Arts and Sciences, Wuhan, Hubei, china

Abstract: AI era is in urgent need of talents with creativity and high problem-solving ability. School art education undertakes the important task of cultivating innovative talents, and the priority of development is creative thinking. This project combines the practice of art education in normal colleges, selects actual cases for analysis, implements the research of art teacher education based on project-based learning, and puts forward feasible solutions, which can effectively solve the problems of the disconnection of art knowledge and skills from art education, the disconnection of art education theory and teaching practice, and the lack of organic connection between normal colleges and primary and secondary art courses. Cultivate a group of excellent art teachers with innovative spirit and practical ability.

1. Introduction

1.1. The Technological Revolution Has Led to a Fundamental Change in the Concept of Occupation

The Future of Work report book released by the World Economic Forum (WEF) on January 18, 2016 predicts; "Under the impact of the Fourth Industrial Revolution, led by artificial intelligence, robotics and life sciences among others, most existing occupations will disappear, while a plethora of new occupations will emerge that do not currently exist." The results of a survey of personnel executives from 350 of these large companies in 15 major industrialized countries, including the United States, China, Japan, Germany, India, the United Kingdom, France, Australia, Brazil, and Italy, show that 5 million jobs will be lost in developed countries over the next five years[1].

The WEF has begun to focus on the industrial revolution and the job changes it may lead to because the speed of recent technological developments has been unmatched by previous industrial revolutions. Developments in technologies such as artificial intelligence and robotic engineering are giving rise to innovations such as the Internet of Things (IoT), self-driving cars and 3D printers. At this rate, it's only a matter of time before robots replace jobs held by humans, and the WEF predicts that there will be 4.759 million fewer office and management jobs and 1.609 million fewer manufacturing and production jobs over the next five years. In contrast, there will be small increases in jobs in computer and mathematics (405,000), business and finance (492,000), and construction and engineering (339,000), and occupations such as clergy, doctors, firefighters, and photographers are considered less likely to be replaced by robots[2].

Geoff Mulgan, founder of the UK-based Demos think tank, notes that the wave of digital technology that has made it possible for organisations and societies to think at scale in recent years has driven the emergence of a new field - collective intelligence. This "big thinking" refers to humans and machines working and thinking together, and it has the potential to solve the great challenges of our time. He explores how collective intelligence can be consciously organized and coordinated to harness its power to help us survive and thrive, points out the difference between environments that inspire intelligence and those that weaken it, and shows how human and machine intelligence can solve the challenges of business, climate change, democracy, and public health. However, to achieve this goal, we need new professions, institutions and ways of thinking[3].

In an era where artificial intelligence has arrived, 65 per cent of seven-year-olds worldwide who entered primary school in early 2016 will grow up to work in jobs that do not currently exist. The knowledge and skills previously imparted in schools are no longer sufficient to meet the needs of society. If our schooling remains the same, how do we meet the challenges of future societies? According to Klaus Schwab, President of the World Economic Forum (WEF), "the dramatic social and economic changes brought about by the technological revolution will lead to fundamental changes in the concept of occupation". If countries want to avoid worst-case scenarios such as mass unemployment, they should seek to enhance students' creativity and problem-solving skills through education and training, rather than teaching them mere skills that could be replaced by robots"[4].

1.2. Artificial Intelligence Paintings Challenge the Boundaries of Art

Nowadays, artificial intelligence has been involved in various fields and is gradually taking over human high intelligence fields, with the emergence of robot lawyers, robot doctors Watson, robot chess players, robot editors, etc. It seems that all areas of human intelligence are being deconstructed and subverted by artificial intelligence. Artistic creation has always been the highest form of human spiritual activity, but in recent years, the development of artificial intelligence is pulling art down from the altar, with the emergence of robot novelists whose novels have been shortlisted for the Japanese Literature Prize, and robot composers who can compose touching music, etc.

