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Comparative study on the effect of talent cultivation between experimental class and regular class of environmental engineering major in a key University of China

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Based on the training demand for high-quality top talents, a key university in China has established "Jingchu Excellent Talents Program". In order to explore the effect of this model on talent cultivation, this study took students majoring in Environmental Engineering as the research object, continuously tracked their academic performance and graduation destination, and studied the cultivation effect of experimental class by comparing with regular class. The study found that the academic performance of the first year was the most critical to determine whether students could achieve admissions to postgraduate qualifications, and also the key factor affecting the subsequent decision of students to take the postgraduate entrance examination or employment. The overall score of the experimental class was higher than that of the regular class, and the employment situation of the experimental class was far better than that of the regular class. There was a positive correlation between students' learning ability and their college entrance examination scores. Considering factors such as curriculum design, differences in student sources, and learning environments, this paper proposed suggestions such as optimizing the selection mechanism for experimental classes, and the research results provided references for the talent cultivation model of top-notch students in colleges and universities.

KEYWORDS
academic performance, employment, environmental engineering major, experimental class, talent cultivation

1 Introduction

Under the background of globalization and knowledge-based economy, scientific and technological innovation has become the core factor of national competitiveness (Sum and Jessop, 2013). In the Outline of the National Medium - and Long-Term Education Reform and Development Plan (2010–2020), China clearly put forward the goal of building an innovation-oriented country, emphasizing that higher education needed to cultivate "top innovative talents" to support the national strategy of self-reliance in science and technology (Ministry of Education of the People's Republic of China, 2010). The Government Work Report of the State Council in 2025 further required "strengthening the training of top-notch innovative talents, urgently needed talents in key areas and high-skilled talents", highlighting the country's urgent need for high-level talent (State Council of China, 2025). Based on this background, experimental classes in colleges and universities of China, as the "experimental field" of talent training mode reform, have become an important action to respond to the national strategy (Han, 2022).

Since the establishment of the "Special Class for the Gifted Young" in the University of Science and Technology of China in the 1970s, Chinese universities have tried to concentrate high-quality resources through experimental classes to break through the limitations of traditional education mode (Dai and Steenbergen-Hu, 2015). Based on the principle of "selecting the best from the best", such classes cultivate leading talents with interdisciplinary thinking and scientific research ability through personalized curriculum, flexible learning system, tutorial system and other mechanisms. For example, the "Lang Shijun" automation experimental class of Northeastern University has explored the systematic training path of top-notch innovative talents through strengthening practical courses, international academic exchanges and participation in scientific research projects (Guo et al., 2017). In recent years, "Yuanpei College" of Peking University and "Turing Class" of Zhejiang University have further expanded the mode of experimental classes, emphasizing the integration of general education and professional education to meet the needs of society for interdisciplinary talents (Cao, 2016). Students in these colleges or classes are collectively referred to as "top innovative college students".

Since the industrial revolution, human beings have discharged a large number of toxic substances into the natural environment through production and living, causing unprecedented damage to the ecological environment and seriously affecting the survival and development of human beings (Singh and Singh, 2017). Based on the urgency of solving environmental problems, environmental disciplines came into being. Among them, Environmental Engineering is an important branch of environmental disciplines, which mainly studies how to protect and rationally utilize natural resources, solve environmental problems through scientific means, and improve environmental quality (National Academies of Sciences, Engineering, and Medicine et al., 2019). The goal of the Environmental Engineering major is to cultivate interdisciplinary senior engineering technology and management talents who have strong environmental engineering practice and innovation ability and can solve complex environmental engineering problems (Mihelcic et al., 2016). In 2018, the Ministry of Education of China implemented the "Six Excellence and One Top-notch" talent development program, marking the entry of the era of excellent engineer education and training program (Na et al., 2021). The Hubei Province in China has launched the "Jingchu Outstanding Talents" program since 2016, encouraging colleges and universities to cultivate applied talents through university-enterprise cooperation and the integration of industry and education (Bao et al., 2021). Relying on this provincial platform and integrating teaching resources, a key university set up an Environmental Engineering "Jingchu Excellence Talent Experimental Class" in 2018, which has become an important part of the program. The experimental class selected students with excellent English and quality assessment from students majoring in Environmental Engineering. Through optimizing the course system and strengthening practical experience, the experimental class breaks through the traditional engineering education mode and highlights the training characteristics of "one system and three modernizations" (double tutorial system, small class, individuation and internationalization). It aims to train outstanding engineers who can solve complex environmental engineering problems and have an international perspective to serve the national ecological protection and pollution control strategy.

