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# The First Lesson for Engineering Students: Engineering Philosophy and Culture –Based on the practice and reflections of the course of ”Engineering Philosophy and Culture” in Zhejiang University, China

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# The First Lesson for Engineering Students: Engineering Philosophy and Culture --Based on the practice and reflections of the course of "Engineering Philosophy and Culture" in Zhejiang University, China


## Abstract

**Background:** In today's era of rapid engineering and technological development, the comprehensive quality of engineering and technological talents has become their core competitiveness. Although the swift progress of engineering and technology has brought about earth-shaking changes to humanity and society, it has also sparked concerns over the negative effects of such advancements, such as environmental destruction and personal privacy breaches. Therefore, it is crucial to cultivate a sound set of values among engineering talents. Engineering education in China has traditionally focused more on the imparting of professional knowledge and skills, but has not placed sufficient emphasis on the content related to engineering philosophy and culture. Particularly, in the "Washington Accord" which outlines the quality requirements for engineering graduates, aspects such as "Engineers and Society," "Professional Ethics," and "Environment and Sustainability" are relatively lacking. There is an almost complete absence of dedicated courses on these topics at the undergraduate level.

**Purpose:** Consequently, Zhejiang University has introduced the "Engineering Philosophy and Culture" course for all first-year engineering students, making it the "first lesson" for them. The aim is to help students understand and recognize key concepts such as engineering, technology, and science, as well as the relationships among them; to stimulate students' awareness of engineering innovation; to acquaint them with engineering ethics, engineering philosophy, and cultural aspects in engineering practice; to make them aware of the responsibilities and challenges faced

by engineers; to familiarize them with policies related to production, design, research, development, environmental protection, and sustainable development in engineering practice; and to cultivate the correct values among engineering students, enabling them to comprehend the relationship between the individual and society, and to understand the social responsibilities of engineers towards public safety, health, welfare, and environmental protection. Through enlightenment education from the perspective of engineering philosophy and culture, the seed of "becoming an engineer who is helpful to society" is sown in the hearts of engineering students.

**Process:** In terms of course construction, the course emphasizes interdisciplinary integration and a balance between hard knowledge and soft skills in its teaching content. This includes understanding of engineering, engineering ethics, the historical evolution of engineering, industrial culture, engineering innovation, and the latest developments in different engineering disciplines. Regarding teaching methods, a variety of approaches are used in a complementary manner, with both strong theoretical foundations and a focus on practical application. The course employs a combination of offline lectures, MOOC viewing, site visits, Q&A interactions, and group discussions and presentations, integrating theory with practice and fostering ample interaction between teachers and students. In terms of course assessment, a multi-dimensional approach is adopted, with both the transmission of knowledge and the cultivation of abilities moving in the same direction. The assessment method combines formative assessment, group discussions, and a final paper.

**Methods:** A combination of interviews and questionnaires was used. We conducted interviews with all students enrolled in the course and also collected feedback through anonymous questionnaires to measure the students' gains from the course and to judge the necessity of it being the first lesson for engineering students.

**Results:** The course has indeed proven effective in enhancing students' understanding of engineering and engineering philosophy and culture, with a high overall satisfaction

rate among students. In terms of teaching methods, students prefer field research approaches. The necessity of this course as the first lesson for engineering students is considered to be relatively high.

**Conclusion:** This study has two main contributions. First, it demonstrates that offering the "Engineering Philosophy and Culture" course can effectively improve students' understanding of engineering and engineering philosophy and culture. It also provides a detailed account of the course's preparatory work, overall conception, and feedback for improvement, serving as a valuable reference for teachers who wish to introduce this course. Second, by analyzing student feedback, it identifies the types of courses that students prefer and possible reasons for this preference. A comparative analysis was also conducted between students of different majors (engineering and non-engineering) to determine the varying degrees of impact on students with different majors and motivations for taking the course, providing insights for future improvements of the course.

***Keywords: Engineering Culture; Engineering Philosophy; Course Construction; Engineering Cognition***

## I. Why Offer This Course?

Globally, engineering and technology are developing at an unimaginable speed, reshaping the world order in an unprecedented way. Against this backdrop, the future industrial manufacturing process will undergo a revolutionary transformation, and the job capability requirements that match it will also move towards a more global and comprehensive direction. Compared with the engineering talents cultivated by traditional engineering education, engineers in the new era need not only to have solid scientific theoretical knowledge but also to pay more attention to the practical essence, comprehensive characteristics, and systemic integrity of engineering. This means that engineers must have an overall awareness of engineering and a sense of engineering responsibility. To achieve this goal, it is necessary to focus on engineering philosophy and cultural education. Engineering colleges, as the main force in cultivating engineering talents, not only have a long history of engineering discipline development but also have a deep historical accumulation and traditional advantages in the concept and mode of engineering talent training. They should actively adapt to the trend of international engineering education reform and take on the important responsibility of overcoming the current difficulties in engineering philosophy and cultural education. At present, engineering philosophy and cultural education in China is still in its infancy. Many colleges and universities have a superficial understanding of the connotation of engineering philosophy and cultural education, and there is also a vague understanding of the training objectives, training process, and educational models. Therefore, Zhejiang University has offered the "Engineering Philosophy and Culture" course for the first time this year, aiming to make it the "first lesson" for all engineering students.