In October 2018, art auction house Christie's fetched $432,500 (plus commission and other fees) for the first meaningful painting created entirely by AI, a portrait of a man titled Edmond de Belamy, in New York. The painting was created by the French art organization Obvious using Generative Adversarial Networks (GAN), an algorithm first created by American AI researcher Ian Goodfellow in 2014.The GAN algorithm consists of two parts. The generator and the discriminator. In Obvious, Hugo Caceres-Dupre, the AI PhD student responsible for much of the technical work, notes that they were "interested in the philosophical approach that lies behind it". He said, "Is it possible for an algorithm to be creative? If so, this algorithm would be the closest to the creativity of the human brain" and "I want to bring this new approach to more traditional markets, not just to the technological field" [5].

The successful auction of Edmond de Belamy by Christie's is certainly an important recognition of artificial intelligence in the field of art. While there are many so-called "creative coders" using similar technologies to refine the Internet experience, few are considered modern artists, and the members of obvious consider themselves to be modern artists, with their main goal being to popularize GAN and legitimize art created by artificial intelligence. This will force people to reconsider what they call "art" and push its boundaries even harder.

1.3. New Challenges for Art Teacher Education

In the face of rapid advances in fields such as artificial intelligence, big data, genetic technologies, and brain science, the organization for Economic Co-operation and Development (OECD) launched the Education 2030: Education and Skills for the Future (OECD Education 2030) in 2015. The project to help countries find answers about what knowledge, skills, attitudes and values today's students need to prosper and shape their world, and how teaching and learning systems can effectively contribute to their development. The Framework for Learning 2030 provides a vision and some basic principles for the future of education systems, showing how young people can navigate their lives and the world. The Learning Framework includes knowledge, skills, attitudes and values; personal and social well-being; and transformative capacity to mobilize knowledge, skills, attitudes and values through a process of reflection, anticipation and action in order to develop the linked competencies needed to engage with the world. Education 2030: Education and Skills for the Future supports countries in addressing common challenges in curriculum implementation and in identifying critical success factors. It also explores the competencies and profiles of teachers to help all students achieve the desired outcomes for future success. These areas will be explored through systematic analysis and consolidation of existing research, national surveys of curriculum implementation, and multi-stakeholder consultations and triangulation of global peer learning[6].

In this context, art education (also known as "visual arts education"), which is an important part of the education system, is also facing enormous challenges and needs to renew itself. In order to meet the challenges of artificial intelligence, art education will have to start a new transformation, the function of art teachers will change profoundly, and art teacher education will face even greater challenges. This is because human differences and cognitive complexity make learning impossible to experience and pathway. We should train the individuals with great differences to become art teachers, and art teachers should also be the groups of primary and middle school students with great differences to achieve higher expected goals than before. Therefore, the goal of art teacher education is not only to prepare teachers to deliver the existing curriculum or to complete what is taught in books, but also to prepare future art teachers for deep learning, not only to know the material to teach, but also to understand how elementary and middle school students learn art, what experiences help them connect is known and they need to know, and what pedagogical changes ensure that they reach a common goal - the acquisition of visual literacy essential for survival and communication in a highly complex world.

2. Innovative Development of Art Teacher Education in the Context of AI Era

2.1. Creative Thinking as a Priority Development Goal in Art Education

Some of the eloquent arguments about the 21st century skills innovation movement suggest that the content of knowledge is becoming irrelevant as vast amounts of new knowledge are being created all the time. Why would students need to spend a lot of time to learning these knowledge if they can search on the internet? The vast majority of the skills children learn now in a variety of subjects may never be useful again by 2050. In such a world, the last thing teachers need to teach students is more information, because students already have too much of it. In fact, what students need is to acquire deeper levels of expertise and creative skills. So, can arts education give students deeper levels of expertise and creative skills? The answer is yes.

This is because the primary defense of arts education should be the intrinsic value of the arts and the associated skills and important habits of mind that they develop. Arts education exists for the acquisition of artistic habits of mind, which is the current priority goal of arts education in OECD

national curricula. Habits of mind in the arts refer not only to the acquisition of craft and technique, but also to such abilities as careful observation, imagination, exploration, perseverance, expression, collaboration and reflection, such as the thinking and creativity and social and behavioral skills developed in the arts. In contrast to science and other cultural curricula, the arts allow for different ways of understanding. Because art is a field where there are no absolute right or absolute wrong answers, it allows students the freedom to explore and experiment, and also promotes introspection and the discovery of the meaning of one's own existence[7]. Art education, which is an important part of arts education, is more prominent in bringing deeper expertise and creative skills to students.

