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Aesthetic Education and Traditional Culture in The Context of New Engineering Disciplines

-- Exploring the Teaching Mode of Collaborative Education

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Abstract

Under the background of the construction of new engineering disciplines, the in-depth integration of aesthetic education and engineering training has become an important way to cultivate high-quality engineering and technological talents. This study takes "comb design and production" as a practical carrier, and explores the innovative teaching mode of collaborative education between aesthetic education and traditional culture in the context of new engineering disciplines. The course adopts the teaching concept of "traditional innovation + modern technology", combines the "online + offline" flipped classroom format, and realizes the organic combination of aesthetic literacy, engineering skills and cultural inheritance through group cooperation and full-process practice. The results of the study show that the teaching mode effectively improves students' aesthetic literacy, design ability and engineering practice ability, and at the same time enhances their understanding and sense of identity of the excellent traditional Chinese culture. Through a diversified evaluation system (including self-assessment, intra-group mutual evaluation, inter-group mutual evaluation and teacher evaluation), the course comprehensively examined the students' comprehensive abilities, ensuring the scientific and fairness of the teaching effect. In addition, in the whole process of design, production and optimization, students cultivated teamwork ability, innovative thinking and craftsmanship, laying a solid foundation for the comprehensive development of new engineering talents. This study not only provides a practical example for the deep integration of aesthetic education and engineering training in the context of new engineering disciplines but also provides a theoretical reference for the innovation and reform of aesthetic education in colleges and universities. In the future, the curriculum design and evaluation system will be further optimized, and more teaching cases combining traditional culture and modern technology will be explored, with a view to supporting the cultivation of new-age engineering and technological talents with all-round development of morality, intelligence, physicality, aesthetics and labor.

Keywords

Aesthetic education; traditional culture; pedagogical innovation.

1. Introductory

With the rapid development of science and technology and the profound change of industrial structure, the new round of scientific and technological revolution and industrial change represented by artificial intelligence, big data and cloud computing are reshaping the world pattern. To cope with this challenge, China has put forward the construction strategy of "New Engineering", aiming to cultivate high-quality engineering talents with innovative spirit,

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practical ability and international vision. However, while stressing scientific and technological innovation and professional skills, the cultivation of humanistic and aesthetic skills is relatively weak, which to some extent restricts the overall development of talents in new engineering disciplines. Aesthetic education, as an important way to enhance students' aesthetic interests, cultivate their sentiments, and shape a sound personality, plays an irreplaceable role in cultivating students' innovative thinking, critical thinking, and cross-cultural communication skills. The excellent traditional Chinese culture has accumulated the deepest spiritual pursuit of the Chinese nation and contains rich aesthetic resources and humanistic spirit, which provides valuable spiritual nourishment and cultural heritage for the cultivation of new engineering talents. Organic integration of aesthetic education and traditional culture, exploring the teaching mode of synergistic education, is of great significance for cultivating new era engineering and technology talents with all-round development of morality, intelligence, physicality, aesthetics and labor. Based on the background of the construction of new engineering disciplines, this study takes the synergistic education of aesthetic education and traditional culture as an entry point to explore the construction of a teaching mode that meets the cultivation objectives of talents in new engineering disciplines, so as to provide theoretical references and practical reference for the cultivation of new-age engineering and technology talents with profound humanistic heritage, strong sense of social responsibility, excellent innovation ability and broad international vision [1]

As an important base for national innovation and education, universities should actively explore the integration of academic innovation with traditional Chinese culture, which is not only one of the important directions for future educational development, but also a key initiative to enhance cultural self-confidence in the context of globalization. The integration of innovation and traditional culture helps to combine the "hard power" of science and technology with the "soft power" of culture, making innovation more Chinese and cultural identity. College students, as an important main body of university innovation, are also the hope of the country's future. Let college students deeply understand, love and inherit traditional Chinese culture, and on this basis, continuous innovation, not only can promote the national culture, but also help Chinese cultural soft power to the world [2]

