



Research on Applying the Deming Cycle (PDCA) Management Method to Promote the Innovative Practical Ability of Art and Design Education Students

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Abstract

This study aims to explore how the Deming Cycle (PDCA) management method can be applied in art and design education to promote students' innovative practical abilities. This study reveals the implementation strategies and effectiveness of the PDCA cycle in art and design education. The study found that through the application of PDCA cycle, art design education can achieve continuous optimization of teaching strategies, enhance students' innovative practical abilities, and establish a learning culture that supports continuous improvement.

Received: 2/10/2024

Accepted: 3/20/2024

Published: 4/5/2024

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This study provides practical guidance to educators and managers in the field of art and design education, aiming to promote the continuous improvement of education quality and the comprehensive development of students' innovative abilities through the application of the Deming cycle management method.

Keywords: Deming cycle (PDCA) management method; innovative practical ability; art design major; teaching practice.

1. Introduction

This section will explain the origin, concept and importance of Deming Cycle (PDCA) in quality management. Explain the necessity and potential value of applying the Deming Cycle to educational improvement and student ability improvement. Identify the questions and objectives this study aims to explore.

1.1 Background introduction

The Deming cycle method is based on the concept of "Plan-Do-See" proposed by statistician Walter A. Shewhart. Shewhart The unique PDS cycle is further developed into Plan-Do-Study-Act. Among them, P (Plan) - Plan, which refers to determining the policies and goals, and determining the activity plan; D (Do) - Execution, doing it on the spot, and realizing the contents of the plan; C/S (Check/Study) - Checking, summarizing the implementation plan Result, pay attention to the effect, find out the problem; A (Action) - action, process the results of the summary inspection, affirm and appropriately promote and standardize successful experience; summarize the lessons of failure to avoid recurrence, and put down the unresolved problems A PDCA cycle[1]. The Deming Cycle is considered the core of continuous improvement and quality management.

Table 1.1: Steps and methods of Deming cycle

stage	step	Main methods
P 1	Analyze the current situation to identify problems	Pareto charts, histograms, control charts
P 2	Analyze various influencing factors or causes	cause and effect diagram
P3	Find out the main influencing factors	Pareto chart, correlation chart Answer "5W1H" Why was this measure developed (Why)? What goal is achieved?
P4	Develop action plans for the main reasons	Where to execute? Who is responsible for completing it? When will it be completed? How?
D5	Execution, implementation plan	
C6	Check plan execution results	Pareto charts, histograms, control charts
A7	Summarize successful experiences and formulate corresponding standards	Formulate or modify work procedures, inspection procedures and other relevant rules and regulations
A8	Transfer unresolved or emerging issues to the next PDCA cycle	