In the author's opinion, the priority development goal of art education in schools is creative thinking. Creative thinking refers to a new and unique thinking activity that reveals the essence and inner connection of objective things and guides a person to obtain a new interpretation of the problem, thus producing unprecedented thinking results. It brings new socially significant results and is the product of a highly developed level of intelligence. Through project-based learning, students who experience art learning and stimulate creative thinking gain deeper expertise and creative skills in the following areas'[8]:

(1) In-depth exploration of a theme (or topic) in the fine arts to gain knowledge and skills in visual literacy and stylistic representation, and broad exposure to multiple related fields

(2) The ability to integrate visual arts information in new ways, to stimulate imagination and inspiration, to analyze ideas and to promote the use of them to their fullest potential, and the ability to think creatively in order to generate aesthetically useful and creative ideas.

(3) Curiosity, intrinsic interest and perseverance in the fine arts, a willingness to take risks, and a motivation to be comfortable with the uncertainty of meaning.

(4) Apply critical thinking to make creative metacognitive decisions about subject matter, theme, medium, and presentation.

(5) Create and incorporate environments that communicate, collaborate and encourage risk-taking.

These deep levels of expertise and creative skills not only help students navigate their own learning and lives, but also contribute to thriving and shaping the world of tomorrow.

2.2. Achieving Creative Thinking as a Priority Development with Strong Art Teacher Education

Since the eighth basic education reform in China in 2001, the art curriculum and teaching in primary and secondary schools have taken on a new style. Looking at the art classroom teaching in primary and secondary schools in recent years, we find that some art teachers have transcended the limitations of textbooks, focusing on their own creativity in teaching design and putting it into practice, striving to cultivate students to think through materials, experiencing the process of transforming creativity in their minds and emotions into artistic images, and encouraging a multi-faceted vision. However, from the perspective of students' learning, some art classroom teaching is only limited to the teacher's own creativity, and does not really stimulate students' creativity. In other words, the art teacher plays the role of the artist, and each student is only a part of the "artist's" work, hard working to complete the teacher's work. This is a phenomenon that deserves full attention.

In searching for the root causes of this problem, we found that one of the main reasons was the lack of creative thinking among art teachers themselves. As a further corollary, we find that pre-service art teacher education has failed to prepare future art teachers with the skills to teach project-based art with creative thinking as a priority. A large pool of exceptional art teachers is needed to help all children and youth in elementary and secondary art classrooms across the country to have

access to art education that prioritizes creative thinking in order to promote project-based learning art units, and the solution must rely heavily on strong art teacher education.

3. Project-Based Learning and Art Teacher Education

3.1. Project-Based Learning

Project-based learning (PBL) is a dynamic, student-centered approach to learning that stems from John Dewey's idea of "learning by doing." [9]It promotes active learning and inquiry-based learning, where students work for long periods of time to investigate and answer a complex question, challenge or ask questions to understand a topic, i.e. students gain deeper knowledge by actively exploring real-world challenges and problems.

Another definition of PBL is a student-centered instructional model. In this model of instruction, students are guided by teachers and other adults to ask questions and are supported by them to explore and discover answers to those questions. PBL lessons are guided by several important questions that tie content standards and higher-level thinking to authentic contexts; expanded task-based learning products and performance to develop knowledge and skills in cognitive domains; and authentic assessments that require students to complete authentic tasks rather than demonstrate what they have learned by answering specific questions on a test paper. Students work together to solve real-world problems in their schools and communities. Successful problem solving often requires students to draw lessons from several disciplines and apply them in very practical ways. It has six elements: the goal (the task to be accomplished in the project), the role (the role the student plays in the project), the object (the individual or group served by the role the student plays in the project), the context (the background or environment in which the project is implemented, etc.), the product (the outcome of the project), and the standard (the criteria for evaluating the outcome of the project).