So far, this experimental course has been successfully implemented in three batches of students at this university. It is necessary to evaluate the talent cultivation effect of the experimental course. Therefore, this study focuses on the student group of the environmental engineering major of the 2020 graduating class and conducts a longitudinal follow-up survey for 4 years. By comparing the experimental class with the regular class, and comparing the differences in academic performance and graduation destination between the two classes, the cultivation effect of this project is evaluated. The assessment of academic performance at different stages with the most critical predictive effect on students' final graduation destinations was evaluated. After controlling the influence of students' initial academic foundation, it was determined whether the training model of the "experimental class" can still significantly improve students' academic performance and the probability of further education. Challenges in the talent cultivation process have been identified, and valuable insights have been provided for optimizing the talent cultivation of the environmental engineering discipline.

2 Data and methods

2.1 Source of data

The data used in this research, such as the academic results and graduation destination of cohort of 2020 undergraduates, was provided by the educational affairs department of the School of Environmental Science and Engineering of the key university. The statistics included 72 courses accumulated in 4 years of university. The basic information of students, including gender, college entrance examination scores, admission intentions, places of origin, etc., came from the department of student affairs.

2.2 Method of analysis

The independent sample t-test and the chi-square test were used to calculate and compare the differences in various academic performances and graduation destination distributions between the two classes. Pearson correlation analysis was employed to examine the correlation between students' university academic performance and their college entrance examination scores. Trend analysis was used to draw a trend chart of the average score changes for the two classes by semester, visually presenting the dynamic differences in academic development.

3 Results

3.1 Basic information of students

The Environmental Engineering program's 2020 cohort had a total of 40 students, divided into one experimental class and one regular class, each consisting of 20 students. The experimental class was selected through the application of students after entering the university in the first year. The basic information of the two classes was compared as shown in Table 1.

It could be seen that experimental class occupy obvious advantages in the quality of students, including the average score of college entrance examination, percentage of first-batch regular undergraduate admissions and percentage of students from economically developed areas. However, it was interesting that the percentage of first-priority admissions of the regular class was higher than that of the experimental class, indicating that the students of the regular class were more willing to choose environmental majors (Chen, 2016).

In the macroscopic framework of the curriculum system, the training programs for environmental engineering in the experimental class and the regular class are highly consistent and homogeneous, ensuring the integrity of the core knowledge structure of the major. The main difference between the two classes is not the number of courses, but rather the depth, challenge level and resource investment in teaching implementation. For the course "Fundamentals of Computer and Programming", the experimental class learned Python, while the regular class learned C++. There was no difference in postgraduate recommendation, and all students were recommended for graduate school admission exemption based on academic ranking within their cohort. Therefore, the main factors that led to the difference in academic performance were the establishment of different classes and the influence of the learning environment.

3.2 Training result of students

As shown in Figure 1, the employment rate of the students in experimental class reached 95%, while the employment rate of the students in regular class was only 50%. For the type of employment, the proportion of the students in experimental classes with the permission for graduation was as high as 60%, while the students in the regular class is only 30%. The proportion of agreed employment was 35% in the experimental class and only 20% in the regular class. In general, the employment situation of the experimental class was far better than that of the regular class, and

TABLE 1 Basic information of experimental and regular classes.

Item	Experimental class	Regular class
Number of students	20	20
Male–female ratio	19:1	15:5
Average score of college entrance examination	636.40	621.68
Percentage of first-batch regular undergraduate admissions	35%	30%
Percentage of first-priority admissions	25%	35%
Percentage of major adjustment	30%	50%
Percentage of students from economically developed areas	25%	10%