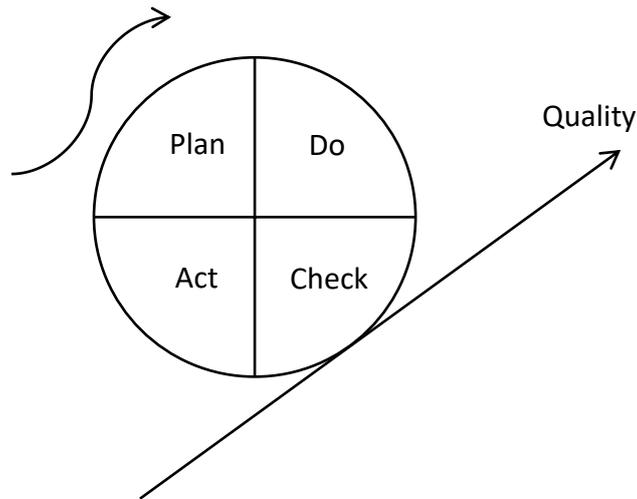


Figure 1: PDCA cycle steps and methods

The Deming Cycle was popularized in Japan in the 1950s by William Edwards Deming, helping the country rebuild its postwar economy. The Deming Cycle was initially mainly used in manufacturing and economic fields. Over time, people gradually realized the universal effectiveness of the PDCA cycle in managing and improving processes, and this method began to be applied to a wider range of fields, including education field. From the late 20th century to the early 21st century, the educational community began to pay more attention to quality assurance, continuous improvement, and outcome-based evaluation. Educational institutions are beginning to seek effective ways to improve teaching quality, enhance student learning outcomes, and meet the growing demand for external assessment and accreditation. The reason why the PDCA cycle can be successfully transferred from the economic and manufacturing fields to the education field is mainly because it provides a simple and systematic method to identify, implement and evaluate improvement measures. In educational settings, the PDCA cycle is used to improve curriculum design, teaching methods, student assessment, and overall educational management and operational processes. Through a continuous cyclical process, educational institutions are able to gradually optimize their procedures and services, thereby improving the quality of education and student satisfaction.

1.2 Reasons for research

Applying the Deming Cycle (PDCA Cycle) to art and design education is of great necessity and potential value for improving students' abilities. Art and design education is a field that is constantly evolving and changing, and the pursuit of innovation and quality requires efficient and continuous improvement methods. As a mature

quality management tool, the PDCA cycle can provide important value to art and design education.

1.2.1 Promote continuous improvement of teaching quality

In art and design education, teaching methods and course content need to be constantly updated to adapt to new technologies and market trends. Through the PDCA cycle, educators can continuously evaluate and improve teaching plans to ensure the timeliness and relevance of teaching content.

1.2.2 Strengthen students' practical abilities and innovative thinking

The core competencies of art and design students include innovative thinking, aesthetic judgment and technical skills. The PDCA cycle encourages students to adopt reflective and iterative methods in project practice to enhance their innovation capabilities and problem-solving skills through continuous trial, evaluation and adjustment.

1.2.3 Improve the adaptability of courses and teaching methods

Rapid changes in the field of art and design require educational curricula to be highly adaptable and flexible. The PDCA cycle enables educators to regularly adjust teaching methods and course structures based on student feedback and learning outcomes, ensuring that educational activities are aligned with industry needs.

1.2.4 Enhance students' critical thinking and self-evaluation abilities

The "Check" and "Act" phases of the PDCA cycle are particularly helpful in cultivating students' critical thinking. Students learn how to evaluate their own work, identify areas for improvement, and take action to improve it.

1.2.5 Promote collaboration between educators and students

In the PDCA cycle, educators and students participate in the design, implementation and evaluation process of teaching plans. This collaborative approach helps create a more open and interactive learning environment, encouraging students to actively participate and take responsibility for their own learning.

1.2.6 Support the development of personalized learning paths

The PDCA cycle supports the monitoring and adjustment of individual students' learning needs and progress, thereby providing students with a more personalized learning experience.

In short, applying the Deming cycle to art design education can not only improve the effectiveness of teaching and learning, but also cultivate students' innovative thinking , critical thinking and self-directed learning abilities .

1.3 Research objectives and questions

1.3.1 Research objectives

- 1.3.1.1 Continuous improvement of education quality.
- 1.3.1.2 Cultivation of students' innovative abilities.
- 1.3.1.3 Improve the adaptability of course design and teaching methods.
- 1.3.1.4 Promote critical thinking and self-evaluation.
- 1.3.1.5 Collaboration and feedback mechanism between educators and students.
- 1.3.1.6 Development of personalized learning paths.

1.3.2 Research questions

- 1.3.2.1 Research how to achieve continuous optimization of teaching methods and course content in art design education through the PDCA cycle to adapt to new technologies and market trends.
- 1.3.2.2 Explore how the PDCA cycle helps students develop innovative thinking and technical skills in project practice, especially in the diverse and interdisciplinary environment of art and design.
- 1.3.2.3 Study how the PDCA cycle enables educators to flexibly adjust teaching strategies based on student feedback and learning outcomes to improve teaching effectiveness and student satisfaction.
- 1.3.2.4 Through the “Check” and “Act” phases of the PDCA cycle, study how to cultivate students' critical

thinking and self-evaluation abilities, and the impact of these abilities on the long-term career development of art and design students.

1.3.2.5 Explore how the PDCA cycle promotes effective communication and collaboration between educators and students, and the contribution of this interaction to educational outcomes.