The project "Creating strong art teacher education through project-based learning" is based on the definition of "PBL as a student-centered teaching model", which encompasses the following two aspects.

On the one hand, undergraduate art education, work in small groups under the guidance of university faculty to propose and establish research projects in primary and secondary art education, each of which is authentic; each project is independent and consists of phases of project establishment, implementation, conclusion, and evaluation of results.

On the other hand, during their educational internships, undergraduate students as a practicing teachers guide elementary and middle school students in a long-term art learning task that requires them to take on the role of real-world characters, ask and analyze and research problems through art appreciation and creation, and present the conclusions of problem solving by creating artwork and using PowerPoint presentations, just as artists (including fine artists, designers, and craftspeople) work as well. Thus, PBL gives undergraduate art education students not only the knowledge and abilities they will need for their future work, but also the art education work itself that they will do in the future.

3.2. Project-Based Art Education Internship with "Creative Thinking as a Priority Development Goal"

In recent years, a growing number of undergraduate art education students in normal university have prioritized the development of creative thinking in primary and secondary school students during their educational internships, and they have developed and practiced teaching a series of project-based learning art units, thus providing ample evidence that through project-based art

learning, primary and secondary school students do acquire deeper professional knowledge and creative problem-solving skills.

So, the author describes a concrete and feasible approach to the development and teaching practice of a project-based learning art unit curriculum, taking into account a typical case of an educational internship (September-November 2021) for undergraduate art education students at central china Normal University.

3.2.1. Case Study: "My Textbook" Unit Curriculum Development and Teaching Practice

Zhang Xiaoli, a teacher at Wuhan Guanggu Fourth Primary School, province hubei, developed a unit course on "My Textbook" and carried out teaching practice. The unit curriculum is guided by constructivism, with the goal of stimulating the creative thinking of sixth-grade students as a priority, "book binding and design" as the curriculum content, and project learning as the methodological guide, and has achieved remarkable results.

The project is based on students' flexible use of book design knowledge to analyze the shortcomings of existing textbooks, aiming to raise students' awareness of quality textbooks, and then generate new ideas to improve existing textbooks; after analyzing the feasibility of new ideas, revise and improve the new ideas; students work in groups, using a combination of creative thinking, design skills, modeling skills, and hands-on skills to complete the textbook work of each group. Finally, each group of students used PowerPoint to present the creation process of "my textbook" and demonstrate the finished textbook, demonstrating the knowledge, skills and improved overall literacy.

At the end of the unit, Ms. Zhang Xiaoli compiled feedback from each group on the unit to obtain comprehensive and authentic feedback on the unit.

For example, the Geography Textbook Group: "Through this course, we have learned how to identify problems, think about them and solve them back, creating newer and more interesting books through objective comparison and creative imagination. We chose some common materials in our lives to complete our work. However, we also encountered some minor problems during the process, such as the effect of coloring on the cardboard box was different from the expected effect, in order to solve this point, we thought and discussed, and changed to use the method of covering and pasting leaves to improve the decoration, and achieved better results. This kind of flexible attitude is also worth learning from in our daily lives."

Another example is the history textbook group: "During the initial idea stage, we all thought enthusiastically and came up with all sorts of great ideas and then successfully completed the design of our work. However, during the practical stage, we found that making holes in the drawings was not a particularly easy task and sometimes it was easy to poke holes in the paper. Nevertheless, we persevered and finished our work with patience and perseverance, and the results we got through our efforts made everyone very happy."

Another example is the group in the English textbook: "In fact, our group's initial idea was also different from the present work, but we encountered certain difficulties in the process of making it. However, our group improvised and discussion, and finally finished learning activity, we understood a new minded: "use your head when you meet with difficulties, brave to face problems, to solve difficulties, so that when we grow up, we will be able to solve whatever troubles we encounter successfully."

Thus, through project-based learning that prioritizes creative thinking as a starting point, students working as a team are driven by the real question of "what makes a quality textbook" and demonstrate their knowledge in the design and production of a subject textbook. Students develop their creativity, knowledge of textbooks, modeling skills, design and production skills, problem

identification, problem solving, creativity, improvisation, collaboration, presentation and communication skills through active and inquiry-based learning.

