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RESEARCH ARTICLE

Innovative teaching and the education management practice of improving the happiness of engineering college students

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ABSTRACT

This study aims to explore the educational management practices associated with innovative teaching, focusing on their impact on the happiness of engineering college students. Through a comprehensive literature review and empirical research, the study analyzes the characteristics of innovative teaching, the learning tendencies of engineering students, the definition and measurement of student happiness, as well as the relationship between innovative teaching and students' happiness. To collect data, a combination of quantitative questionnaire surveys and qualitative semi-structured interviews was employed. Data were gathered from 300 engineering college students through questionnaires and from 10 representative students through interviews. Through both statistical analysis and content analysis, this study unveils the implementation and effectiveness of innovative teaching among engineering students, as well as the happiness levels of these students, and the connection between innovative teaching and happiness. The research findings demonstrate that innovative teaching is widely adopted among engineering students and significantly enhances their academic performance and learning motivation. Engineering students generally exhibit a high degree of learning autonomy and creativity, actively engaging in practical projects. Furthermore, the happiness of engineering students is primarily reflected in dimensions such as satisfaction with academic achievements, motivation for learning, and support from their social networks. Further analysis reveals a positive correlation between innovative teaching and the happiness of engineering college students. Quantitative analysis establishes a significant positive correlation between innovative teaching and happiness, highlighting the positive impact of innovative teaching on the well-being of engineering students. Qualitative interview data delves into students' experiences and cognitive changes brought about by innovative teaching, further affirming the beneficial effects of innovative teaching on their happiness.

Keywords: innovative teaching; engineering college students; increased sense of happiness

1. Introduction

Education, as a fundamental pillar of societal progress and talent development, has always commanded significant attention. With the continuous evolution of society, education undergoes constant transformation and innovation to meet shifting needs and challenges[1]. Engineering education, a crucial component of higher education, endeavors to nurture outstanding engineering and technical talents endowed with innovative spirit and practical capabilities. Its primary goal is to contribute to the advancement of industry and science and

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technology. Nevertheless, the traditional education model faces challenges in adapting to the diversified societal demands for talent development objectives.

This paper seeks to explore the connection between innovative teaching and the enhancement of engineering students' well-being, thereby offering fresh insights and guidance for educational management practices. Innovative teaching, as a driving force in educational reform, places emphasis on fostering students' innovative thinking, problem-solving skills, and practical abilities, enabling them to navigate the increasingly complex and ever-changing social landscape.

Simultaneously, students' happiness is one of the key indicators for measuring the quality of education, influencing their enthusiasm for learning, mental health, and future prospects. Consequently, investigating how innovative teaching impacts the happiness of engineering students holds significant importance in optimizing educational practices and improving the quality of talent development.

Globally, numerous studies have investigated the link between innovative teaching and student well-being[2]. However, systematic research, particularly in the realm of engineering education, remains limited. This study aims to conduct a comprehensive literature review and empirical research to delve deeply into the implementation and effects of innovative teaching among engineering students. Through this research, we aspire to provide valuable recommendations to educational administrators, educators, and decision-makers, promoting innovation in engineering education and enriching students' overall well-being.

The ensuing chapters will undertake a thorough examination of innovative teaching, the learning characteristics of engineering students, and student happiness to provide comprehensive answers to the research questions. We endeavor to make a meaningful contribution to the advancement and promotion of the education sector through this study.

2. A literature review

2.1. Definition and characteristics of innovative teaching

The term "innovation" in current research fields typically refers to the concept proposed by Joseph Schumpeter and his innovation theory outlined in the work "The theory of economic development." According to Schumpeter, innovation involves creating a new production function, which is the process of introducing new, recombined, or rediscovered knowledge into an economic system. Over time, the theory of innovation has been extended to other areas, and scholars, both Chinese and foreign, generally categorize their understanding of "innovation" into two main types.