1.3.2.6 Examine how the PDCA cycle can support educators in developing and adapting personalized learning plans based on each student's unique needs and progress.

2. Literature review

2.1 Theoretical basis of Deming cycle

Through continuous improvement, step-by-step, reflection and improvement, and the cultivation of independent learning and problem-solving abilities, students' learning participation can be affected, thereby improving students' innovative practical abilities. By constantly reflecting on teaching effects and adjusting teaching methods and content, students' interest can be attracted, learning participation improved, and the development of innovative practical abilities promoted[2]. Teachers can gradually guide students to participate in learning, from simple to complex, thereby cultivating students' learning interests and innovative practical abilities[3]. Reflection and improvement in teaching activities can cultivate students' active learning attitude and innovative thinking[4]. In the process of solving problems, students can develop their independent learning and problem-solving abilities. Teachers can guide students to develop innovative practical abilities through cyclical learning and practice[5]. PDCA is used for curriculum development, teaching method improvement and student assessment[6]. The application of this circular approach promotes efficiency, effectiveness and sustainability. Teaching practice is a step-by-step process. In project-based teaching, we pay attention to the practice process. Deming's cycle management method is a process of discovering and solving problems. It helps to find deficiencies in a timely manner and make improvements during the teaching process, especially in project-based teaching. Analyze and sort out the problems existing in each specific step, and be able to provide timely feedback on the teaching effect and make continuous improvements[7]. In teaching, the Deming cycle management method can be used to discover deficiencies in teaching in a timely manner. Teachers and students can conduct self-examination in a timely manner, record feedback on results, analyze problems and summarize improvement strategies, continuously optimize teaching effects, and improve students' overall strength[8]. The

views in Table 2.1 emphasize how the cyclical teaching method promotes students' active participation and the cultivation of innovative abilities.

Table 2.1: Research results related to Deming cycle management method

Direction	View	Scholar	Time
Continuous improvement of the teaching environment	Emphasis on continuous improvement of the teaching environment. Improving the teaching environment can stimulate students' interest, increase learning participation, and create conditions more conducive to the development of innovative practical abilities.	Deming	1986
Standardization of professional construction	Curriculum construction, course design and teaching methods can be adjusted according to the cyclical steps to improve the level of professional construction, thus affecting students' learning participation and innovative practice abilities.	Juran	1988
Improve teacher quality	Teacher quality can be improved through continuous learning and improvement. Excellent teachers can better guide students and stimulate their interest in learning, thereby promoting students' learning participation and innovative practical abilities.	Feigenbaum	1961
Cultivate students' quality	Through the cyclical process, students can continuously reflect on and improve their learning methods and abilities, enhance learning participation, and create conditions for the development of innovative practical abilities.	Ishikawa	1985
Effective educational evaluation	Emphasizing problem prevention and continuous improvement, educational evaluation should also do the same. Through cyclic feedback and adjustment, teaching quality can be improved and students' learning participation and innovative practice abilities can be improved.	Ishikawa	1985

Deming's cycle management method can influence students' learning participation by improving the teaching environment, standardizing professional construction, improving teacher quality, cultivating student quality, and effective educational evaluation, thereby enhancing students' innovative practical ability[9]. These perspectives highlight how the principles of circular management can promote students' active participation and the cultivation of innovative abilities in education.

2.2 Current needs and challenges of education improvement

2.2.1 Main improvement requirements

2.2.1.1 Updates to educational resources and tools

As technology develops, educational resources and tools are constantly updated to adapt to new art and design trends.

2.2.1.2 Innovation in teaching methods

Develop and implement more effective teaching methods to stimulate students' innovative thinking and practical abilities.

2.2.1.3 Improvement of evaluation and feedback mechanism

Establish an effective evaluation and feedback mechanism to adjust teaching strategies in a timely manner and improve teaching quality.

2.2.2 Challenges faced

2.2.2.1 Alignment of course content and market demand

Ensure that course content is consistent with the actual needs of the current art and design industry.