3.2.2. Case Study: "Wuhan Jianghan Road Pedestrian Street" Unit Curriculum Development and Teaching Practice

Yao Hailing, a teacher at Wuhan Guanggu Experimental Primary School, province hubei, developed and implemented a unit course on "Wuhan Jianghan Road Pedestrian Street". The unit curriculum is guided by constructivism, and the starting point is to stimulate the sixth grade students' intention of redesigning the Jianghan Road Pedestrian Street, a traditional characteristic district of Wuhan, with creative thinking as the priority development goal. The course content is based on the history of Jianghan Road, architectural shape, function and spatial design, model making, and project learning.

Through a pre-class survey, the teacher found that students lacked knowledge of Wuhan's regional traditional culture, and in response to this problem, students experienced the project-based learning process of "Jianghan Road Pedestrian Street - Regeneration of Wuhan's Characteristic Neighborhood" to improve their knowledge, understanding and recognition of regional traditional culture. After analyzing the feasibility of the new idea, they revised and improved the new idea. Students learned how to design the shop space and make a model of the shop with paper clay, and worked in groups to complete each group's shop design drawing and model by using creative thinking, design ability, modeling ability and hands-on ability. At the end, students of each group used PowerPoint to present the creation process of "Jianghan Road Pedestrian Street" and demonstrated the finished shop design drawings and models, showing the knowledge and skills they had learned and the improvement of comprehensive 's literacy.

Ms. Yao Hailing summarized that the teaching effect was generally satisfactory for this research practice. The students were not only able to have a deeper understanding of Wuhan's traditional architecture, the Jianghan Road Pedestrian Street, through classroom learning, but also had further exposure to the design of Chinese characteristic street districts. In the classroom, students learned to explore on their own, instead of just being taught by the teacher. They studied and discussed together, starting from the history, architectural features and commercial culture of Jianghan Road, then analyzing the current problems of Jianghan Road Pedestrian Street, investigating the characteristic streets of Wuhan, then proposing solutions and actively engaging in design practice. The students were also able to work as a team and present their work." Her thinking on teaching is: "According to the current teaching methods, identify the strengths and weaknesses; try to find out the best teaching methods suitable for students and effectively improve the quality of classroom teaching. Teachers should advocate independent and cooperative learning according to the requirements of the new curriculum reform, and constantly awaken students' motivation in the classroom atmosphere, and strive to make students the main body of classroom teaching."

The description and analysis of the two cases above show that in the art classroom the teacher's actions do not stand alone, but interact with individual and groups of pupils and students. Teaching all primary and secondary school students to use art to solve problems and apply knowledge requires that art teachers have a deep understanding of the art discipline and know how to effectively present art concepts to primary and secondary school students with different abilities and levels of ability and prior experience, organize a constructive art learning process, and assess what students have learned; and how they have learned it, so that they can make timely adjustments according to different art learning styles curriculum goals, instructional content, and pedagogical equations. Both cases highlight the characteristics of project-based learning curriculum development with creative thinking as a priority development goal; students are at the center of the learning process; projects are driven by framing questions, projects are closely connected to the real

world and contain interconnected tasks and activities that last over time; thinking skills are integrated into project-based learning; multiple instructional strategies support a variety of learning styles; and projects incorporate process-based, Multiple types of assessment; Through posting and presenting assignments and performances, students demonstrate the knowledge and skills learned.[10]

In conclusion, through project-based learning art unit curriculum development and teaching practice, we allow primary and secondary school students to experience art learning, stimulate creative thinking, and gain deeper expertise and creative problem-solving skills. At the same time, art education undergraduates will rapidly grow into quality art teachers with creative thinking and innovative practical skills in the 21st century.

4. Effectiveness and Outlook

In the context of the AI era, more and more teacher education institutions are shifting their training programs and curricula towards creative thinking as a priority goal, and undergraduate students (future teachers) are learning ways to develop project-based learning art unit courses with the priority goal of developing students creative thinking, and the method of art unit course based on project learning, and actively carry out teaching practice in the process of education practice., which has already resulted in both.