Based on this, relying on the teacher experience and equipment advantage of milling, Chengdu Technological University Student Innovation Practice Centre takes "traditional comb" as the research direction, explores the innovative mode of combing milling technology and Chinese traditional culture, and builds a new teaching system of aesthetic education based on traditional culture. This program not only enables students to deeply understand the aesthetic value of traditional Chinese culture but also helps to cultivate their correct outlook on the world, life, values and aesthetics. At the same time, the course focuses on promoting the comprehensive development of students' abilities as the core, and the comprehensive enhancement of the connotation of the ability, especially in the hands-on practice, design innovation, engineering literacy and craftsmanship, which provides a strong support for the future of college students in the new era [3]

2. Methodology

2.1. The Integration Practice of Aesthetic Education and Engineering Training

In the context of the construction of new engineering disciplines, the integration of aesthetic education and engineering training has become an important way to cultivate high-quality engineering and technological talents. In order to enhance students' aesthetic literacy, deepen their understanding of traditional Chinese culture, and strengthen their practical innovation ability, the Engineering Training/Student Innovation Practice Centre has carried out a series of innovative courses with aesthetic education as the core. Among them, taking "wooden comb",

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a traditional Chinese handicraft, as the research object, the Centre explores the whole process teaching mode from design to finished product, so as to enable students to cultivate teamwork ability in the project practice, enhance the practical effectiveness of the aesthetic education courses, and strengthen the aesthetic literacy of contemporary college students.

2.1.1. Course Design and Teaching Objectives

Taking "comb" as the carrier, the course organically combines aesthetic education and engineering training, and aims to achieve the following teaching objectives through Project-Based Learning (PBL):

(1) Improvement of aesthetic literacy: Through the design and production of wooden combs, students are guided to understand the aesthetic elements of traditional crafts, such as symmetry, proportion, line, etc., and incorporate them into modern design.

(2) traditional culture inheritance: take the comb as the entry point, deeply excavate the craft wisdom and cultural connotation of Chinese traditional culture and enhance the students' cultural self-confidence and sense of identity.

(3) Cultivation of engineering practice ability: Through the whole process of practice from design to finished product, students' engineering skills are enhanced, including industrial design, processing technology, tool operation, etc.

(4) Innovative thinking and teamwork ability: Encourage students to carry out innovative design based on traditional crafts and complete projects through teamwork, to cultivate their comprehensive interdisciplinary ability.

2.1.2. Programme Content and Implementation Pathway

2.1.2.1 Theoretical Learning and Case Analysis

Students first learn the theoretical knowledge of industrial design, graphic design and related processing technology independently, and master the tool operation process [4]. At the same time, through analyzing classic design cases, they can understand the cultural background and craft characteristics of traditional wooden combs, laying a foundation for innovative design.

2.1.2.2 Innovative design and cultural integration

In the design of comb handle shape and comb structure, students need to combine traditional cultural elements with modern design concepts. For example, the design of comb handle can be integrated with traditional patterns (such as cloud pattern, back pattern) or regional cultural characteristics, while the comb head structure should take into account the practicality and aesthetics. This process not only exercises students' design innovation ability, but also deepens their understanding of traditional culture.1.2.3 Engineering Practice and Process Realization

Students transform the design drawings into real objects through milling and other processes, which requires students to master the use of processing equipment and pay attention to details, such as the uniformity of the teeth of the comb and the comfort of the comb handle. Through hands-on practice, students not only improve their engineering skills, but also experience the exquisite and craftsmanship of traditional craftsmanship.

2.1.2.3 Teamwork and Achievement Presentation

The course adopts a teamwork mode, in which students are required to divide the work and work together to complete the whole process from design to production. In the end, students can learn from each other, summarize their experiences and further improve their comprehensive ability through the presentation and evaluation of the results.

2.1.3. Program Features and Innovations

2.1.3.1 Interdisciplinary Integration

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The course breaks the single-skill cultivation mode of traditional engineering training, organically combines aesthetics, culture, design and engineering practice, and realizes interdisciplinary knowledge integration and ability enhancement.

2.1.3.2 Integration of traditional culture and modern design

Through the modern innovative design of comb, a traditional handicraft, the course not only inherits the excellent traditional Chinese culture but also gives it a new connotation of the times, reflecting the unity of cultural self-confidence and the spirit of innovation.