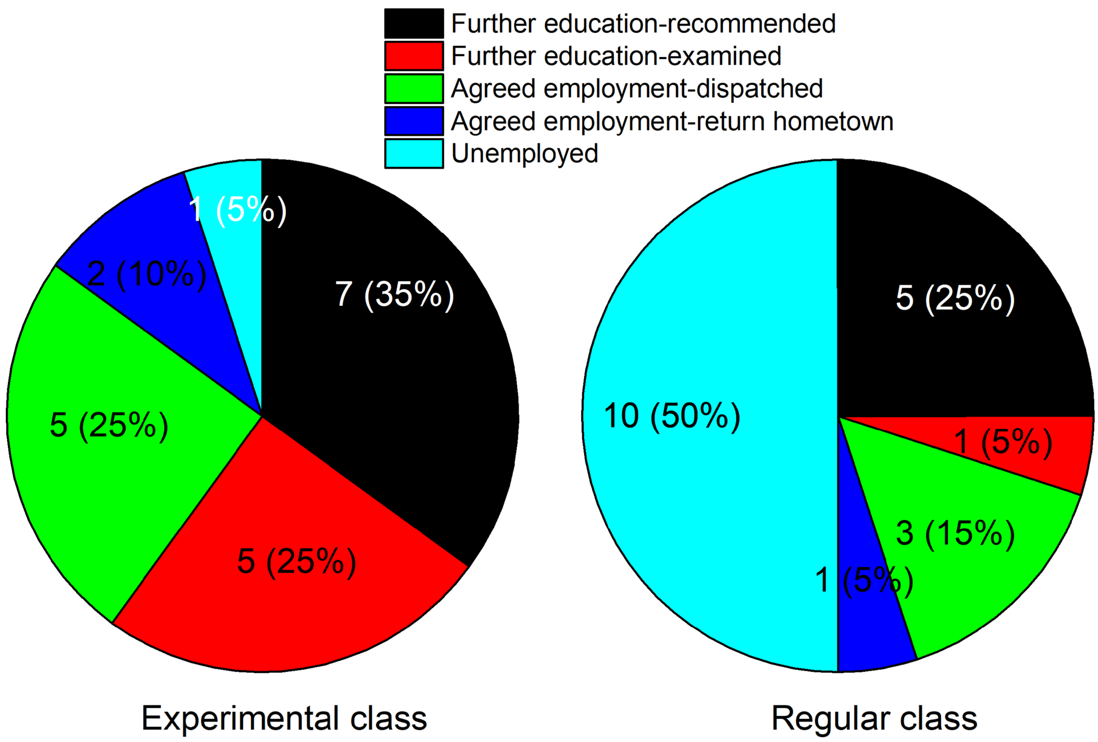

FIGURE 1
The employment situation of experimental class and regular class.

the overall talent training effect was remarkable, which was relevant to the excellent quality of the overall student source of the experimental class.

However, from the perspective of top students (exempted postgraduate candidates), regular classes also had their advantages, such as the number of exempted postgraduate candidates had reached 5. From the result analysis, among the top 5 students in the freshman to junior year, there were 3 students from regular class, ranking 1, 2 and 4 respectively, which indicated that regular class had shown a good effect on the cultivation of top students.

3.3 Analysis of academic performance in the first three years

Students' academic performance of the first three years was the most critical, which was the main reference to determine whether students can be exempted as postgraduate candidates (Xu and Li, 2024), and also the key factor affecting the subsequent decision of students to take the postgraduate entrance examination or employment. Therefore, we conducted a detailed analysis of the students' learning situation in the first three years.

3.3.1 First semester of freshman year

Twelve courses of first semester included Comprehensive English (I), Linear Algebra, Calculus (I-1), Ideological Ethics and Rule of Law, General Chemical Experiments, General Chemistry, Military Training, Military Theory, Fundamentals of Computer and Programming, Mechanical Design Theory and Method (I-1), Introduction to Environmental and Architectural Disciplines, and Physical Education (I). All courses added up to 26 credits. The average score of the experimental class (weighted average score of 81.21) was higher than that of the regular class (weighted average score of 79.40). In 7 of the 12 courses, the experimental class scored higher than the regular class (Figure 2). However, for top students (top 5), the average score of the regular class (weighted average score of 87.69) was better than that of the experimental class (weighted average score of 87.27), and the average scores of 8 of the 12 courses were better than that of the experimental class. This was a very interesting phenomenon.

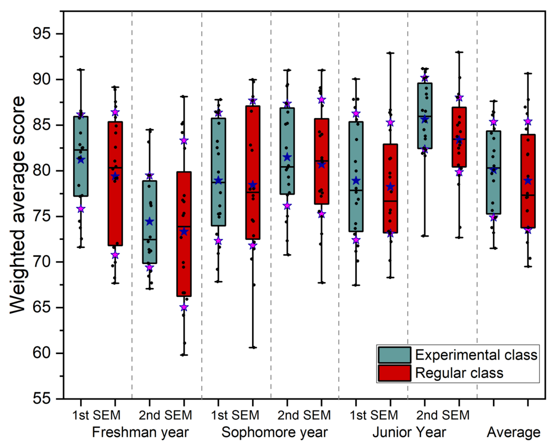

FIGURE 2
General academic performance of experimental class and regular class in the first three years of university.

3.3.2 Second semester of freshman year

Ten courses of second semester included Comprehensive English (II), Chinese Language, Outline of Modern Chinese History, Physics Experiment (I), Calculus (I-2), Computer Network Technology and Application, Mechanical Design Theory and Method (I-2), College Physics (I), Ideological and Political Courses Social Practice, and Physical Education (II). Similarly, the average score of the experimental class (weighted average score of 74.43) was higher than that of the regular class (weighted average score of 73.33). In 7 of 10 courses, the experimental class scored higher than the regular class. However, for the top students, the average score of the regular class (weighted average score of 85.04) was better than that of the experimental class (weighted average score of 82.18), and the average scores of 8 courses were better than that of the experimental class (Figure 2).