2.2.2.2 Satisfying students' personalized learning needs

Adapt to the learning needs and styles of different students and provide personalized education solutions.

2.3 Application of PDCA in the field of education

Yu Bichun and Lin Qifa proposed the concept of teaching diagnosis based on the OBE concept and PDCA cycle . They established a professional team of teaching diagnosis experts, developed diversified teaching evaluation tools, promoted the application of information-based teaching methods, and established a teaching diagnosis assessment and incentive mechanism. , ensure the smooth development of course teaching diagnosis,

and promote the effective improvement of college teachers' education and teaching abilities[10]. It can be beneficial to the Deming cycle theory to guide alumni to play an important role in innovation and entrepreneurship education in colleges and universities, and explore their play paths[11]. Qi Min elaborated on how to use this theory to guide students to self-manage among higher vocational students, and at the same time provide reference for other students' work management methods in higher vocational colleges[12].

Tang Qi and Qi Chenyun introduced the "life cycle theory" and "PDCA Deming cycle theory" by exploring the practical application of project management in entrepreneurship education, and tried to integrate the core ideas and methods of these theories into the management practice of entrepreneurship education middle. A "three-layer progressive" monitoring and management model based on project management and combined with the PDCA cycle was developed, aiming to provide a more systematic, standardized and effective management framework for college entrepreneurship education activities[13].

Wang Shihuai used Deming cycle theory to construct a spirally improving PDCA cycle for teaching quality assurance in newly established undergraduate colleges and departments. This cycle takes goal setting and planning, implementation, evaluation, and optimization as the core links, aiming to continuously improve the quality of teaching. The designed framework mainly includes four major systems: departmental teaching organization and goal planning system, departmental teaching resource support system, departmental teaching evaluation and inspection system, and departmental teaching optimization and feedback system. These systems respectively correspond to the Deming cycle theory. The four stages of planning, execution, inspection, and action (improvement) demonstrate the characteristics of combining theory and practice[14].

Based on the Deming cycle theory, Li Donghua analyzed the current problems existing in the practical teaching of moral education courses in higher vocational colleges from the four dimensions of teaching objectives, teaching process, teaching implementation forms and teaching evaluation, and started from the problems to build a new model of practical teaching of moral education courses in higher vocational colleges[15]. Based on the Deming cycle theory, a department-level teaching quality monitoring system for independent colleges is constructed to ensure the stable and gradual improvement of the teaching quality of independent colleges. Establish a scientific and reasonable teaching quality monitoring system, shift the focus of teaching management downward, strengthen department-level teaching quality management, and form an effective teaching quality monitoring system to ensure the continuous improvement of independent college

teaching quality[16]. Chen Xianming proposed the operation model of the teaching quality monitoring system based on the Deming cycle , which consists of establishing a teaching quality goal system , improving the teaching quality management system , building a teaching quality assurance system , and implementing the teaching quality management process[17]. The above scholars have covered many aspects in their research on Deming cycle guidance education and teaching management, but there are few studies from the perspective of art and design disciplines. Research from the perspective of cultivating the innovative practical ability of art and design students will also be of great guiding significance.

3. Research methods

This study uses a case study method to evaluate the role of the Deming Cycle (PDCA) management method in enhancing students' innovative practical abilities in art and design education. The case study method is particularly useful because it provides in-depth, multi-perspective insight into complex issues within education. Through careful review of selected cases, this study intends to explore the effective integration of the PDCA cycle and its application in the field of art and design teaching, as well as its specific contribution to promoting students' innovative practical skills.

4. Case study

Xi'an University of Science and Technology has established a relatively complete teaching quality monitoring system. First of all, the Teaching Steering Committee assumes important responsibilities, including the adjustment of the school's professional structure, the review of professional settings, the review of teaching plans and syllabuses, and the approval of teaching reform projects. It focuses on key issues in undergraduate teaching and ensures that undergraduates ensure the correctness of the teaching direction and promote the sustained and healthy development of undergraduate teaching. Secondly, the Teaching Quality Control Section under the Academic Affairs Office is responsible for the teaching quality monitoring tasks of the whole school, including work arrangement, inspection and feedback. Third, the main responsibilities of the teaching supervision group are to supervise and inspect the quality of teaching, promptly discover and promote the resolution of quality problems that arise during the teaching process, and guide young teachers to improve teaching methods and skills to ensure teaching quality. Fourth, the Evaluation Section and Evaluation Expert Group of the Institute of Higher Education are responsible for the self-evaluation work of colleges (departments