2.1.3.3 All-process practical teaching mode

From theoretical learning to design innovation, to process realization and results display, the course builds a complete practical teaching chain, so that students can comprehensively improve their comprehensive quality in the process of "learning by doing, learning by doing" [5].

2.1.4. Effectiveness and significance of the course

Through the practice of the course, students not only master the engineering skills and design methods, but also subconsciously improve the aesthetic literacy and cultural identity. The specific effects are reflected in:

(1) Improvement of aesthetic literacy: students can apply aesthetic principles to practical design and create works that are both practical and artistic.

(2) Enhancement of cultural self-confidence: through in-depth understanding of traditional crafts and innovative practice, students have a greater sense of recognition of the value of the excellent traditional Chinese culture.

(3) Improvement of practical and innovative ability: Students practice engineering skills and innovative thinking in the whole process of practice, laying a solid foundation for future career development.

Taking the integration of aesthetic education and engineering training as an entry point, the course explores an effective path to cultivate new engineering talents and provides a useful practical reference for the in-depth integration of aesthetic education and engineering training in colleges and universities.

2.2. Teamwork and Practice Mode

In the context of new engineering, the cultivation of teamwork and practical ability is an important goal in the integration of aesthetic education and engineering training [6].Through the teamwork mode, combined with the whole-process evaluation system, this course aims to cultivate students' teamwork ability, design thinking, practical ability and sense of responsibility, to help them adapt to the fast-paced, complex and changing social environment, and to grow up to be new-age talents with proper values and outstanding abilities.

2.2.1. Teamwork Mode

The course adopts a teamwork mode, with each group consisting of five to six students, and students can form teams voluntarily. In order to cultivate students' self-management and collaboration skills, the course adopts a parallel management mode, i.e. there is no fixed team leader in the group, but members negotiate and divide the work among themselves, each taking up different tasks, such as designing, roadshow, physical production, etc. This mode not only enhances students' responsibility but also makes them more capable of working in a team. This mode not only enhances students' sense of responsibility, but also promotes communication and collaboration within the team.

During the implementation of the project, each team needs to combine design knowledge, case studies, physical research and experience in operating relevant tools to formulate a reasonable design plan and finally complete the production of the wooden comb. The head of the comb

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should be carefully designed to meet the ergonomic requirements, while the handle of the comb should take into account the aesthetics and practicality to ensure that the finished product achieves the best results in terms of innovation, functionality and cultural heritage.

2.2.2. Full-process evaluation system

The assessment of the comb work adopts the whole process evaluation system, which comprehensively examines the students' thinking ability, design ability, learning ability and cooperation ability in the whole project. The scoring consists of four parts: self-assessment, mutual assessment within the group, mutual assessment between groups and teacher's evaluation, with a total score of 100 points. The specific scores are as follows:

2.2.2.1 Self-assessment (10 marks)

Students are required to evaluate themselves in four aspects, each of which accounts for 2.5 marks, totaling 10 marks. Self-assessment of how well they have fulfilled their responsibilities within the group; their ability to access and acquire new knowledge in the project; their communication and co-operation within the group; and their overall assessment of their design work.

The self-assessment session aims to cultivate students' self-reflection ability and help them identify their own strengths and weaknesses, so that they can make continuous improvement in their subsequent learning.

2.2.2.2 Mutual assessment within the group (20 marks)

Team members rate each other, and each member's score is averaged, focusing on the following four aspects (5 points for each item). Communication efficiency and collaborative performance in the team; scientific and innovative design solutions; operational skills and degree of completion in physical production; and completion of assigned tasks and responsibility.

Mutual evaluation within the team not only promotes mutual supervision and learning among team members but also enhances team cohesion and collaborative efficiency.

2.2.2.3 Inter-group Mutual Evaluation (30 marks)

Each group will grade the works of other groups in both blind assessment and defense, focusing on the quality of the works in the following five aspects (6 points for each item).The overall aesthetics and design of the work; the artistic value and cultural connotation embodied in the work; the unique style and innovation of the work; the technical difficulty and craftsmanship of the work; and the degree of innovation in the design and function of the work.