Compared with first semester, the scores of this semester were generally lower. The main reason was the increased course difficulty. For instance, Comprehensive English (average score: 74.05 → 73.73), Calculus (average score: 80.83 → 67.85) and Mechanical Design Theory and Method (average score: 80.43 → 73.20) had been strengthened in the second semester. In addition, more difficult courses such as College Physics (average score: 69.53) were added in this semester, resulting in a drop in academic performance.

3.3.3 First semester of sophomore year

There are 12 courses in this semester, including Internet of Things Technology, Physical Experiment (II), Basic Principles of Marxism, Computer Graphics, Engineering Mechanics, Engineering Measurement, Probability Theory and Mathematical Statistics, Electrical and Electronics (III), College Physics (II), Measurement Practice, Principles of Automatic Control, and Physical Education. Compared with the last semester, the overall score had improved. Similarly, the average score of the experimental class was better than the regular class, but for the top students, the regular class was better than the experimental class (Figure 2).

3.3.4 Second semester of sophomore year

There are 13 courses in this semester, including Organic Chemistry, Physical Chemistry, Fundamentals of Civil Engineering, Knowing Practice, Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics, Fluid Mechanics (II), Mechanical Principles, Innovation and Entrepreneurship in Environmental Engineering, Comprehensive Chemistry Experiment, Engineering Training (III), Analytical Chemistry, 3S Technology, and Physical Education. The overall score of this semester was further improved, but the score of Fluid Mechanics was relatively low. The overall performance of the experimental class was better than that of the regular class, and top students of the experimental class was also slightly better than that of the regular class. In general, the performance of the experimental class improved significantly (Figure 2).

3.3.5 First semester of junior year

There are 12 courses in this semester, including Comprehensive Experiment of Environmental Microbiology, Environmental

Economics, Comprehensive Experiment of Environmental Monitoring, Environmental Monitoring, Environmental Planning and Management, Environmental Planning Course Design, Principles of Environmental Engineering, Environmental Engineering Microbiology, Biochemistry, Instrumental Analysis, Environmental Chemistry, and Hydrology and Hydrogeology. The learning situation of this semester was similar to that of the second semester of sophomore year. The experimental class was better than the regular class in terms of the overall performance and the performance of the top students, which could be seen that the performance of the experimental class was improving (Figure 2).

3.3.6 Second semester of junior year

There are 13 courses in this semester, including Physical Pollution Control Engineering, Sludge Treatment and Recycling, Soil and Groundwater Remediation Technology and Engineering, Water Pollution Control Course Design, Comprehensive Experiment of Water Pollution Control Engineering, Water Pollution Control Engineering, Membrane Science and Technology, Comprehensive Experiment of Environmental Engineering, Solid Waste Treatment and Disposal, Solid Waste Treatment Course Design, New Technology of Wastewater Treatment, Air Pollution Control Course Design, and Air Pollution Control Engineering. The performance was similar to that of last semester and the experimental class was better than the regular class in terms of the overall score and the scores of the top students (Figure 2). Perhaps due to the rush of postgraduate quota, it obviously felt the endurance and potential of the experimental class. Other studies have also confirmed that some students become more motivated in their studies in the second half of their junior year in order to strive for guaranteed graduate school admission (Zhu et al., 2023).

The general rules could be summarized as follows: (1) the overall average score of the experimental class was higher than that of the regular class. (2) The differentiation between the two levels of the regular class was more serious. The performance of the poor students was basically the bottom of the grade, and the performance of the top students was also the top of the grade. (3) The scores in the second semester of freshman year had declined significantly and the specific reasons had been analyzed above. (4) It was obvious that students' enthusiasm for study had shown a rising momentum since the second semester of sophomore year, especially the experimental class. The result might be related to the students' awareness of the importance of academic performance and the postgraduate qualification, so students were trying to improve their scores.

3.4 Analysis of student performance based on different graduation destinations

The destinations of students were classified according to further education-recommended, further education-examined, agreed employment and unemployment, and then the academic performances of each type of students in the university were compared. The results are summarized in Figure 3. It was obvious that the order of general performance was as follows: further education-recommended > further education-examined > agreed employment > unemployment, and the relative academic performance of each type of students during the 4 years of university was quite stable, which reflected the differences in their own learning abilities. In turn, the academic performance of students also determined the destination of students' graduation (Pan and Lee, 2011). Students' learning ability might be determined as soon as they entered university, which made us curious to explore whether students' learning ability was related to the relevant indicators of source of student.