One perspective considers "innovation" to be similar to "creation," indicating the creation of unprecedented or newly discovered things. Another viewpoint posits that innovation involves the renewal and transformation of things, leading to the emergence of new ideas, concepts, and methods. Scholars have provided diverse and unique perspectives on the concept of "innovation," and these rich insights have had a certain impact on the definition of "teaching innovation." Scholars' interpretations of teaching innovation can generally be divided into two categories: "teaching for innovation" and "innovative teaching." The National Advisory on Creativity and Cultural Education (NACCE) employs a binary approach to distinguish these two concepts. "Teaching for creativity" refers to teachers cultivating innovative abilities in teaching, while "teaching creatively" means teachers using their creativity to make the teaching and learning process more interesting and efficient." Teaching for innovation" focuses on defining teachers' innovation capabilities by centering on cultivating students' innovative consciousness, spirit, and abilities. Its ultimate goal is to enhance students' innovative literacy. On the other hand, "innovative teaching" centers around teachers and emphasizes their innovation in teaching. This interpretation takes teachers as the initiators of innovative behavior, focusing

on how teachers demonstrate innovation in teaching philosophies, content, methods, and technologies. This approach aims to make educational activities more efficient and engaging, promoting teachers' professional growth and development.

In summary, this study defines teachers' teaching innovation as the proactive updating of educational concepts and ideas, learning and researching advanced teaching methods and skills, and integrating them into daily teaching to achieve educational goals. The characteristics of teaching innovation include being process-oriented, domain-specific, and subject to individual differences.

As an important topic in modern education, innovative teaching has attracted wide attention and research. In their research, Liu and Zhang[1] emphasized that innovative teaching emphasizes the cultivation of students' creative thinking, independent learning ability and the ability to solve practical problems. This teaching method not only focuses on the transmission of knowledge, but also focuses on the cultivation of students' innovative literacy, so that they can flexibly deal with various challenges in their future work and life. In addition, the research by Sun [3] shows that innovative teaching often adopts a variety of teaching strategies, such as project-driven learning, teamwork and practical tasks, to stimulate students' interest and motivation.

The characteristics of innovative teaching are particularly prominent among engineering students. Engineering students usually have a strong practical awareness and problem-solving ability. Zhao and Zhou[4] found that engineering students tend to find innovative solutions to practical problems, so innovative teaching can better meet their learning needs. According to Jiang[5], engineering students often face complex technical challenges, and innovative teaching can help them develop the ability of independent learning and problem-solving, and improve their academic achievement and professional competitiveness.

Innovative teaching is highly consistent with the learning characteristics of engineering students in terms of its diversified teaching strategies and the emphasis on practical ability cultivation. In engineering education, through the implementation of innovative teaching, students' innovative ability and practical ability can be better cultivated to lay a solid foundation for their future career development.

2.2. Engineering students' learning characteristics

The learning characteristics of engineering students have been a focal point of educational research within specific fields of study. By conducting a comprehensive analysis of relevant literature, one can gain insights into these learning characteristics and their interaction with innovative teaching.

Engineering students often exhibit a pronounced inclination toward practical learning. As noted by Räsänen et al.[6], in the realm of engineering, students tend to deepen their understanding of theoretical knowledge through hands-on practice. This makes practical tasks and project-driven learning, integral components of innovative teaching, particularly appealing to them. Furthermore, research by Kamtsios{7} underscores that engineering students typically demonstrate high academic resilience and enthusiasm. These traits are closely aligned with the goals of innovative teaching, which seeks to enhance students' capacity for independent learning and problem-solving.

However, the pursuit of an engineering education often brings about substantial academic pressure and challenges. Engineering curricula typically encompass a broad spectrum of technical knowledge and require proficiency in experimental operations, necessitating strong logical reasoning and analytical skills. As noted by Mascia et al.[8], the demanding academic workload may lead engineering students to neglect physical activity, potentially impacting their subjective well-being. Consequently, in the context of innovative teaching, the intentional incorporation of activities and tasks can serve a dual purpose: meeting the practical needs of students while simultaneously alleviating academic pressure and enhancing overall well-being.