Mutual evaluation between groups adopts blind auditing to ensure the fairness and objectivity of the scoring, through which students can not only learn the merits of others but also improve their aesthetic ability and critical thinking.

2.2.2.4 Teacher Evaluation (40 points)

Teachers' evaluation covers three aspects: course report, defense performance and physical works, with a total of 40 points.

Course report (20 points): The course report should contain the following contents, each part is worth 5 points. The final product of the program, the photos need to be exposed accurately, clearly present the finished product; program evolution logic, the evolution of the comb design should be logical and clear, combined with the characteristics of the material, reflecting innovative thinking; sketches can be hand-drawn or computer-drawn, the final drawings need to be marked with dimensions; processing mode detailed records of the processing steps, mastering the work station, work process, work step, equipment category, processing content, processing range, processing efficiency and other elements. The course report should be printed on A4 paper, and the layout should be clear, beautiful and neat.

Defense performance (10 points): each group will have 10 minutes for defense, using PPT to report, and the teacher will grade the report from the following two aspects (5 points each).

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202508_8(8).0009

The logic and clarity of expression of the content of the report; the language expression and on-site performance of the reporter. The session aims to develop students' presentation and communication skills and help them adapt to the conference reporting scenarios in the future workplace.

Teachers and students will conduct blind auditing together, and the presentation will be graded in five aspects: appearance, artistry, personalization, technicality and innovation, with a total score of 10 points.

2.2.3. Significance and effectiveness of the practice model

Through the implementation of teamwork and practice mode, students not only mastered the skills of design, processing and collaboration, but also achieved significant results in the following aspects:

(1) Improvement of teamwork ability: students learnt to divide work and communicate effectively in teamwork, and enhanced team awareness and sense of responsibility.

(2) Overall development of comprehensive ability: Through designing, making and reporting, students' design thinking, practical ability and expression ability have been comprehensively improved.

(3) Cultivation of innovative consciousness: In the combination of traditional culture and modern design, students learnt to think from multiple perspectives and cultivated innovative and critical thinking [7].

(4) Enhancement of cultural self-confidence: through the in-depth understanding of traditional crafts and innovative practice, students identify more with the value of Chinese excellent traditional culture and enhance cultural self-confidence.

In conclusion, the teamwork and practice mode not only provides a platform for students to improve their comprehensive ability, but also provides a useful practical exploration of the deep integration of aesthetic education and engineering training in the context of new engineering disciplines [8].

2.3. Course Arrangement

This course is arranged in the spring semester, with a teaching cycle of 15 days, starting from the 10th week. There are 50 students in each class, and students are divided into groups of 4-5 people, totaling 10 groups for aesthetic education teaching practice. The course adopts the teaching mode of "traditional innovation + modern technology" and combines the "online + offline" flipped classroom, aiming to improve students' aesthetic literacy, design ability and engineering practice ability through the combination of theory and practice.

2.3.1. General Design of the Program

2.3.1.1 Teaching Mode

The course adopts the teaching mode of "traditional innovation + modern technology", which combines traditional cultural elements with modern design concepts, and at the same time integrates practical engineering skills training. Through the form of "online + offline" flipped classroom, students are encouraged to take the initiative to learn and enhance the interactivity of the classroom.

2.3.1.2 Teaching cycle and grouping

Teaching cycle: 15 days (week 10 to week 12).

Class size: 50 students per class, divided into 10 groups of 4-5 students each.

Teaching Format: Offline practice-based, supplemented by online learning.

2.3.1.3 Course Objectives

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To enhance students' aesthetic literacy and design ability; to develop students' practical engineering skills and teamwork ability; to enhance students' understanding of traditional Chinese culture and their ability to apply it creatively.