First, undergraduates learn to develop and implement a project-based art curriculum that "prioritizes creative thinking." Through project-based art teacher education, art education undergraduates learn to go beyond the limitations of art textbooks to include more authentic and meaningful local art curriculum resources and establish creative thinking as a priority development goal, thus maintaining a good dialectic between content goals and general curriculum goals, as well as the interests, abilities, starting points and pathways of primary and secondary school students. They have developed and implemented a series of innovative school-based art programs that take social development, regional culture, and new media art as entry points, not only to deliver the curriculum or complete the textbook content, but more importantly, to ensure high-quality art learning for primary and secondary school students with diverse needs. This research direction and practical experience will help advance the development of a new art curriculum for basic education in China, as well as promote the development of art teacher education.

Second, undergraduates achieve a change in identity from teacher educator to art teacher. By conducting project-based learning in art teacher education, undergraduate art education majors change their old habits of responding to problems through rote knowledge and become people who can think, solve problems, and create more possibilities. They are much ahead of other new teachers, more confident, have their own plans, and know what they are doing and why they are doing it in the first place. They are able to respond to new issues in art curriculum and teaching, discover, integrate, analyze, and interpret information through their own inquiry, and improve in all areas of art education philosophy, art teaching skills, and experience, thus completing the identity change from a novice to a qualified art teacher in the shortest and fastest time possible.

5. Conclusion

Through the research of creating a art teacher education based on project-based learning, we have effectively solved the long-standing problems of art knowledge, skills and art education that have not been solved in the training program and curriculum of art education in normal colleges and universities, art education theory and teaching practice, and the lack of organic connection between normal colleges and primary and secondary art courses. In the future, we should take moral education as the fundamental task of aesthetic education, and actively carry forward the excellent traditional Chinese culture. We should establish the concept of taking innovative thinking as the

priority development goal of art education worldwide. Further develop art teacher education through various ways and methods, and cultivate a large number of excellent art teachers who can truly help all children and teenagers to acquire visual literacy, innovative spirit and practical ability.

References

[1] Park Woongbin and Kwon Hyuksoo. Implementing artificial intelligence education for middle school technology education in Republic of Korea. International journal of technology and design education, 2023: 21-27.

[2] Im Chaeyeong. Medical student's artificial intelligence education and research experiences. Korean journal of medical education, 2022, 34 (4): 341-344.

[3] Zhou Ruogang, Thinking Big: How Collective Wisdom Can Change Our World, translated by Guo Li et al, CITIC Publishing Group, 2018.

[4] Trilling, Charles Fidel, 21st Century Skills: Learning for the Times We Live In, translated by Hong You, Tianjin Academy of Social Sciences Press, 2011.

[5] Nanjala Ruth et al. A mentorship and incubation program using project-based learning to build a professional bioinformatics pipeline in Kenya. PLoS computational biology, 2023, 19 (3).

[6] Pei Zhao and Heikki Kynäshlahti and Sara Sintonen. A qualitative analysis of the digital literacy of arts education teachers in Chinese junior high and high schools. Journal of Librarianship and Information Science, 2018, 50 (1): 77-87.

[7] Alan Weiner, Talia R. Goldstein, [French] Stephen Vincent Lanklin, Back to Art Itself: the Impact of Art Education, translated by Zheng Yan, Teachers College Press, 2016, pp. 4 i 5.

[8] Qian Chuxi, "Re-discussing the value and purpose of visual arts education in schools," Chinese Art Education, Vol, 3, 2018, 4-8.

[9] Tsybulsky Dina and Muchnik-Rozanov Yulia. The contribution of a project-based learning course, designed as a pedagogy of practice, to the development of preservice teachers' professional identity. Teaching and Teacher Education, 2023, 124.

[10] Sun Shanjie and Kong Yanrong and Bao Hanjin. Exploration of the development path of aesthetic education in colleges and universities in the digital context. Frontiers in Educational Research, 2023, 6 (2)