## (II) Significance of Course Construction

Advancing the construction of the "Engineering Philosophy and Culture" course is an inevitable requirement for building the knowledge system of Engineering Education. Throughout the long course of human history, numerous brilliant civilizations have been created, and countless remarkable projects have been constructed, forming an independent form of human civilization and making outstanding contributions to the progress of human civilization. Summarizing and refining the engineering philosophy and culture of the past five thousand years of human history is an inevitable requirement for constructing the knowledge system of Engineering Education. Promoting the construction of the "Engineering Philosophy and Culture" course is an effective way for higher engineering education to fulfill its mission of cultural education. It can further strengthen students' understanding of engineering, promote the intersection and integration of natural science education, humanities and social science education, and engineering technology education. It helps students to understand engineering, comprehend the relationship between engineering and society, establish the concept of engineering philosophy and culture, and promote the sound development of their values, personality cultivation, moral standards, and intellectual horizons. Higher engineering education should proactively take on the mission and responsibility of promoting and inheriting excellent engineering philosophy and culture, which is the inevitable path for the development of higher engineering education.

Promoting the construction of the "Engineering Philosophy and Culture" course is an important part of "telling good engineering stories" and advancing engineering education reform in the era of mega-engineering. However, the long-standing evaluation mechanism in China that "values papers over practice" and the talent cultivation model that "turns engineering into science" have seriously restricted the shaping of students' technological innovation capabilities and their ability to solve complex engineering problems. This has significantly affected the pace of development of the engineering industry in China. Engineering activities in the era of mega-engineering are characterized by complexity, integration, innovation, sociality, and sustainable development, involving many factors such as economy, management, law, culture, and art. How to solve problems such as "engineering not being practical," "the separation of industry and education," and even "escaping from engineering" has become an important proposition that engineering education reform urgently needs to solve. Promoting the construction of the "Engineering Philosophy and Culture" course, nurturing college students' engineering concepts, and using vivid cases of major engineering projects to solve major engineering problems through collective intelligence to tell "good engineering stories" has important practical value for advancing engineering education reform in the era of mega-engineering.

Promoting the construction of the "Engineering Philosophy and Culture" course is an inevitable requirement for serving the "education power" and cultivating outstanding talents that are in line with modernization. Both the engineering and education sectors are increasingly recognizing the importance of engineering philosophy and cultural education in the training of engineering and technological talents, and they regard engineering philosophy, engineering ethics, and the concept of sustainable development as essential content in engineering education and a necessary condition for professional engineers, such as the "Washington Accord." The "General Standards for Engineering Education Accreditation (2020 Edition)" issued by China not only requires graduates to master engineering knowledge and capabilities but also emphasizes content related to engineering and society, environment and sustainable development, and professional ethics, which are part of engineering philosophy and culture. In 2021, the Ministry of Industry and Information Technology of China formulated the "Implementation Plan for Promoting the Development of Industrial Culture (2021-2025)," which further emphasizes the supporting role of engineering philosophy and culture in promoting the construction of a manufacturing power and a cyber power.

## II. How to Offer This Course?

This course is a general education course, open to all students across the university, with 2.0 credits, consisting of 15 sessions in total. There is one session per week, and each session lasts for 2 academic hours (90 minutes). The course follows the talent cultivation philosophy of "enhancing quality, practical participation, focusing on innovation, and highlighting characteristics." It is guided by the current development trends in engineering education and prominent social demands. With engineering philosophy and cultural education as the main thread and real engineering cases as the background, the course aims to improve students' literacy in engineering philosophy and culture, awareness of innovation, consciousness of engineering ethics, and sense of engineering innovation. This enables students to have a comprehensive understanding of engineering and preliminary analytical capabilities, laying a solid foundation for their future growth as outstanding engineers.