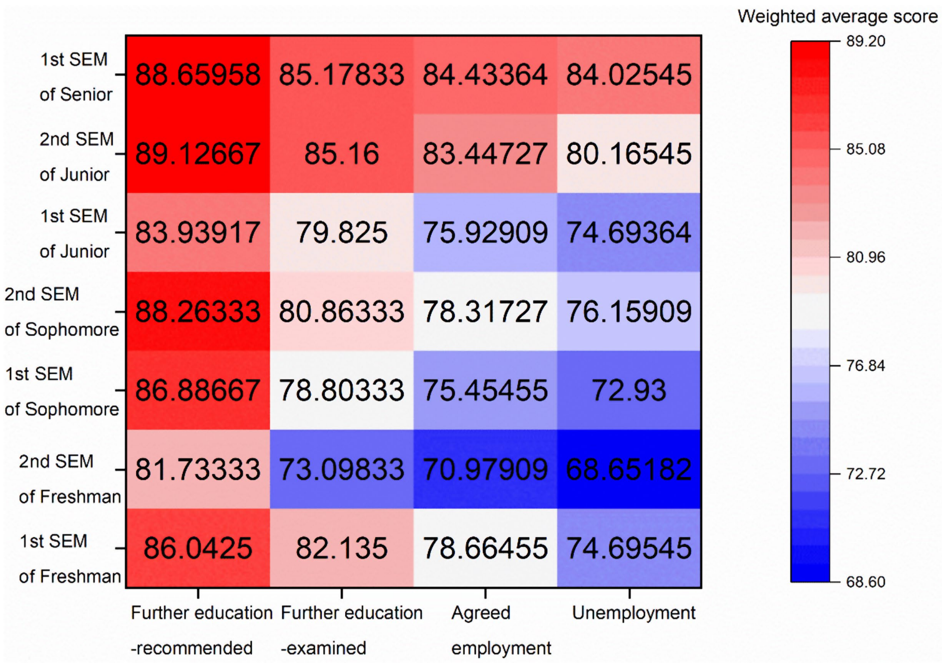

FIGURE 3
Heatmap for student academic performance based on different graduation destinations.

3.5 Correlation between students' learning ability and basic information of student source

As shown in Figure 4, there was a strong correlation between academic performance and college entrance examination scores ($r = 0.35$, $p = 0.03$). In other words, there was continuity and consistency between university learning ability and high school learning ability (Ma et al., 2019). For another example, the analysis of the college entrance examination scores of the top students (exempted postgraduate candidates) in the experimental class and the regular class also found that the average score of the regular class (658) was higher than that of the experimental class (641), which could also explain that the top students in the regular class had higher college scores than the top students in the experimental class. The results indicated that students with strong learning ability could either join the experimental class or stay in the regular class to achieve good university results.

3.6 Analysis of the difficulty of specific courses

The difficulty of the courses in the 4 years of university was analyzed. As shown in Figure 5, the difficult courses (average score <75) included Comprehensive English (I), Comprehensive English (II), Mechanical Design Theory and Method (I-2), Environmental Monitoring, University Physics (I), University Physics (II), Computer Network Technology and Application, Fluid Mechanics (II), and Mechanical Principles. The most challenging course is Fluid Mechanics (II), with an average student score of only 66. Some teachers believe that the difficulty of Fluid Mechanics was mainly manifested in two aspects: firstly, fluid mechanics involved a wide range of knowledge, such as advanced mathematics and college physics; secondly, fluid mechanics was relatively abstract, making it difficult to understand (Mi et al., 2020).

Courses with high fractional dispersion (variance >100) included Calculus (I-1), Fundamentals of Computer and Programming, Mechanical Design Theory and Methods (I-1), Probability Theory and Mathematical Statistics, Engineering Project Management, University Physics (I), University Physics (II), Computer Network Technology and Applications, Fluid Mechanics (II), and Mechanical Principles. The most difficult and differentiated courses included University Physics (I), University Physics (II), Computer Network Technology and Applications, Fluid Mechanics (II), and Mechanical Principles. Most of these courses were distributed in the first year, so the performance of the first year basically determined the overall ranking of the scores, and the following professional courses could not open the gap between students.