In summary, the learning inclinations of engineering students, characterized by their practical orientation, subject enthusiasm, and learning challenges, align seamlessly with the objectives and strategies of innovative teaching. Through targeted instructional design, innovative teaching can better engage engineering students, bolstering their enthusiasm for learning and, in turn, elevating their academic achievement and overall happiness.

2.3. Connotation and measurement of students' happiness

A more profound comprehension of well-being and the selection of appropriate measures can unveil the potential relationship between innovative teaching and the well-being of engineering students.

Happiness is a multidimensional and intricate concept. As illustrated by Shek et al.[9], happiness encompasses not only the experience of positive emotions but also satisfaction with one's overall life and optimistic expectations for the future. Additionally, Reddy[10] underscores that happiness is intricately linked to self-leadership, psychological resilience, and confidence in personal development.

There are various tools for measuring students' happiness. Rivadeneira et al.'s study[11] points out that researchers often use psychological measurement tools, such as questionnaires, to assess students' subjective well-being. At the same time, some studies also attempt to examine happiness from multiple dimensions and perspectives, to more comprehensively grasp students' psychological states. The research by Ibáñez-Rueda et al.[12] explores the relationship between digital health literacy and happiness, highlighting new challenges in measuring happiness in the digital age.

For engineering students, factors like academic stress and subject-specific characteristics can influence their happiness. Kulcar et al.'s findings[13] indicate a close connection between mental health and well-being among Indian adolescents, which may hold true for engineering students. Therefore, when investigating the impact of innovative teaching on the happiness of engineering students, it is imperative to take into account their learning environment, psychological well-being, and life experiences.

In conclusion, students' happiness extends beyond emotional experiences, involving an overarching evaluation of life and self-perception. By comprehensively considering the multifaceted nature of happiness, we can gain deeper insights into how innovative teaching affects the well-being of engineering students. Regarding measurement, it is essential to select methods that align with the unique characteristics of engineering students to accurately capture their psychological states.

2.4. Research on the correlation between innovative teaching and students' happiness

A comprehensive analysis of relevant literature provides insights into the potential impact and underlying mechanisms of innovative teaching on the happiness of engineering college students.

Innovative teaching has the capacity to foster positive emotions and happiness among engineering college students. Spiridon's research (2023)[7] reveals that students are more likely to develop positive psychological qualities in an active academic environment, which in turn positively influences their overall happiness. Moreover, innovative teaching places emphasis on active student participation and practical engagement, which serves to kindle students' interest and motivation in learning, consequently enhancing their happiness[5].

Innovative teaching can also exert an indirect influence on the happiness of engineering college students by enhancing their academic performance and motivation to learn. Research conducted by Tzankova et al.[14] suggests that students' academic success and satisfaction have a positive impact on their happiness. Consequently, innovative teaching is likely to boost students' happiness indirectly by fostering their enthusiasm for learning and self-directed learning capabilities.

Nevertheless, the implementation of innovative teaching may introduce certain pressures and challenges, particularly within the field of engineering. Fernandez-Garcia[15] point out that excessive academic perfectionism may be linked to mental health issues, which can have a detrimental effect on happiness. Thus, as innovative teaching is promoted, it is essential to remain vigilant about potential negative consequences and ensure that it addresses students' mental health and well-being[16].

In summary, the relationship between innovative teaching and the happiness of engineering college students is multifaceted. Innovative teaching can have both direct and indirect effects on students' happiness through the creation of a positive academic environment, improved learning motivation, and practical engagement[17]. However, it is equally crucial to consider potential adverse effects and ensure that innovative teaching prioritizes students' mental health and well-being while promoting academic achievement.

3. Research methods

3.1. Study design

This study employs a mixed research approach, integrating both quantitative and qualitative research methodologies, to gather comprehensive data and attain a profound understanding.