## (I) Overall Course Construction Approach

In terms of teaching content, the course emphasizes interdisciplinary integration and places equal importance on professional knowledge and personal qualities. The course content spans multiple disciplines such as education, management, philosophy, mechanical engineering, civil engineering, information and electronics, chemical engineering, and energy, achieving a true interdisciplinary fusion. Through the collision of knowledge and cultures from different disciplines, students are genuinely cultivated to have a cross-disciplinary perspective and a holistic view of engineering. Moreover, the course invites academicians and experts from various fields to share the most cutting-edge knowledge and engineering advancements in the form of special lectures. This approach avoids the potential issue of teaching content lagging behind social development that may occur in traditional teaching methods, thereby fostering students' innovative vision that keeps pace with the times. In specific course teaching, vivid cases of major projects and "national heavyweights" that involve collective intelligence to tackle significant engineering problems are interspersed, making the course more closely related to engineering and daily life.

Regarding teaching methods, the course adopts a multi-path, complementary approach, with a strong emphasis on both theory and practice. A variety of methods such as offline lectures, MOOC viewing, on-site visits, Q&A interactions, and group discussions and presentations are employed. The combination of theory and practice, along with ample interaction between teachers and students, is designed to avoid the potential drawbacks of traditional unidirectional knowledge transmission, such as low student engagement and poor learning outcomes. The aim is to stimulate students' enthusiasm for active learning, cultivate their self-learning abilities, and enhance learning effectiveness as much as possible.

In terms of course assessment, a multi-dimensional approach is constructed, with both knowledge transmission and capability cultivation moving in the same direction. The assessment method combines formative assessment with a final group presentation at the end of the term. Specific evaluation methods include: increasing formative assessment to evaluate students' active participation and to strengthen the assessment of their in-depth understanding of the integration of disciplinary knowledge and course-related ideological and political education. The composition of the grades is as follows: each student's participation in teaching activities and classroom performance account for 20% of the total score, encouraging active classroom participation; each student's special report based on case studies accounts for 30% of the total score, fostering students' research and communication skills; and finally, a paper on the theme of "Engineering Philosophy and Culture" accounts for 50%, examining students' understanding of engineering philosophy and culture.

## (II) Specific Course Arrangements

The course is primarily divided into four categories: General Education Lectures, Frontier Development Lectures in Engineering Fields, Faculty-Student Discussion Classes, and Field Visit Practice Classes. As shown in Appendix 1, the General Education Lectures include "Engineering, Engineers, and Engineering Education," "The Dissemination of Engineering Spirit and the Spillover of Engineering Value," "The History of Modern and Contemporary Engineering Development," "Engineering Innovation," "Expansion and Enhancement of Engineering Thinking," and "Engineering Ethics." The Frontier Development Lectures in Engineering Fields include a lecture on architecture and civil engineering titled "Exploring the Unknown: Thoughts and Actions - Taking Civil Engineering as an Example," a lecture on integrated circuit engineering titled "Introduction to Integrated Circuits," and a lecture on artificial intelligence titled "Empowering Science and Engineering with Artificial Intelligence." The Field Visit Practice Classes involve visits to aircraft assembly projects and intelligent manufacturing factories for automobiles. The discussion classes focus on the course content for in-depth faculty-student discussions. Each class is taught by renowned academicians from the Engineering or Science Academies, or by expert professors and senior engineers in the respective fields.

### (III) Collective Lesson Preparation Meeting System

Prior to the commencement of the course, the course team, based on the content requirements of engineering philosophy and culture and taking into account the time constraints of the course, only determined the themes for each session and the general content needed, without specifying the exact lecturers. After the course syllabus was fully established, the team recruited experts and professors who had achieved remarkable research results in the respective thematic areas, or engineers with outstanding work performance in those fields, to conduct trial lectures. The course team would review the trial lecture content to decide whether the individual would serve as the lecturer for that session, and whether the lecture content and delivery method required any adjustments. Once the main lecturer for each session was confirmed, students were also invited to participate in the collective lesson preparation meetings to simulate a real classroom environment. After the sessions, students were asked to provide feedback to further refine the course. Through these two rounds of collective lesson preparation meetings, which involved screening and improvement, the quality and effectiveness of each lecture were ensured.

## III. How Do Students Feel About This Course?

### (I) Feedback Results

This course was offered for the first time this semester, and undergraduate and graduate courses were separated. Therefore, the course in the fall and winter semester was only for undergraduates. In the end, 22 undergraduate students chose this course. The teaching and research group understood students' feedback on this course through the faculty-student interactive discussion in the discussion class (all 22 students participated), including their evaluation of the course content, teaching methods, course organization, and what they gained from this course. At the same time, in order to exclude the influence of course grades and shyness in front of others on students' expression of real experience, the questionnaire was distributed at the end of the last class when the course grades had not yet been determined, and finally, 17 anonymous questionnaires were received. The reliability of the questionnaire was assessed by Cronbach's α coefficient, with α being 0.91, indicating very good reliability of the scale.