and departments). Fifth, each college (department, department) has established its own teaching steering committee, which is mainly responsible for the quality control of this second-level teaching unit. Finally, by setting up teaching information officers to record the teaching activities of teachers in real time, these departments provide the school with a solid organizational guarantee for teaching quality monitoring through clear division of labor and mutual collaboration[18]. For education quality management, Xi'an Peihua College has established a Research and Development Department, an Administrative Affairs Department, and a Teaching Affairs Department for overall coordination and management to ensure the effective operation of teaching. Among them, the Research and Development Department has a Cooperation and Development Center (including the Alumni Service and Development Center), which is mainly responsible for off-campus cooperation, platform building, combining "bringing in" and "pushing out" to expand education and teaching development resources. The Administrative Affairs Department has a Development Planning and Quality Construction Center and a Teacher Teaching Development Center. The Development Planning and Quality Construction Center includes the Education and Teaching Supervision Office. The main responsibilities of the Development Planning and Quality Construction Center are to organize the formulation and inspection of school development plans and various sub-plans, and supervise the implementation of the plans, to establish and implement the school education and teaching quality assurance system, to be responsible for teaching evaluation and certification, and to be responsible for teaching Responsible for daily monitoring and management, responsible for carrying out higher education research work, promoting the school's excellent performance strategy deployment and implementation series activities, and promoting school review and evaluation and the construction of special fund projects. The Teacher Teaching Development Center is mainly responsible for teacher teaching training and teacher exchange and cooperation. The Teaching Affairs Department has an Academic Affairs Management Center, which is mainly responsible for school teaching operation management, teaching reform research, experimental training management, professional construction, curriculum construction, teaching material construction, curriculum ideological and political construction, and teaching informatization construction. The above departments collaborate with each other to implement the PDCA cycle.

The Development Planning Department identifies areas for improvement and sets goals and plans. The Academic Affairs Management Center implements education improvement measures. The Education and Teaching Supervision Office evaluates implementation results and compares them with expected goals. Make adjustments based on the evaluation results and formulate plans for the next PDCA cycle.

From the school level, it is necessary to clarify teaching objectives, establish complete teaching regulations and quality standards, and set teaching objectives according to the school's school positioning and market demand, which provides a guiding "blueprint" for teaching work, establishes a quality assurance system, and ensures Stable operation of teaching activities. Reasonably arrange teaching activities, formulate semester plans, assign teaching tasks, organize teachers to design teaching, and carry out teaching. The Academic Affairs Office is responsible for the overall arrangement and coordination, each college (department, department) and the teaching and research office are responsible for inspection and implementation, and the teachers are responsible for the implementation of specific teaching activities. The school's teaching supervision office is responsible for accurately collecting teaching information. It collects teaching information through various methods such as organizing teaching inspections, supervision, leaders' lectures, and students' evaluations, etc., to understand the teaching situation in real time and lay the foundation for teaching quality evaluation. Scientifically evaluate the teaching quality, summarize, count and analyze the collected teaching information, evaluate and analyze the teaching quality in a scientific way, identify internal and external factors that affect the teaching quality, and continuously improve it. The teaching evaluation system covers many aspects such as professional evaluation, curriculum evaluation, teacher teaching quality evaluation, and student learning evaluation. The above content will be formed into an evaluation report to adjust and control teaching work and achieve continuous optimization of teaching quality. At the school level, we formulate a reasonable reward and punishment system to form an effective incentive and restraint mechanism to promote the improvement of teaching quality.