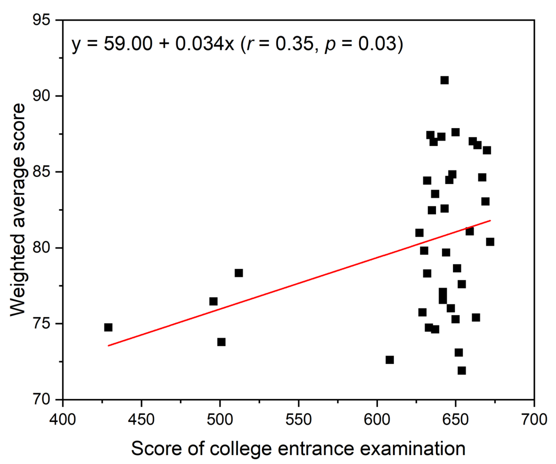

FIGURE 4
Correlation analysis between academic performance and college entrance examination scores.

4 Discussion

With the popularization of higher education, the differences in abilities and interests among student groups are becoming increasingly significant. The experimental class provided top students with a more challenging learning environment through stratified selection (such as recommendation and secondary selection) and differentiated cultivation. For example, the Association of Computing Machinery (ACM) class of Shanghai Jiao Tong University took high-intensity scientific research training and subject competitions as the core to cultivate top talents in the field of computer science (Zhao, 2022). The Classical Studies Experimental Class of Renmin University of China broke down disciplinary barriers and enhanced students' critical thinking abilities through the study of Chinese and Western classics (Hou, 2022). This model not only met the individualized needs of students, but also optimized the allocation efficiency of educational resources. Furthermore, in terms of engineering talent cultivation, the introduction of concepts such as industry-education integration and "new engineering" disciplines has placed even higher demands on the ability development of engineering students (Eidenskog et al., 2023; Dong et al., 2024; Gong, 2024). The "Outstanding Engineer" experimental class for environmental engineering in a certain university was established precisely based on this demand, with the goal of cultivating outstanding environmental protection engineers (Li et al., 2018).

The data from this paper showed that the experimental class had a significant advantage over regular class in employment rate (95% vs. 50%) and postgraduate enrollment rate (60% vs. 30%), which was closely related to the quality of students' source (average college entrance examination score 636.40 vs. 621.68, proportion of students admitted to the first batch 35% vs. 30%). This indicated that high-quality student source was an important foundation for the success of the experimental class, which conformed to the "Matthew Effect," i.e., resources were concentrated in the dominant group (Margolin, 2018). However, the first-choice major rate of the regular class was higher that of experimental class (35% vs. 25%), but it had not been transformed into an employment advantage, possibly because the higher proportion of students admitted through major adjustment (50% vs. 30%), combined with their weaker sense of major identity, had negatively impacted their academic engagement. It is suggested that in future recruitment, major promotion should be strengthened and the proportion of passive adjustment should be reduced to enhance the sense of belonging of students in the regular class.

Although the experimental class performed better overall, the top students in the regular class had consistently ranked among the top in the grade from the first to the third year (for instance, three of the top