Among all the students who participated in the questionnaire survey, there were 11 students from engineering majors and 6 students from non-engineering majors. Regardless of their major, none of the students had previously received education in courses related to engineering philosophy and culture. As shown in Figure 1, 53% of the students chose this course because they were interested in the topic, 18% chose it for the credits, and 29% chose it randomly.

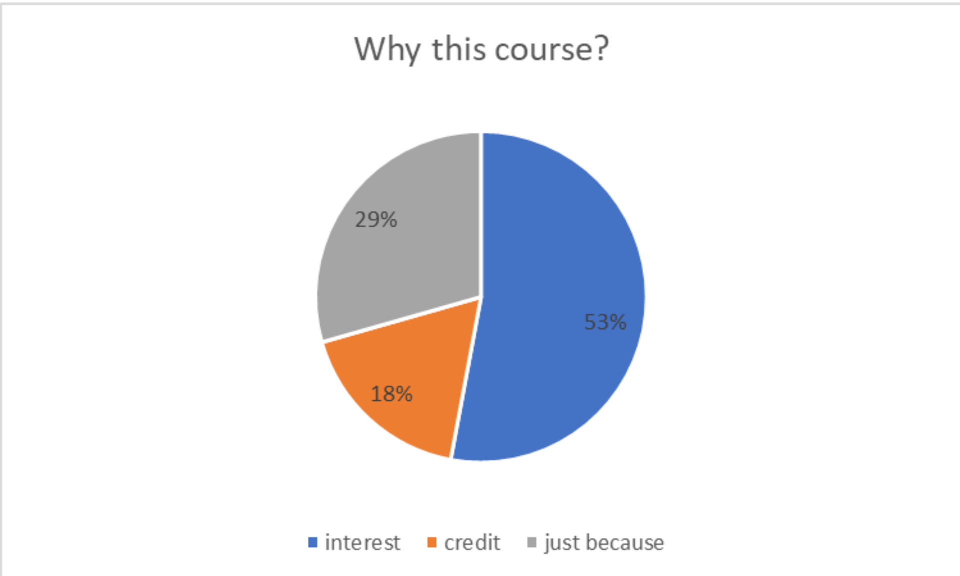


**Figure 1. Different reasons for taking this course**

Overall, students have a positive overall evaluation of the course. As shown in Figure

2, in the 17 anonymous questionnaires received, the overall evaluation of the course was reflected using a Likert five-point scale, where 5 points represent very satisfied and 1 point represents very dissatisfied. The final average score was 4.61, with 94% of the students giving a score of 4 (satisfied) or 5 (very satisfied), and 76% of the students giving the highest score of 5. The average score for the evaluation of teaching was 4.72, with all students giving a score of 4 or 5, and 76% of the students giving the highest score of 5. The average score for the evaluation of the overall course organization was 4.5, with 94% of the students giving a score of 4 (satisfied) or 5 (very satisfied), and 71% of the students giving the highest score of 5. However, some students pointed out that the course content is too rich, which may make it difficult for beginners to understand.