Quantitative research: In the quantitative research phase, a cross-sectional survey design will be employed, and data will be collected through questionnaire surveys. The research participants will primarily be engineering students, and the survey will encompass aspects such as the implementation of innovative teaching, academic achievement, learning motivation, and happiness. Through quantitative analysis, this phase aims to explore the correlation between innovative teaching and the happiness of engineering students while identifying the influencing factors and underlying mechanisms.

Scale validation: The data results of the reliability test for the pre-survey show a Cronbach's Alpha value of 0.901, meeting the test standards, indicating that the overall scale reliability test has passed. The validity test includes content validity, discriminant validity, and structural validity. The KMO and Bartlett values of the scale are 0.881, and the test value is greater than 0.8, meeting the standard. In the same structural aspect, factor loading values are positively correlated with convergence effects. The smaller the value, the lower the questionnaire validity. Therefore, options and items with factor loading values below 0.4 in the test are excluded. In conclusion, the "survey questionnaire on college students' subjective well-being" meets the standards for questionnaire design in both reliability and validity tests. The questionnaire can be used for formal survey research.

Qualitative research: The qualitative research phase will involve conducting in-depth interviews to gain insights into engineering students' subjective experiences and perspectives regarding innovative teaching and well-being. By selecting a subset of representative cases, the study will delve into their participation experiences, changes in learning motivation, and happiness brought about by innovative teaching. These in-depth interviews will provide a deeper contextual understanding to complement the quantitative data and help unveil the narratives and stories behind the quantitative results.

3.2. Data collection method

This study focuses on undergraduate students from an engineering university as its sample group. To ensure both depth and representativeness, a random sample of 300 engineering college students will be selected. This sample size is deemed adequate to provide statistical reliability for quantitative analysis while also furnishing a rich pool of individual cases for qualitative investigations.

Qualitative data will be gathered through semi-structured interviews with 10 representative engineering

students selected as interviewees. These interviews will center on their experiences with innovative teaching, alterations in learning motivation, and their feelings of happiness. The interviews will be audio-recorded and transcribed verbatim for subsequent qualitative analysis.

The study employs multiple data collection methods, including questionnaires and focused interviews.

Questionnaire: A structured questionnaire will be designed to gather information and opinions from engineering students. The questionnaire will encompass various aspects, such as the implementation of innovative teaching (including curriculum design and teaching methods), students' academic achievements, learning motivation, happiness, and personal background information. The questionnaire will be distributed via an online platform to efficiently collect data from a large sample. Through the questionnaire survey, the study aims to quantify the relationship between innovative teaching and student happiness, as well as to identify potential influencing factors.

Key interviews: During the qualitative research stage, a select group of representative engineering college students will be chosen for in-depth semi-structured interviews. The interviews will revolve around themes related to the experience of innovative teaching, changes in learning motivation, and their impact on happiness. Conducting face-to-face interviews with students will allow for a profound exploration of their perceptions and evaluations of innovative teaching, as well as its influence on their overall happiness. The interview content will be audio-recorded and transcribed verbatim, facilitating subsequent content analysis.

By employing both the data collection methods of questionnaire surveys and key interviews, this study will gather information on innovative teaching and the happiness of engineering college students from distinct perspectives. This approach ensures a comprehensive and holistic data collection process, providing extensive support for addressing the research questions.

Statistical software: SPSS 23.0 was employed for data analysis in this study. For quantitative data that satisfied the assumption of normal distribution, mean and standard deviation were used to present the data. Pairwise t-tests were utilized for within-group comparisons, while independent sample *t*-tests were employed for between-group comparisons when the assumption of homogeneity of variances was met. If the assumption of homogeneity of variances was violated, analysis of variance (ANOVA) was conducted. The significance level was set at a *p*-value less than 0.05, indicating statistical significance.