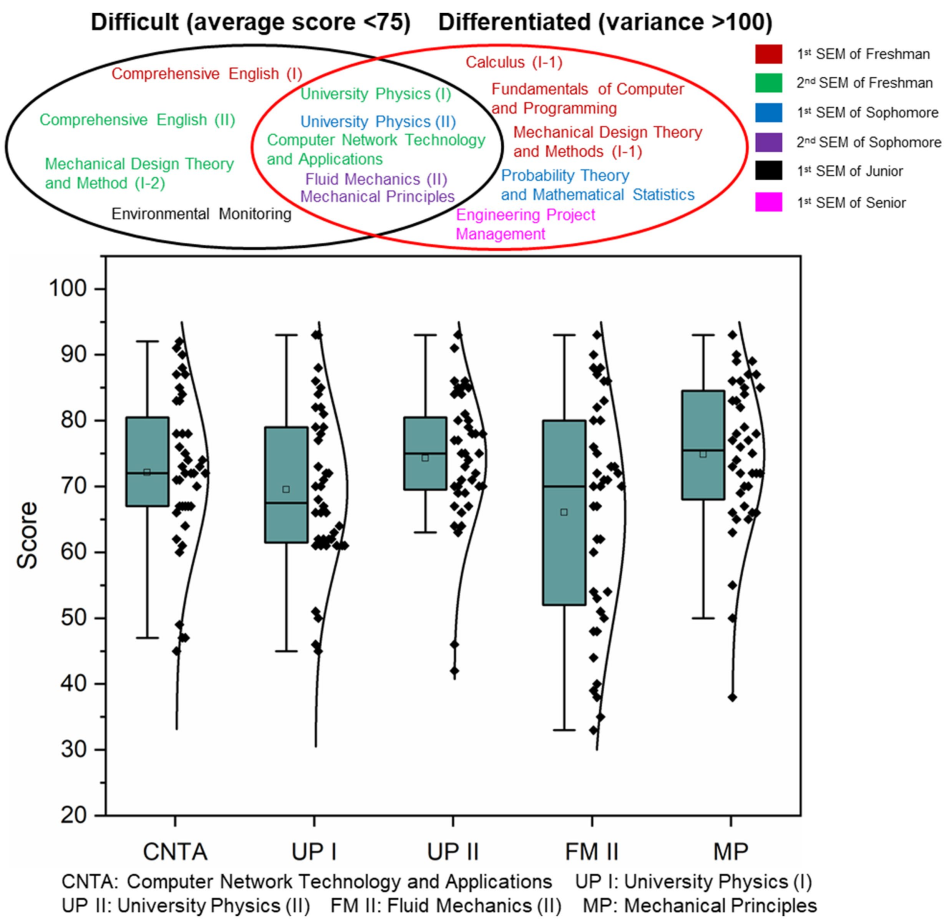

FIGURE 5
Analysis of more difficult and differentiated courses in the four year of university.

five students in the grade were from regular class). The possible causes of this phenomenon could be attributed to the follows:

(1) Differences in competitive pressure: The competition within the experimental class was intense, which might cause some students to fluctuate in performance due to excessive pressure. Students in regular class might be more likely to focus on self-improvement due to the relatively relaxed environment.
(2) Teacher attention distribution: For the experimental class, the teachers might pay more attention to the overall improvement of the level, while for the regular class, the teachers provided more guidance to potential students.
(3) Differences in learning motivation: Top students in regular classes might make up for their resource disadvantages through "self-motivation" and develop stronger autonomous learning abilities.

This result suggests that in stratified teaching, attention should be paid to the psychological states of students in different classes, excessive emphasis on competition should be avoided, and at the same time the balanced allocation of teacher resources should be optimized.

The grades of both classes decreased significantly in the second semester of the first year (for example, Calculus dropped from 80.83 to 67.85), mainly attributed to the increase in course difficulty (such as College Physics and Mechanical Design). However, the decline in the grades of the experimental class was smaller than that of the regular class (weighted average score 74.43 vs. 73.33), which might be related to the stronger learning adaptability of students in experimental class. It is suggested that adaptive courses (such as learning method training and psychological counseling) should be added in the freshman stage, and the pressure caused by the sudden increase in course difficulty should be alleviated through stratified teaching.

Although university scores were positively correlated with the college entrance examination scores ($r = 0.35$, $p = 0.03$), the correlation was weak, indicating that the high school foundation was only one of the influencing factors. Other potential variables (such as learning strategies, interest matching degree, and family support) might play an important role. For example, top students in regular class had higher college entrance examination scores but did not choose experimental class. This might be because they attached more importance to professional interests rather than "labeled" class, and eventually performed better in college. Future research can introduce questionnaire surveys to quantify the influence of non-cognitive factors (such as learning motivation and time management).

Key courses (such as College Physics and Fluid Mechanics) were concentrated in the freshman year of college, and the grade dispersion was large (with a variance of up to 100), resulting in the situation where "the top student in freshman year won the world". The experimental class established a leading position in the freshman year due to the advantage of student sources, while students in the regular class were prone to fall into a passive situation if they failed to adapt in time. It is suggested to optimize the course gradient, move some highly difficult courses backward, and strengthen the tutoring of basic subjects in the first year (such as setting up an intensive calculus class) to remove obstacles for subsequent learning.

This study only followed one batch of students (n = 40), with a small sample size, and did not control for confounding variables such as teachers' teaching styles and class management methods. This study is an in-depth case study, with the sample covering the entire cohort of students from one major at a key university. Although the total sample size limits the generalization of the research findings to a broader population, the design of the full sample and longitudinal tracking provides rare data integrity and internal consistency, enabling us to clearly depict the development trajectories of students under the two training models and identify the key predictor of academic performance in the first year. Future research can replicate this design in multiple institutions and use meta-analysis to verify the universality of the findings of this study. In the future, the sample range could be expanded. It is planned to conduct a cross-university comparative study, collecting data from multiple universities that have implemented similar "Excellence Program," in order to test the general applicability of the current research conclusions in different institutional contexts. Besides the data of multiple batches of students in this university could be compared longitudinally. Qualitative research (such as interviews) could also be introduced to deeply explore implicit factors such as class atmosphere and teacher-student interaction. In terms of research methods, the "quasi-experimental design" approach such as the propensity score matching (PSM) method could be adopted to match the academic foundation and background characteristics of the students in the experimental class with those of the "control individuals" in the regular class, which are the closest in these aspects. This enabled us to simulate a random experiment statistically and more cleanly estimate the "treatment effect" of the training model. Furthermore, the curriculum differences between the experimental class and the regular class (only in programming languages) did not significantly affected the results. It is suggested that subsequent research design comparative experiments with larger curriculum differences to clarify the specific path of teaching reform.