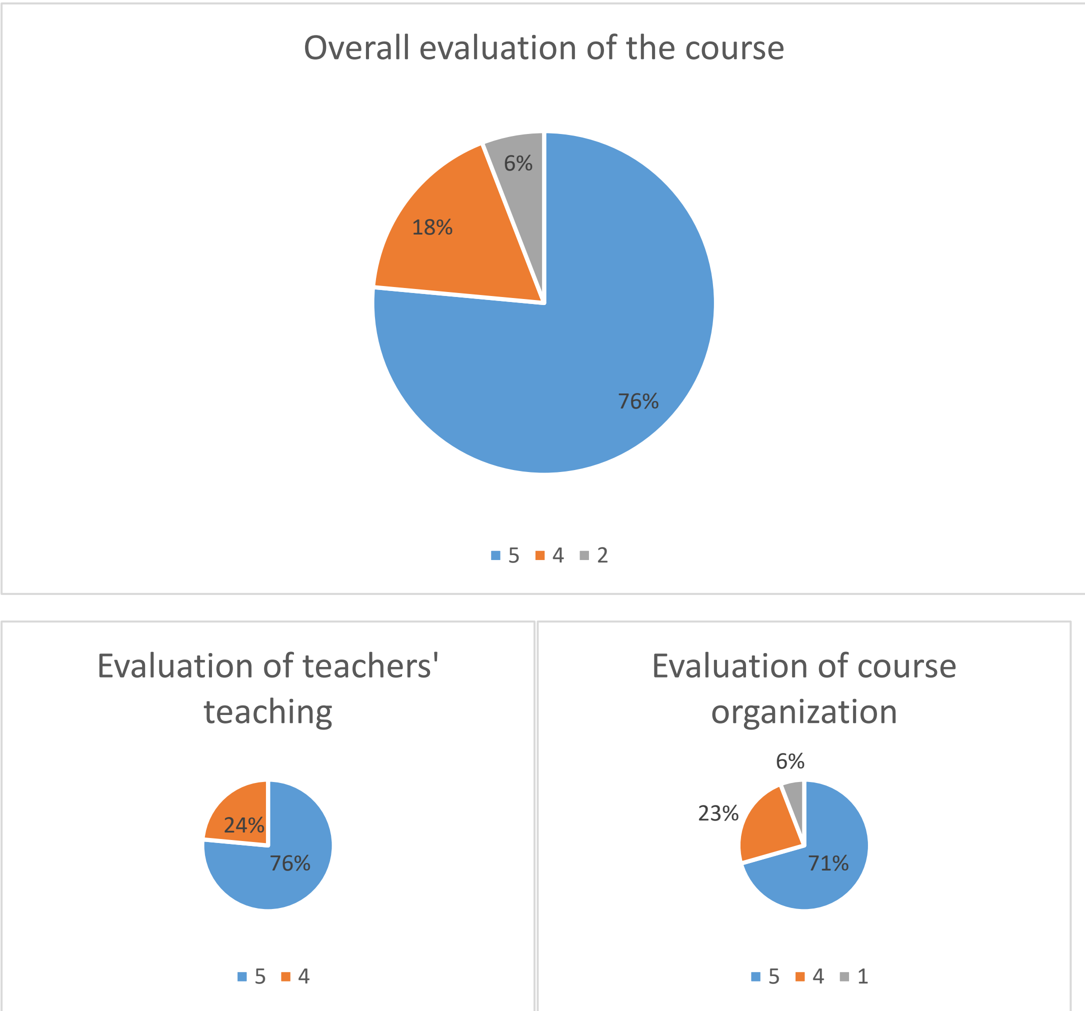


**Figure 2. Student's evaluation of this course**

This course has a relatively significant effect on enhancing students' understanding of engineering and engineering philosophy and culture. During the discussion sessions, all students expressed the knowledge and concepts they gained about engineering, engineering philosophy, and culture from the course, and many students were able to combine their own majors for in-depth understanding and independent in-depth learning. Through the Likert five-point scale and objective questions related to engineering and engineering philosophy and culture, students' understanding of "what is engineering" and "what is engineering philosophy and culture" has been greatly improved. As shown in Figure 3, the scale for the improvement of engineering cognition (5 points = strongly agree, 1 point = strongly disagree) has a final average score of 4.67, with 88% of the students giving a score of 4 or 5, and 82% of the students giving the highest score of 5; the scale for the improvement of understanding of engineering philosophy and culture (5 points = strongly agree, 1 point = strongly disagree) has a final average score of 4.72, with all students giving a score of 4 or 5, and 76% of the students giving the highest score of 5.