2.3.2. Specific course arrangement

The first week of design week, the teacher explains the design method of comb, the use of tools and traditional cultural background, to help students master the basic knowledge of design, understand the cultural connotation and craft characteristics of wooden comb(Picture 1), teacher lecture + case study + tool operation demonstration. Z

Picture 1. Teachers teach students how to design combs and use tools

Students will work in small groups to conceptualize the design, combine traditional cultural elements with modern design concepts, complete the preliminary design plan, and cultivate students' thinking and innovation ability. (Picture 2)

Picture 2. Students work on designing ideas

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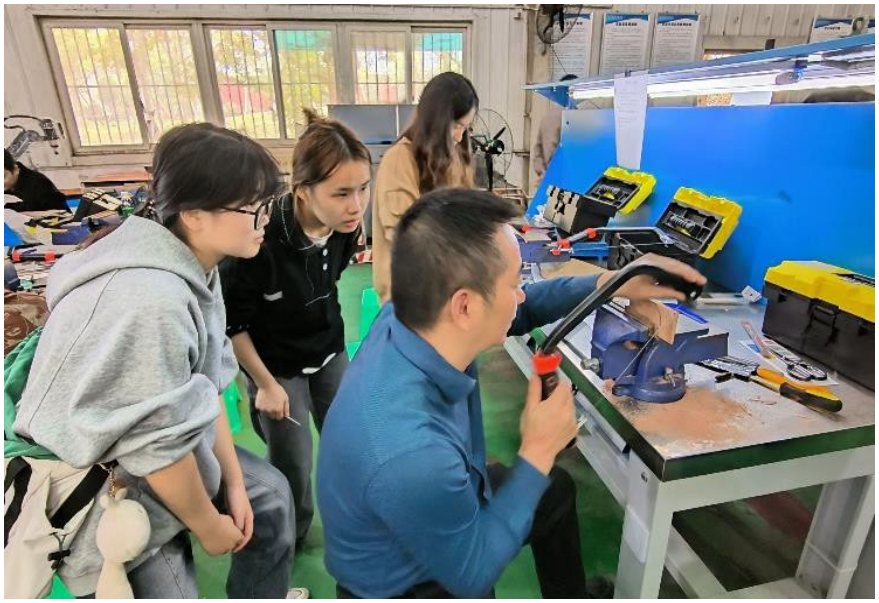
The teaching form is group discussion, sketching and optimization of the plan in online classroom, and the online support will provide design resources and case references through online platforms (e.g. Learning Management System), so that the students can check and optimize the plan at any time. Each group submits a design proposal, the teacher reviews and gives feedback to ensure the feasibility of the proposal and integrates aesthetics and innovation elements to optimize the design proposal and ensure its scientific and innovative nature, the teaching form is display + teacher's comments + group modification.

Picture 3. Rough mold of student design proposal

The second week of production week, the teacher to provide space and tools, students in accordance with the design program to make the comb finished products, to develop students' hands-on practical ability and engineering skills, the form of teaching for group cooperation + teacher guidance + practical operation, tools and equipment milling machine, carving tools, sanding equipment. (Picture 4)



Picture 4. Teacher is guiding students in designing

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Finishing and optimizing the finished product to improve its aesthetics and practicality (Picture 5), cultivate students' ability to deal with details and the craftsmanship of striving for excellence, the teaching form is group practice + teacher guidance. Students summarize the design process, innovation and learning gains, and write a course report to cultivate students' ability to summarize and reflect and express themselves in writing, the teaching form is group discussion + independent writing + teacher guidance, the content of the report is the final finished product of the program (Picture 6) (the photos should clearly present the finished product), the logic of the program's evolution (the logic of the design process and innovativeness), the original draft sketches (hand-drawn or computer drawn, with dimensions), the processing method (detailed records of the processing steps and processes), and the design process.(detailed records of processing steps and process parameters).

Picture 5. Students producing final artwork

Picture 6. Student final product

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202508_8(8).0009

In the third week of defense and marking, each group will present and defend their works, and the teacher and students will conduct a blind marking to cultivate students' expressive ability and critical thinking. Teachers and students grade the works in five aspects: appearance, artistry, personalization, technology and innovation. Each group uses PPT to make a 10-minute report, focusing on design ideas, innovations and production process.