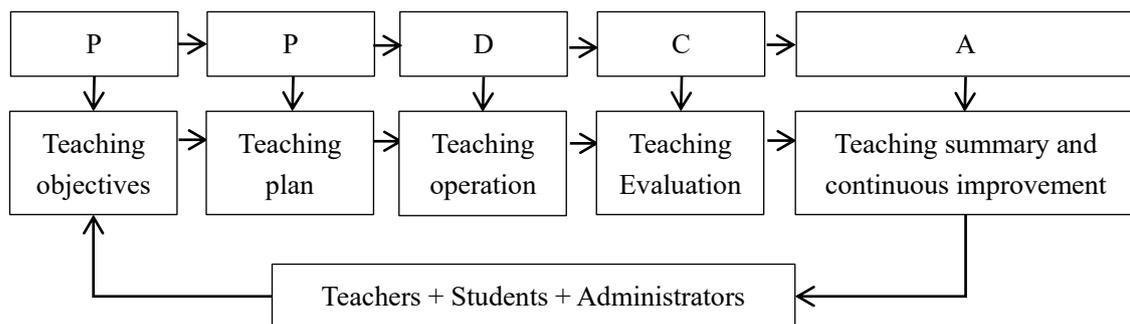


Figure 2: Deming cycle teaching quality monitoring system

5. Further research

The PDCA cycle management method should integrate and optimize the entire process of education and teaching management from the macro to the micro level, and optimize the education and teaching management

system from the school perspective, the college perspective, and the teacher perspective. The fifth section discusses the departmental setup and work division at the school level. All departments work together to promote the effective implementation of PDCA. Now, from the perspective of colleges and teachers, we will talk about how to optimize the entire education process with the PDCA cycle management method.