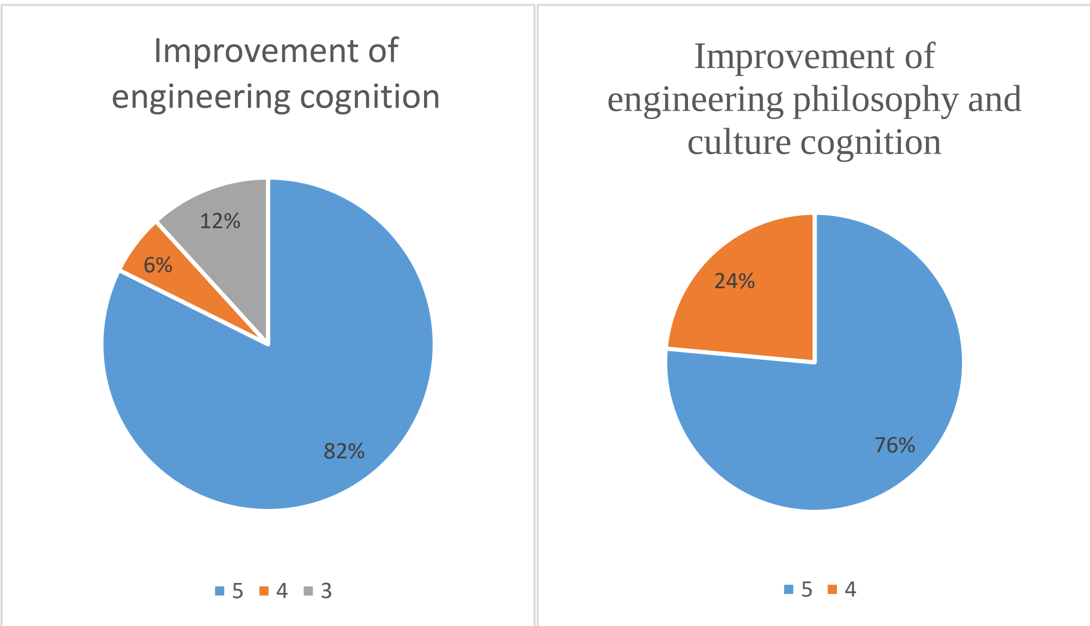


**Figure 3. Improvement of engineering cognition and engineering philosophy and culture cognition**

In terms of course format, students have a strong preference for the field research component, with 100% of the students considering this segment essential. When compared to other courses, 100% of the students also expressed a greater liking for field research.

As for the necessity of this course being the first lesson for engineering students in university, it is considered highly important. As shown in Figure 4, the Likert five-point scale (5 points = very necessary, 1 point = very unnecessary) has an average score of 4.44 points. Among the respondents, 88% of the students rated it as 4 (necessary) or 5 (very necessary), with 65% of the students giving the highest score of 5.

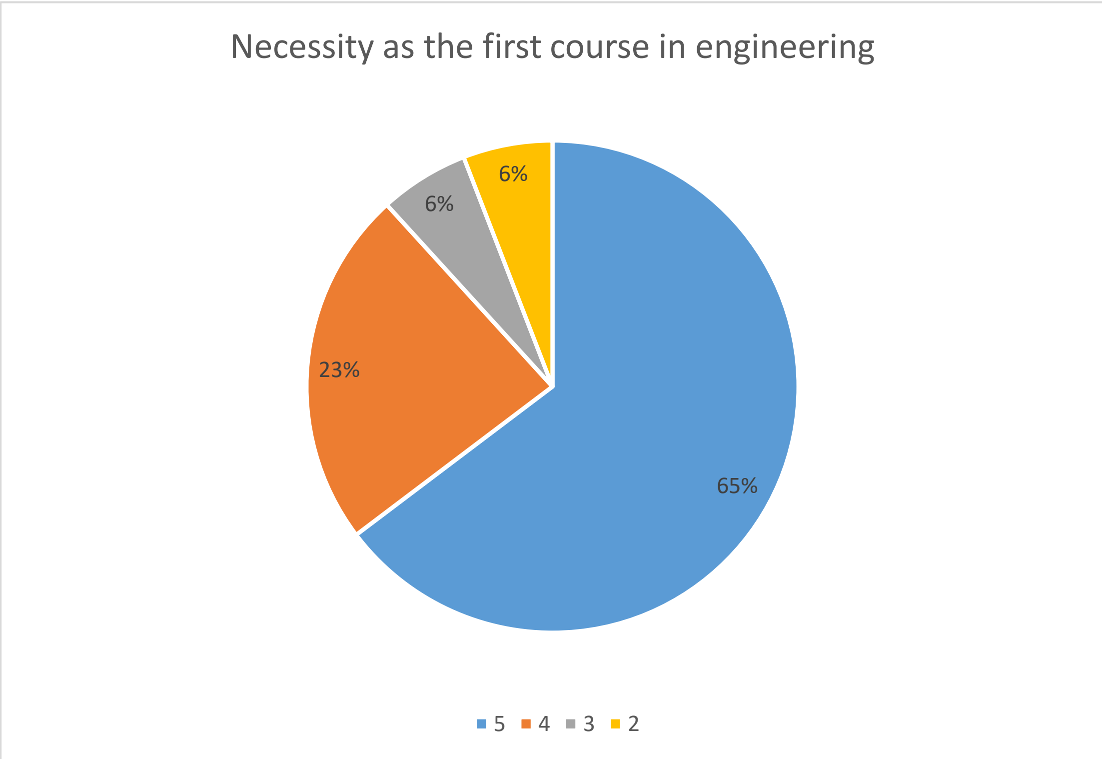


**Figure 4. Feedback on the Necessity for the first course in engineering**

Students from different majors provided varying feedback scores. As shown in Table 2, non-engineering students scored higher in every indicator compared to engineering students, forming a distinct major characteristic.