The scoring criteria are self-assessment (10 points) from the sense of responsibility, learning ability, teamwork, and quality of the work, intra-group mutual assessment (20 points) from the co-operation and communication ability, design ability, hands-on practical ability, and sense of responsibility, inter-group mutual assessment (30 points) from the appearance of the design, artistry, personalization, technology, and innovation, and teacher's evaluation (40 points) from the course report (20 points)), defense performance (10 points), and physical works (10 points).

2.3.3. Program Features and Innovations

2.3.3.1 Integration of "Traditional Innovation + Modern Technology"

The course combines traditional cultural elements with modern design concepts, which not only inherits the excellent traditional Chinese culture, but also gives it a new connotation of the times [9].

2.3.3.2 "Online + Offline" Flipped Classroom

Through the combination of online resource support and offline practice, students' independent learning ability and classroom interactivity are enhanced.

2.3.3.3 Full-process practical teaching mode

From design to production to defense, the course builds a complete practical teaching chain, so that students can comprehensively improve their comprehensive quality in the process of "learning by doing and learning by doing".

2.3.3.4 Diversified Evaluation System

Through a combination of self-assessment, intra-group mutual assessment, inter-group mutual assessment and teacher's assessment, the comprehensive ability of students is examined comprehensively to ensure the fairness and objectivity of the grading.

2.3.4. Significance and Expected Results

This course aims to achieve the following goals through scientific and reasonable curriculum arrangement and diversified teaching modes:

(1) Enhance students' aesthetic literacy and design ability: through the combination of theory and practice, cultivating students' aesthetic ability and innovative thinking [10].

(2) Enhance students' practical engineering ability: through physical production and process optimizations, enhance students' hands-on ability and engineering skills.

(3) Cultivate students' teamwork and expression ability: enhance students' communication ability and team consciousness through group cooperation and defense session.

(4) Inheritance and innovation of Chinese traditional culture: enhance students' culture through the modern innovative design of the traditional handicraft of wooden comb.

3. Conclusion

In conclusion, this study explores an innovative teaching mode based on "comb design and production" with the background of the construction of new engineering disciplines and the core of synergistic education of aesthetic education and traditional culture. Through the combination of theory and practice, the course not only realizes the in-depth integration of aesthetic education and engineering training but also provides a useful practical path for the cultivation of new-age engineering and technological talents with profound humanistic

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connotation, strong sense of social responsibility, excellent innovation ability and broad international vision.

Through the teaching mode of "traditional innovation + modern technology", the course organically combines the elements of excellent traditional Chinese culture with modern design concepts, which not only inherits the cultural essence of traditional crafts but also gives it a new connotation of the times. In the whole process of design, production and optimization, students not only improve their aesthetic literacy and design ability, but also enhance their understanding of traditional culture and sense of identity, and realize the unity of cultural self-confidence and innovative spirit. The "online + offline" flipped classroom, combined with group cooperation and the whole-process evaluation system, effectively improves students' independent learning ability, teamwork ability and practical innovation ability. Through the combination of self-assessment, group mutual assessment, inter-group mutual assessment and teacher evaluation, the course comprehensively examines the comprehensive ability of the students and ensures the scientific and fairness of the teaching effect. Through the specific project of "comb design and production", a complete teaching chain has been constructed from theoretical learning to practical operation and then to the display of the results, so that students not only master the engineering skills and design methods but also cultivate the spirit of craftsmanship and excellence in the process of "learning by doing and learning to do". In the process of "learning by doing, learning by doing", students not only master engineering skills and design methods, but also cultivate the spirit of craftsmanship and interdisciplinary comprehensive ability. This teaching mode provides a replicable and scalable practice example for the deep integration of aesthetic education and engineering training in the context of new engineering disciplines.

In the future, this study will further optimize the curriculum design and evaluation system and explore more teaching cases combining traditional culture and modern technology, to provide richer theoretical support and practical experience for the cultivation of talents in new engineering disciplines. At the same time, this study also calls for more universities to pay attention to the value of collaborative nurturing between aesthetic education and engineering training, to jointly promote the comprehensive development of the construction of new engineering disciplines, and to contribute to the cultivation of new-age engineering and technological talents who are all-rounded in morality, intelligence, physicality, aesthetics and labor.

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