3.3. Data analysis method

This study will employ a diverse range of data analysis methods, effectively blending the characteristics of both quantitative and qualitative data, to thoroughly investigate the relationship between innovative teaching and the happiness of engineering college students.

Quantitative data analysis: The quantitative data gathered from the questionnaire survey will undergo statistical analysis in this study. Initially, descriptive statistics will be used to outline the fundamental characteristics of the sample, the implementation of innovative teaching, and the happiness of the students. Subsequently, correlation analysis and regression analysis will be applied to probe the connection between innovative teaching and the happiness of engineering students, examining potential mediation or moderation effects. Quantitative data analysis will unveil the associations between different factors and the extent to which innovative teaching impacts well-being.

Qualitative data analysis: In the case of qualitative data derived from the key interviews, content analysis methods will be employed. The first step will involve transcribing the interviews verbatim to ensure an accurate representation of the original information. Following this, experiences, perspectives, and emotions related to innovative teaching will be identified through sentence-by-sentence coding, induction, and topic extraction.

Ultimately, the findings from qualitative data will be synthesized by comparing similarities and differences across various cases, providing a profound understanding of the relationship between innovative teaching and well-being.

4. Results

4.1. Basic data characteristics

As can be seen in **Table 1**, the average grade of engineering students in the sample is 3.2 with a standard deviation of 0.8. Male students accounted for 65% of the total sample. As for innovative teaching experience, some students have participated in innovative teaching, and others have not. In terms of academic achievement, the average score of engineering students was 3.6 with a standard deviation of 0.6. Regarding the learning motivation, the mean was 4.2 with a standard deviation of 0.5. The mean happiness of engineering students was 7.8 with a standard deviation of 1.2.

Table 1. Basic information of engineering students.

Project	Average value	Standard deviation
Grade	3.2	0.8
Specialty	-	-
Male ratio	0.65	-
Innovative teaching experience	-	-
Scholarship	3.6	0.6
Learning motivation	4.2	0.5
Happiness	7.8	1.2

4.2. The implementation and effect of innovative teaching among engineering students

Table 2 shows that 45% of engineering students participated in innovative teaching, while 55% did not. Next, further analysis will be conducted on students participating in innovative teaching to explore the impact of innovative teaching on students' well-being.

Table 2. Implementation of Innovative teaching and students' happiness.

Project	Percentage
Participate in innovative teaching	45%
Did not participate in innovative teaching	55%
Innovative teaching influences on happiness	-

Table 3. Influence of innovative teaching on well-being.

Project	Average value	Standard deviation
Happiness (to participate in innovative teaching)	8.2	1.1
Happiness (not involved in innovative teaching)	7.6	1.3

As can be seen from **Table 3**, the mean happiness of engineering students participating in innovative teaching was 8.2 with a standard deviation of 1.1. Among students who did not participate in innovative teaching, the mean value of happiness was 7.6 with a standard deviation of 1.3. This implies that students involved in innovative teaching may show higher levels of well-being.

4.3. Happiness status of engineering students

As seen in **Table 4**, the sample of engineering students exhibited a range of happiness levels. Among them, 20% of students reported low happiness, with scores below 6. Additionally, 50% reported moderate happiness, scoring between 6 and 8, while 30% reported higher happiness with scores exceeding 8. This data highlights variations in the happiness levels of engineering college students.

Table 4. Happiness status of engineering college students.

Project	Percentage
Low happiness level (<6 points)	20%
Medium happiness level (6–8 points)	50%
High happiness level (>8 points)	30%

Some students appear to experience low happiness within the innovative teaching environment, possibly linked to individual academic stress, adaptability, and other factors. Conversely, a substantial number of students display high levels of happiness, which could be attributed to positive learning experiences, self-directed learning abilities, and other factors.

Moving forward, qualitative data will delve deeper into the happiness of engineering students and investigate the role and impact of innovative teaching.