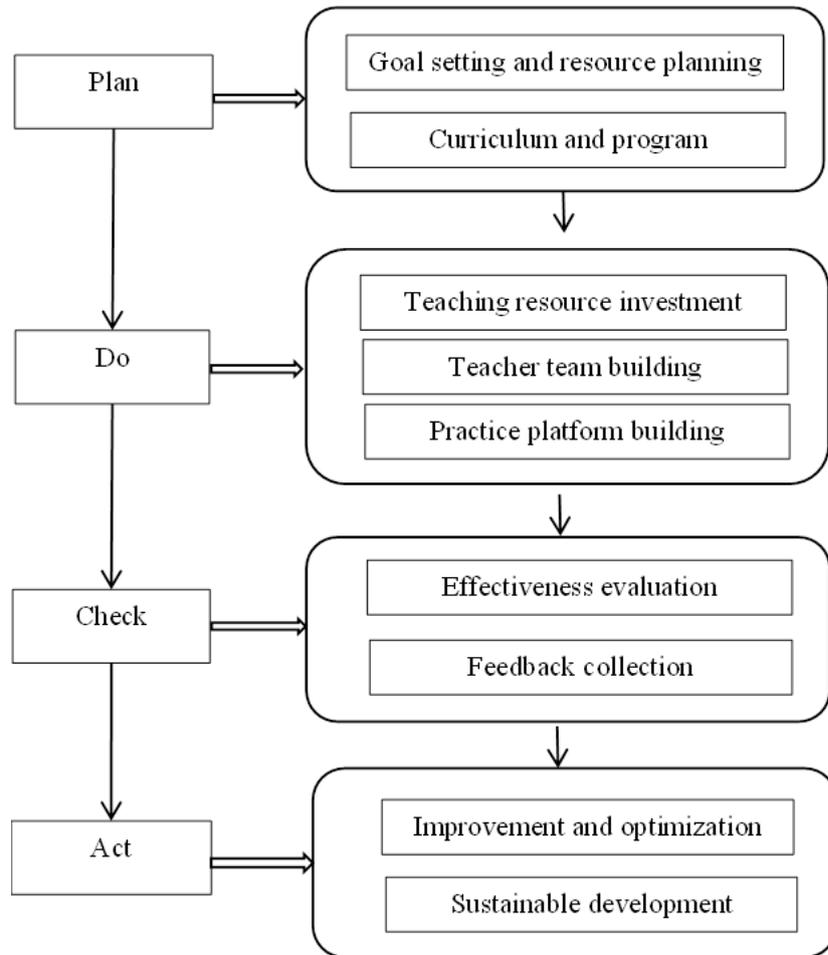


Figure 3: PDCA cycle management strategy from the perspective of the academy

Colleges should clarify the long-term goal of improving students' innovative practical abilities, plan necessary resources, and invest funds, facilities, and personnel to optimize the basic conditions for teaching . Design and develop curricula that encourage innovation and practice, build interdisciplinary projects , create workshops and create internship opportunities. The college has established cooperative relationships with companies and design studios in the industry to provide students with real design projects and internship opportunities , and to establish a practical platform inside and outside the school. The college ensures that teaching and practical activities are supported by sufficient resources. Laboratory construction and workspace construction are very

important for art and design education. In addition, teachers with practical experience and innovative abilities are introduced to enhance the practical guidance ability of the teaching team. After the college implements specific construction tasks, it is necessary to regularly evaluate the effectiveness of innovative practice courses and projects, including student participation, satisfaction and the quality of innovative works. Gather feedback from students, faculty, and industry partners on the effectiveness and issues of practice. Next, based on the evaluation results and feedback, resource allocation, course content and teaching methods will be adjusted, and practice platforms and cooperation projects will be optimized. Continuously carry out continuous improvement to promote the continuous development of strategies to improve innovative practical capabilities, update curriculum design, introduce new practical projects and strengthen industry cooperation.

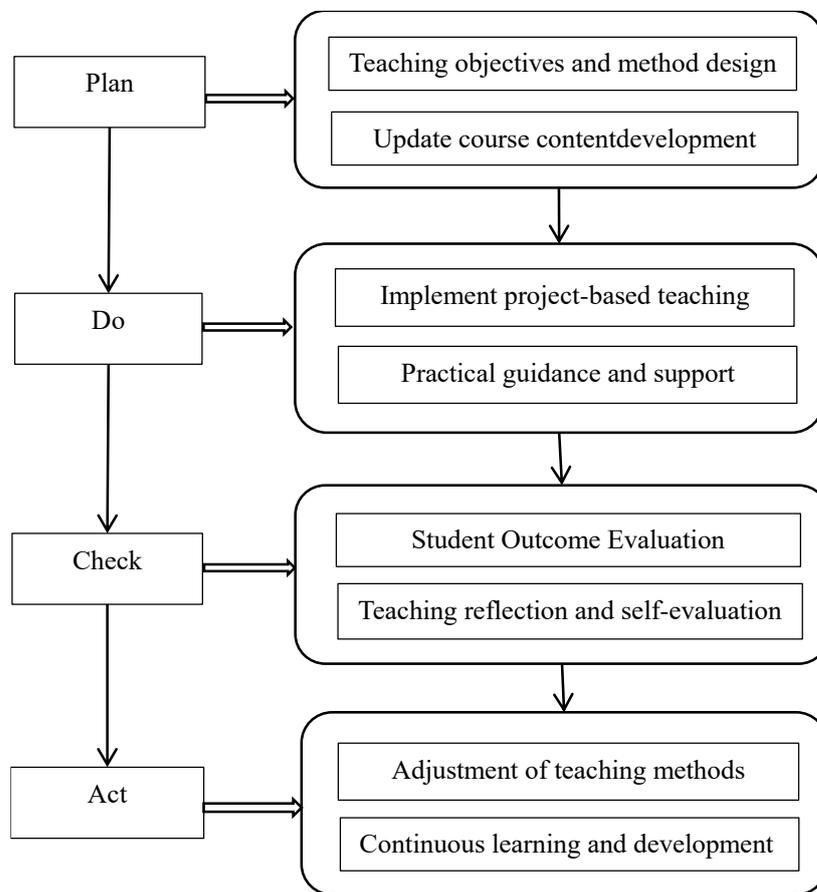


Figure 4: PDCA cycle management strategy from a teacher’s perspective

Teachers need to formulate specific teaching goals to improve students' innovative practical abilities and choose appropriate teaching methods and practical activities. Update course content according to constantly updated market demands and development trends, and introduce innovative design concepts and tools.