Although the student outcomes (employment rate, postgraduate enrollment rate) and academic performance have difficulty in comprehensively reflecting deep-level effects such as long-term development, these indicators are quantifiable, consistently recorded, and objectively comparable metrics across the two cohorts (experimental vs. regular class). They serve as tangible, first-order outcomes directly influenced by the undergraduate training process. By analyzing the academic performance of the experimental class and the regular class during the 4 years of university, it was found that the overall performance of the experimental class was higher than that of the regular class, and the graduation destinations of the experimental class are also better than those of the regular class. To a certain extent, this indicated the training effect of the experimental class. There was no obvious difference in the training programs between the experimental class and the regular class. Only the learning contents of individual courses were different. From the current training program, the evaluation was still relatively monotonous and failed to fully reflect students' practical and innovative abilities. It is suggested that on the basis of the current training program, the experimental class should independently set up a training program, appropriately increase students' credits for innovation and entrepreneurship and comprehensive practice, and reduce the total credits on the basis of meeting national standards and professional certifications. It will enable students to have more time and energy to devote to innovation and entrepreneurship, and effectively contribute to the cultivation of top-notch innovative talents. Global competition requires talents to have an international perspective and the ability to apply cutting-edge technologies (Thairoongrojana, 2024). Meanwhile, emerging technologies such as artificial intelligence and big data have a profound impact on the educational model (Luan et al., 2020). The experimental class needs to cultivate students' core abilities to cope with technological changes by introducing courses such as computational modeling and data analysis.

Although the experimental class had achieved remarkable results, it still faced challenges: such as the uneven distribution of resources might exacerbate the issue of educational equity, and the potential impact of the high-intensity competitive environment on students' psychology, etc. In the future, the training system needed to be further optimized. For instance, by drawing on the "small but exquisite" model of Westlake University, education on research ethics should be strengthened, general education and professional education should be balanced, and the experience of the experimental class should be extended to general education through policy guidance (Wanger and Xie, 2021). Furthermore, in terms of improving the employment rate, it is necessary to further enhance the cultivation of students' practical abilities and increase the proportion of practical teaching.

Overall, the experimental class model had achieved remarkable results in improving the overall training effect, but the potential of the regular class in cultivating top students could not be ignored. Universities needed to take into account both "inclusiveness" and "excellence" in stratified teaching. By dynamically adjusting the class mechanism, optimizing the course design and strengthening psychological support, it could achieve diversified and balanced development of talent cultivation.

5 Conclusion

This study highlighted the effectiveness of experimental class in higher education, which adopted stratified selection and specialized training to enhance the achievements of outstanding students. Experimental class performed better than regular class in terms of employment rate (95% vs. 50%) and postgraduate admission rate (60% vs. 30%), which was related to higher-quality student selection (average entrance score: 636.40 vs. 621.68) and the "Matthew effect." However, regular class had a higher rate of first-choice major selection (35% vs. 25%), but were more affected by passive major adjustments (50% vs. 30%), indicating the need for enrollment reform to increase major participation. Notably, top students in regular class had consistently outperformed their peers, attributed to less competitive pressure, individualized teacher attention, and stronger self-motivation. Both classes experienced a decline in grades during their second semester of freshman year, due to the difficulty of the courses, but experimental class adapted better, suggesting the necessity of providing adaptive courses for freshmen. The correlation between university grades and entrance scores was weak ($r = 0.35$), indicating that non-cognitive factors such as learning strategies and interest matching were more important.

The key challenges included difficult and concentrated freshman courses (such as University Physics), which exacerbated academic disparities. Suggestions included optimizing the difficulty gradient of courses and providing foundational tutoring. Although the experimental class performed well, the differentiation of courses remained limited, thus reformed such as innovative credits and the integration of artificial intelligence/data science were needed. The research limitations of this study included a small sample size and unresolved confounding factors (such as teaching styles). Future research should expand the sample size, incorporate qualitative methods, and test variations of the courses. Despite the success in terms of training results, the experimental class carried risks of unfairness and student stress, so a balanced model and policy-driven inclusiveness were required.

In conclusion, stratified teaching must coordinate "excellence" and "inclusiveness" through dynamic adjustments, psychological support, and curriculum innovation to adapt to the changing educational and technological demands and promote the cultivation of diverse talents.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

YL: Writing – review & editing, Writing – original draft. JF: Writing – original draft.

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