**Table 2: Comparison of feedback results from students of different majors**

| Major | Improve-ment of cognition | Overall Course Evaluation | Teach-ing | Course Organi zation | Necessity as the First Course |
|---|---|---|---|---|---|
| Non-Engineering | 4.92 | 5 | 4.83 | 4.83 | 4.67 |
| Engineering | 4.59 | 4.42 | 4.67 | 4.33 | 4.33 |

## (II) Discussion and Reflections

Although none of the students had previously taken courses in engineering philosophy and culture, students from engineering majors, having already been educated in engineering, might have gained some indirect understanding of engineering philosophy and culture alongside their major studies. Thus, their "starting point" was higher than that of students from non-engineering majors. Consequently, after taking this course, their improvement of engineering cognition and engineering philosophy and culture cognition was less than that of non-engineering students. Moreover, due to the different teaching styles of various majors, engineering courses are generally logically rigorous and layered, which may lead engineering students to be more stringent in evaluating the overall logic of the course. Therefore, their overall evaluation of the course is lower than that of non-engineering students, especially in terms of course organization, where there is a significant difference in feedback scores between engineering and non-engineering students.

During the previous discussion sessions, some students also commented that the course's positioning was not clear enough. If the course is aimed at engineering students to enhance their engineering literacy, the content should be more closely related to engineering. If it is intended for all students, the course should be more general, reducing the difficulty for non-engineering students. This is a point that the research group should consider further. How to balance the course content and difficulty for students from different majors, especially between engineering and non-engineering students, is a challenge. Since many non-engineering students have genuinely improved their engineering-related cognition and completed their knowledge system and logical thinking in this course, focusing only on engineering students seems insufficient. However, establishing two separate courses with different content for engineering and non-engineering students would close the door to interdisciplinary exchange and mutual learning. Therefore, it could be considered that in future courses, students could be grouped by major, with each group containing both engineering and non-engineering students. Course tasks and discussions could be conducted on a group basis to better coordinate the absorption of course content by students from different majors.

In terms of course selection motivation, 53% of the students chose this course out of interest, and their average overall feedback score was 4.78, higher than the feedback score of 4.44 from students who chose the course randomly or for credit fulfillment. Regarding the improvement in understanding of engineering and engineering philosophy and culture, students who chose the course out of interest had an average score of 4.78, higher than the average score of 4.61 from students who chose the course randomly or for credit fulfillment. This suggests that interest-driven motivation may lead students to be more diligent in their studies or invest more time and effort, thereby achieving greater gains. Therefore, in the future, it would be beneficial to align course content more closely with students' hot topics of interest, creating a blend of what teachers want to teach and what students want to learn. This approach can better stimulate students' interest and enhance their learning outcomes.

Regarding teaching, the collective lesson preparation meeting system has ensured that the teaching content and methods are well-aligned with students' expectations and requirements. Therefore, this system should be retained in future course construction or the offering of similar courses. Additionally, inspired by this course, it would be advantageous to invite students from different majors to attend the collective lesson preparation meetings. Their diverse perspectives can contribute to further improving the course.

In terms of course organization, the variety of course types, the broad span of lecture themes, and the diverse teaching formats have stretched the course timeline, making it difficult for students to grasp the main logical thread of the course. Future course organization could be divided into several micro-topics. Each micro-topic could include different types of courses, such as starting with theoretical knowledge lectures, followed by on-site visits to the corresponding engineering enterprises, then group topic selection and discussions within the group, and finally group presentations. This "theory-practice-discussion-presentation" format allows students to experience the complete process of "what-why-how" of engineering philosophy and culture in a shorter cycle, thereby better organizing the course logic and knowledge logic.

## IV. Conclusion

In order to enhance students' understanding of engineering philosophy and culture, as well as the concept of "what is engineering," we introduced the course "Engineering Philosophy and Culture." The teaching content is primarily divided into four categories: general education lectures, frontier development lectures in engineering fields, faculty-student discussion classes, and field visit practice classes. During the preparation phase of the course, the collective lesson preparation meeting system is employed to ensure the quality of the course. For teaching feedback, we utilize faculty-student interactive discussions and anonymous questionnaires to refine the course. In terms of future course improvements, we have reflected on several aspects, including content selection, organizational format, and teaching discussions. Specifically, in content selection, we consider students' interests more; in organizational format, we adopt a micro-topic approach, with each micro-topic encompassing "theory-practice-discussion-report" segments; and in teaching discussions, we mainly conduct them in groups, each comprising students from different majors. Overall, our research has two main contributions. The first is demonstrating that the introduction of the "Engineering Philosophy and Culture" course effectively enhances students' understanding of engineering and engineering philosophy and culture, and it provides a comprehensive course construction approach from preparatory stages to implementation and feedback reflection. The second is offering directions and specific pathways for course improvement through the analysis of student feedback.