Interactive teaching methods such as project-based learning, teamwork and case analysis are adopted to stimulate students' innovative thinking and practical abilities. Provide guidance and technical support to students in practical projects, and encourage students to explore and try new design concepts.

Throughout the teaching activities, it is necessary to provide timely feedback and evaluation of students' learning results, and guide students to focus on innovation and practice through the focus of evaluation. In addition, carry out teaching reflection and self-evaluation on teaching activities, reflect on the effectiveness of teaching activities, collect feedback from students, and conduct self-evaluation. Adjust teaching methods and arrangements of practical activities based on student feedback and evaluation results. Update teaching content and methods, and continue learning to maintain the innovation and practicality of teaching activities. The application of the PDCA cycle in the improvement of art and design education can promote the formation of a student-centered and result-oriented education model. It can not only improve the quality and efficiency of educational activities, but also enhance students' innovative practical abilities and lifelong learning abilities. Through this dynamic cycle process, art and design education can continuously adapt to new educational needs and challenges, provide students with richer and more challenging learning experiences, and ultimately cultivate innovative design talents who can adapt to future social needs.

6. Conclusion and suggestions

6.1 Conclusion

In art and design education and teaching, customized plans (Plan), implementation in actual operations (Do), systematic inspections (Check) and continuous actions (Act) are needed to improve teaching results and promote the cultivation of students' innovative practical abilities. Specifically, it is necessary to clarify innovation goals, integrate interdisciplinary resources, design interdisciplinary courses and projects, integrate knowledge and skills in different fields, encourage students to think about problems from multiple perspectives, and promote innovative thinking. The art design major has strong practical characteristics and should form a practice-oriented teaching method and adopt practice-oriented teaching methods such as project-based learning, workshops, internships, and on-site visits to allow students to learn and explore in actual operations. Create an environment that supports and encourages students to try new ideas and solutions. Regular and multi-dimensional evaluation, using multi-dimensional evaluation methods such as regular self-evaluation, peer

review and tutor feedback, to comprehensively understand students' progress in innovative practical abilities. Apply digital tools and platforms to collect data and feedback to improve the efficiency and effectiveness of assessments. Based on the data and feedback collected during the inspection phase, teaching methods, course content and practical projects will be adjusted in a timely manner to ensure that educational activities are always focused on improving students' innovative practical abilities. Establish a continuous improvement mechanism, regard the PDCA cycle as a process of continuous improvement, and implement it continuously to ensure the continuous improvement of the quality of art design education. During the specific implementation process, attention should also be paid to cultivating teachers' abilities , enhancing student participation, strengthening school-enterprise cooperation , introducing real design projects and challenges into the curriculum, and providing students with opportunities for practice and innovation. Through the above measures, the PDCA cycle theory can be more effectively applied to the improvement practice of art and design education, creating a learning environment for students that supports innovation, encourages practice and continuous improvement. The PDCA cycle promotes the continuous optimization of teaching strategies , and educators can regularly evaluate and adjust teaching methods to more effectively respond to students' learning needs and innovative challenges. Through the PDCA cycle, students' innovative practical abilities can be enhanced. The implementation of the PDCA cycle provides students with more opportunities to practice and try new ideas, thereby stimulating students' innovative spirit and practical skills. At the same time, the PDCA cycle establishes a learning culture that supports continuous improvement.

6.2 Recommendations

In future teaching practice, in view of the diversity of art and design education, it is recommended to customize the application strategy of the PDCA cycle according to the specific teaching content and student characteristics to ensure its effectiveness. Establish a systematic feedback mechanism to collect opinions and suggestions from students, teachers and industry partners as an important basis for the "inspection" and "action" phases of the PDCA cycle. Monitor the application effect of PDCA cycle in art design education through regular evaluation activities, and timely adjust and optimize implementation strategies. This study uses a case study method to deeply explore the application and effectiveness of the Deming Cycle (PDCA) management method in promoting the innovative practical ability of art and design education students. Through the analysis of specific educational situations, the research reveals the positive impact of the PDCA cycle on improving teaching

practices, enhancing students' innovative abilities, and promoting continuous improvement of educational quality.

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