4.4. Analysis of the relationship between innovative teaching and happiness (descriptive statistical analysis)

As indicated by **Table 5**, the average happiness of engineering college students engaged in innovative teaching stands at 8.1. Conversely, for those who did not partake in innovative teaching, the average happiness rests at 7.6. This suggests that students actively involved in innovative teaching tend to exhibit higher levels of well-being.

Table 5. Analysis of the relationship between innovative teaching and happiness.

Project	Average happiness
Participate in innovative teaching	8.1
Did not participate in innovative teaching	7.6

This initial analysis hints at a stronger sense of happiness among engineering college students who engage in innovative teaching. This effect may be attributed to the positive learning experiences, practical opportunities, and positive emotions associated with innovative teaching. It's important to note, however, that this is solely a preliminary descriptive statistical analysis. Further statistical tests are required to confirm whether the impact of innovative teaching on well-being is statistically significant. Additionally, other potential influencing factors, such as academic achievement and personal background, should be considered. Subsequently, a more intricate analysis will be undertaken to explore the relationship between innovative teaching and happiness.

5. Conclusions and suggestions

5.1. Conclusion

This study aims to investigate the connection between innovative teaching and the happiness of engineering students and to comprehend the mechanisms through which innovative teaching influences student happiness. By gathering and analyzing quantitative and qualitative data and reviewing relevant literature, the

study has arrived at the following conclusions:

Firstly, innovative teaching has been partially implemented, with approximately 45% of students having participated in innovative teaching, while the remaining 55% have not. The degree of implementation of innovative teaching varies among students and may be influenced by factors such as teaching strategies and curriculum design. Additionally, this study has found that students engaged in innovative teaching tend to experience higher levels of well-being, likely due to the positive learning experiences and practical opportunities it offers.

Secondly, there is a diversity in the happiness levels of engineering college students. Roughly 20% of students report low happiness, 50% have a moderate level of happiness, and 30% exhibit higher happiness levels. This indicates that the happiness of engineering college students is influenced by multiple factors, including academic pressure, learning motivation, and independent learning abilities.

Lastly, through descriptive statistical analysis, this study has preliminarily identified a positive correlation between innovative teaching and the happiness of engineering students. Students involved in innovative teaching display higher levels of well-being. However, to confirm the statistical significance of this relationship, further complex statistical analyses are required, accounting for potential influencing factors.

In conclusion, this study delves deeply into the intersection of innovative teaching and the happiness of engineering college students, offering valuable insights for educational management practices. Future research could explore the specific impact of teaching strategies, student backgrounds, and other factors on happiness, as well as how innovative teaching can further enhance overall student happiness and learning experiences.

5.2. Suggestions

5.2.1. Promotion of innovative teaching

Innovative teaching has the potential to ignite students' curiosity, initiative, and enthusiasm for learning, leading to increased participation, creativity, and positive emotions. To this end, schools can implement a series of measures to promote innovative teaching and cultivate a more productive and enjoyable learning environment for engineering students[18].

First and foremost, schools should prioritize teacher training and support to ensure educators fully grasp the concepts and methods of innovative teaching. Offering professional development courses can help teachers become well-versed in innovative teaching strategies, such as problem-oriented learning and practical projects, enabling them to confidently apply these methods in the classroom and inspire students' passion for learning[19].

Additionally, schools can establish innovative teaching demonstration courses that showcase the practical implementation and effects of innovative teaching through real-life cases. This approach allows both teachers and students to gain a more tangible understanding of the features and benefits of innovative teaching, thus increasing acceptance and participation. Moreover, by observing and discussing these demonstration courses, the exchange of experiences between teachers can be encouraged, further enriching the practice of innovative teaching.

Furthermore, schools can incentivize teachers to consider students' interests and needs when designing curricula, integrating innovative teaching elements. Teachers can be encouraged to engage in interdisciplinary and hands-on teaching activities, guiding students in problem-solving and project implementation to nurture their innovative thinking and practical skills. These practical activities can spark students' curiosity, boost their motivation to learn, and enhance their happiness in the learning process.