**Appendix 1**

**Course Schedule for "Engineering Philosophy and Culture"**

| Week | Course Content | Teaching Method | Hours |
|---|---|---|---|
| 1st | **Lecture Title:**<br>"Engineering, Engineers, and Engineering Education "<br>**Main Content:**<br>1) The concept, connotation, and extension of engineering;<br>2) The evolution of engineers' identity and professional characteristics;<br>3) The evolution, concept, and connotation of engineering education. | Classroom teaching with online synchronous recording | 1.5 hours |
| 2nd | **Lecture Title:**<br>"The Dissemination of Engineering Spirit and the Spillover of Engineering Value"<br>**Main Content:**<br>1) The relationship between culture and engineering;<br>2) Engineering spirit and engineering aesthetics;<br>3) The evolution, concept, and connotation of engineering education. | Classroom teaching with online synchronous recording | 1.5 hours |
| 3rd | **Lecture Title:**<br>"The History of Modern and Contemporary Engineering Development"<br>**Main Content:**<br>1) Modern engineering and engineering education;<br>2) Contemporary engineering and engineering education; | Classroom teaching with online synchronous recording | 1.5 hours |

| **Week** | **Course Content** | **Teaching Method** | **Hours** |
| --- | --- | --- | --- |
| | 3)Typical modern and contemporary engineering cases. | | |
| 4th | **Lecture Title:**<br>"Engineering Innovation"<br>**Main Content:**<br>1) The concept and characteristics of engineering innovation;<br>2) Systematic thinking in engineering innovation;<br>3) Asymmetric advantages in engineering innovation. | Classroom teaching with online synchronous recording | 1.5 hours |
| 5th | **Lecture Title:**<br>"Exploring the Unknown: Thoughts and Actions - Taking Civil Engineering as an Example"<br>**Main Content:**<br>1) The relationship between exploration ability and technological innovation, talent cultivation;<br>2) The relationship between scientific spirit and the cultivation of exploration talents;<br>3) The development of civil engineering and talent cultivation in the new era. | Classroom teaching with online synchronous recording | 1.5 hours |
| 6th/7th | **Field Research:**<br>Aviation Manufacturing and Assembly Factory.<br>**Main Content:**<br>1) On-site visit to the aircraft assembly workshop and communication with technical personnel;<br>2) Seminar, discussing the visited content and related themes of | On-site field research | 4 hours |

| Week | Course Content | Teaching Method | Hours |
|---|---|---|---|
| | engineering philosophy and culture. | | |
| 8th | **Course Discussion**<br>**Course Content:**<br>1) Q&A on course content;<br>2) Exchange and discussion of research reports. | Faculty-student interactive discussion | 1.5 hours |
| 9th | **Lecture Title:**<br>"Expansion and Enhancement of Engineering Thinking"<br>**Main Content:**<br>1) The core of expanding engineering thinking;<br>2) Methods for enhancing innovative thinking;<br>3) Strategies for classification and reasoning thinking. | Classroom teaching with online synchronous recording | 1.5 hours |
| 10th | **Lecture Title:**<br>"Introduction to Integrated Circuits"<br>**Main Content:**<br>1) The development of integrated circuit engineering;<br>2) Moore's Law in the development of integrated circuits;<br>3) The chip manufacturing process. | Classroom teaching with online synchronous recording | 1.5 hours |
| 11th | **Lecture Title:**<br>"Empowering Science and Engineering with Artificial Intelligence"<br>**Main Content:**<br>1) Struggling in human-machine confrontation: breaking through | Classroom teaching with online synchronous recording | 1.5 hours |

| Week | Course Content | Teaching Method | Hours |
|---|---|---|---|
| | the problem of combinatorial explosion;<br>2) AI-driven scientific research: the endless frontier of interdisciplinary integration;<br>3) General education in artificial intelligence: growing together in intelligence. | | |
| 12th | **Lecture Title:**<br>"Engineering Ethics"<br>**Main Content:**<br>1) Basic concepts and relationships in engineering ethics;<br>2) Core values of engineering ethics;<br>3) The relationship between data and morality in the big data era. | Classroom teaching with online synchronous recording | 1.5 hours |
| 13th/14th | **Field Research:**<br>Intelligent Manufacturing Factory for Automobiles.<br>**Main Content:**<br>1) On-site visit to the intelligent manufacturing workshop for automobiles and communication with technical personnel;<br>2) Seminar, discussing the visited content and related themes of engineering philosophy and culture. | On-site field research | 4 hours |
| 15th | **Course Discussion**<br>**Course Content:**<br>1) Q&A on course content;<br>2) Exchange and discussion of research reports. | Faculty-student interactive discussion | 1.5 hours |