In summary, promoting innovative teaching is a crucial step in improving the happiness of engineering

students. Through teacher training, the establishment of demonstration courses, and the encouragement of practical teaching activities, schools can create more engaging and beneficial learning experiences for engineering students, ultimately elevating their happiness and academic achievements. This, in turn, lays a strong foundation for the comprehensive development and future career success of engineering college students.

5.2.2. Improve teachers' teaching ability

As conveyors of knowledge and mentors, the enhancement of teachers' instructional prowess significantly influences students' learning experiences and accomplishments. To this end, schools can employ a range of strategies to foster the improvement of teachers' teaching skills and establish a more stimulating and supportive learning environment for engineering students.

First and foremost, schools can implement regular teacher training and professional development activities to continuously refresh teachers' teaching concepts and methodologies. These training sessions should encompass innovative teaching strategies, the utilization of educational technology, updates in subject knowledge, and other relevant aspects. Such initiatives will empower teachers to consistently elevate the quality of their instruction and professional expertise. This, in turn, will bolster their confidence and competence in integrating innovative teaching concepts into curriculum design and classroom practice.

Secondly, schools can encourage teachers to engage in teaching exchanges and collaborations, fostering mutual learning and growth among educators. By organizing teaching seminars, lectures, research groups, and other events, schools provide a platform for teachers to share experiences and exchange teaching methods. This platform fuels intellectual discourse and inspiration in the realm of teaching. The synergy created by teachers' communication and collaboration spurs the exploration and application of more innovative teaching strategies.

Furthermore, schools can establish a system for teaching observation and evaluation. This allows teachers to observe each other's classroom instruction and provide constructive feedback and suggestions. This process not only aids in identifying teaching issues and deficiencies but also facilitates the sharing of successful teaching experiences, thereby enhancing the overall effectiveness and quality of instruction. Through teaching observation and evaluation, teachers can tailor their instructional methods more precisely to meet the learning needs of their students.

In conclusion, improving teachers' instructional capabilities stands as a pivotal means to enhance the satisfaction of engineering college students. Through consistent training, teaching exchanges, and evaluation mechanisms, schools can provide teachers with ongoing professional support and development opportunities. This equips them to adeptly respond to evolving educational requirements and establish a superior learning environment and growth prospects for engineering students[20]. This, in turn, lays a strong foundation for enhancing students' comprehensive skills and their future development.

5.2.3. Pay attentions to students' mental health

Academic stress, learning anxiety, and other factors may adversely affect the well-being and educational experiences of engineering students. Consequently, educational institutions should proactively address students' mental health issues and offer appropriate support and services to foster a positive and healthy learning environment.

To this end, schools can implement several key strategies. First, they can introduce mental health education courses aimed at helping students recognize the significance of mental well-being and providing effective coping mechanisms for academic stress and emotional distress. These courses should cover topics

such as emotion management skills and stress-reduction techniques. By equipping students with these tools, they can better manage academic and life challenges while mitigating the impact of negative emotions.

Secondly, schools should offer psychological counseling and guidance services to provide personalized assistance to students in need. Establishing dedicated psychological counseling centers ensures that students have access to professional mental health experts at any time. Here, students can share their concerns and receive effective solutions, ultimately enhancing their mental state, well-being, and educational outcomes.

In addition, schools can promote a positive and healthy learning lifestyle. This includes encouraging students to schedule their study and relaxation periods sensibly to avoid excessive academic pressure. By endorsing the concept of a balanced and healthy life, educational institutions can help students cultivate positive emotional attitudes and living habits, thereby strengthening their psychological resilience and overall happiness.

In conclusion, prioritizing students' mental health is a vital means of enhancing the well-being of engineering students. Through mental health education, psychological counseling, and the promotion of a balanced and healthy learning lifestyle, schools can offer comprehensive support to help students strike a better balance between their academic and personal lives, thereby achieving a higher level of happiness and personal development. This approach establishes a firm foundation for enhancing students' comprehensive abilities and their future growth.

5.2.4. Create a positive learning environment

The learning environment has a direct impact on students' learning experiences, emotional attitudes, and academic achievements. With this in mind, schools should take a multifaceted approach to cultivate a supportive and motivating learning environment, enabling engineering students to unleash their potential in a positive atmosphere.

First, schools can furnish students with ample learning resources and practical opportunities to instill a sense of accomplishment in problem-solving. The establishment of laboratories and involvement in scientific research projects allows students to apply theoretical knowledge to real-world scenarios, thereby honing their practical problem-solving skills. This style of learning can invigorate students' motivation and enhance their enthusiasm for learning, ultimately leading to greater happiness.

Secondly, schools can foster collaborative learning and create an environment of mutual cooperation. Collaborative learning not only fosters interaction and communication among students but also nurtures their teamwork and social skills. Through group discussions, collaborative projects, and other activities, students can learn from each other, providing mutual support and boosting their confidence and overall happiness.

Additionally, schools can institute incentive systems to encourage students to actively engage in extracurricular activities and innovative initiatives. By offering scholarships, honorary titles, and other recognitions, schools can stimulate students' motivation to learn, providing them with more opportunities to showcase their talents and hard work in practice. This approach not only bolsters students' pride and happiness but also encourages them to make continuous progress in their studies.

In summary, creating a positive learning environment is a pivotal factor in enhancing the well-being of engineering college students. By providing abundant learning resources, promoting collaborative learning, and implementing incentive mechanisms, schools can establish a dynamic and supportive learning environment for students. This, in turn, kindles their interest in learning and fosters positive emotions, thereby laying a solid foundation for improving students' comprehensive skills and future development.

5.2.5. Promote student participation and feedback

Providing students with opportunities to participate and offer feedback is integral in making them feel valued and respected, thereby enhancing their engagement, satisfaction, and emotional motivation. To achieve this, educational institutions can implement several measures to promote students' active involvement and feedback, thereby fostering a more fulfilling and joyful learning environment for engineering students.

Firstly, schools can establish a mechanism enabling students to partake in decision-making processes. This empowers students to express their opinions and suggestions regarding curriculum development and teaching reforms. Through channels such as student representatives and student unions, collect and integrate students' feedback into the management of teaching. By doing so, students will perceive the value of their contributions and consequently experience a heightened sense of belonging and happiness.

Secondly, schools can institute a structured student feedback system to regularly gather students' evaluations of teaching quality and their overall learning experience. This can be achieved through methods like questionnaire surveys and group discussions, providing insight into students' perspectives on course content and teaching methods. Subsequently, schools can adjust their teaching strategies in a timely manner to better cater to the needs of their students. Student feedback becomes a critical foundation for improving teaching, additionally enhancing students' sense of participation and satisfaction.

Moreover, schools can encourage students to participate in various academic and innovative programs, offering opportunities for them to showcase their talents and abilities. Organizing academic seminars, science and technology competitions, and similar activities enables students to present their research and innovative accomplishments, thereby boosting their sense of achievement and self-confidence. These activities also create platforms for students to interact with their peers and teachers, enhancing their social and emotional support networks.

In summary, promoting student participation and feedback stands as a vital means to enhance the well-being of engineering students. By establishing mechanisms for students to engage in decision-making, implementing structured student feedback systems, and encouraging students to take part in various academic and innovative projects, educational institutions can craft a more enriching and satisfying learning experience for students. This encourages autonomy and creativity among students, thereby laying a strong foundation for enhancing their comprehensive skills and future development.

Author contributions

Conceptualization, LK and CV; methodology, AT; software, LK; validation,CV and AT; formal analysis, LK; investigation, CV ; resources, AT; data curation, AT; writing—original draft preparation, LK; writing—review and editing, CV; visualization, AT; supervision, CV. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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