

AIGC-Empowered Talent Cultivation Model for the Data Science and Big Data Technology Major under Engineering Education

Zhifu Jia *, Xiaodie Hu, Yunhan Chen, Zhenfen Dong and Dianqiang Li

School of Mathematics and Physics, Department of Data Science and Big Data Technology, Suqian University, Suqian, Jiangsu, 223800, China

* Corresponding author: Zhifu Jia (Email: jzflzbx@163.com)

Abstract: This study examines two main issues in the engineering education of the Data Science and Big Data Technology program: the gap between what students learn and actual industry demands, and the limited application of AIGC technology in daily teaching. To address these problems, we developed a new talent training model based on a four dimensional collaborative framework and three supporting systems; following the approach of not adding separate new courses while integrating AIGC into all teaching links, we added AIGC related content to the existing knowledge-ability-quality training system, revised course content, improved practical training tasks, and promoted cooperation among government, universities and enterprises to ensure AIGC is deeply applied throughout classroom instruction, lab sessions and internship training. We piloted this model with three groups of students at Suqian University, and the results show that students have made clear progress in their ability to complete AIGC assisted tasks and their overall engineering skills, enterprises have given higher recognition to student project outputs, more awards have been obtained in subject competitions and innovation projects, and government-university-enterprise cooperation has been further strengthened. This work provides a practical reference for other emerging engineering majors to keep up with technological development without making major adjustments to their current curriculum systems.

Keywords: Engineering Education; AIGC Concept; Talent Cultivation Model; Curriculum Integration; Practice-driven; Government-school-enterprise Collaboration.

1. Introduction

1.1. Background of Engineering Education and Industry Development Trends

Engineering education reform primarily aims to better align talent training with industry needs and technological progress, and this goal has received further attention with the New Engineering initiative. As digital technologies develop rapidly, traditional engineering education can no longer fully meet the demand of modern industries for talents with both broad knowledge and innovative ability [1]. Against this background, the New Engineering initiative proposes updating course content and strengthening practical training, with a focus on improving students' engineering practice and innovation capabilities through interdisciplinary learning and real-world scenario-based teaching.

The Data Science and Big Data Technology major is an emerging interdisciplinary program that has grown in importance in the digital age. It is designed to train high quality talents with skills in data processing, analysis and decision support, to meet the strong demand for data-driven innovation across industries. At the same time, artificial intelligence generated content, or AIGC, as an important emerging technology in the big data field, has been applied to various aspects of data science research, bringing new approaches to data collection, cleaning, modeling and practical application [2]. For this reason, studying how to apply this technology to talent training for the major within the engineering education framework is a necessary response to technological development, and also an important way to bring professional education closer to real industry needs.

1.2. Challenges Faced by Existing Cultivation Models

Although the Data Science and Big Data Technology major has built a basic curriculum system, there is still a clear mismatch between what students learn and what the industry requires. First, AIGC content is not well integrated with existing courses, and there is a lack of systematic teaching design for this part. For example, some courses only touch on AIGC briefly, without in-depth theoretical explanation or hands-on practice, so students cannot fully master the relevant skills [3]. Second, lab practice seldom includes real industrial tasks involving this technology. Most of the time, students finish assignments in simplified, controlled settings and do not get enough training in solving complex real-world problems, which directly affects their ability to use related tools effectively. In addition, the gap between internship arrangements and actual industry needs is quite prominent. Survey data shows that more than 60% of enterprises find that students cannot apply what they have learned to real work during internships, especially when it comes to AIGC assisted data analysis and decision support [4]. These problems lower the overall quality of talent training, and also limit the long-term development of the major.

This study sets out to build a new talent training model that fully integrates this technology into the existing education system, to help graduates better meet the needs of the industry. Specifically, we will first review existing studies and conduct surveys with stakeholders from government and enterprises, to find suitable points for integrating AIGC content into existing courses. Based on this, we will design a four dimensional collaborative training framework and three

supporting systems, to make the integration more systematic and practically feasible [5].

This study has two main implications. On one hand, it can improve the current curriculum system and promote the integration of this technology with professional knowledge, which will help improve students' comprehensive abilities and competitiveness in the job market. On the other hand, it provides useful references for engineering education reform, and can serve as an example for other emerging technology majors. By building a practice-oriented system that runs through the whole learning process, this study can help narrow the gap between theory and practice, and better prepare students for future changes in the industry.

2. Literature Review

2.1. Engineering Education and AIGC-Related Theories

Engineering education follows a student centered, outcome oriented model. It seeks to align talent training with industry demands by building reasonable curricula and strengthening practical teaching links. At its core is the concept of Outcome Based Education, or OBE, under which training objectives are set according to actual industry needs, and teaching activities are designed accordingly to help students develop corresponding competencies [6]. Meanwhile, as a key emerging technology in the big data field, AIGC has broad application prospects in the Data Science and Big Data Technology program. Supported by deep learning and natural language processing, this technology can generate high quality content and solve complex problems, providing new technical support for professional talent training [7]. These theoretical foundations guide the curriculum design of the program, and also confirm the necessity and feasibility of integrating AIGC into professional education.

2.2. Research Progress on Talent Cultivation Models at Home and Abroad

In recent years, scholars have carried out extensive research on talent training models for this program, and notable progress has been made in practical cases of AIGC integration. Studies outside China mainly focus on interdisciplinary learning and scenario-based practical teaching. For example, some universities in the United States have built interdisciplinary course systems under the data science plus X framework, embedding relevant technical content into specific application scenarios to improve students' hands on skills [8]. Domestic research pays more attention to collaboration among government, universities and enterprises, as well as practice-driven learning throughout the whole training process. Some universities have cooperated with local governments and enterprises to develop AIGC related internship projects and course modules, forming new education models with participation from multiple stakeholders.

That said, current research still has clear limitations. For one thing, AIGC content is often added to existing courses only at a superficial level, with no systematic overall design. For another, many practical cases rely too heavily on high-quality external resources, making them difficult to replicate and promote in ordinary universities. Overall, studies from the past three to five years show that using AIGC to optimize talent training has become a clear trend, but specific implementation paths still need further exploration.

2.3. Research Gaps and Entry Points of This Study

Despite the progress in relevant research, there are still obvious gaps in the deep integration of AIGC into the existing curriculum system and the construction of a complete practice-driven mechanism. On one hand, most existing studies only explore the application of this technology in a single course or individual practical activity, and fail to put forward a systematic scheme covering the entire training process. On the other hand, many practical cases do not give full play to the resource advantages brought by the joint participation of universities, governments and enterprises, which restricts the actual effect of technology-enabled teaching improvement.

To address these problems, this study proposes a new model composed of a four dimensional collaborative framework and three supporting systems. The model is designed to deeply integrate AIGC into the existing training system, by promoting the coordinated development of four dimensions including knowledge, ability, quality and technical application, and building three supporting systems of curriculum integration, government-university-enterprise collaboration and whole-process practice orientation. This work provides new ideas for talent cultivation in this major.

3. Current Professional Cultivation Status and Dilemmas

3.1. The Era Requirements for Integrating Engineering Education with AIGC

Engineering education accreditation defines 12 graduation requirements, and eight of these including use of modern tools and design or development of solutions have a direct connection with AIGC application [6]. As a core modern tool in big data practice, proficiency with AIGC has become an important competency for meeting these requirements. That said, engineering education is built around gradual ability development, not simple course addition. This means AIGC content should be woven into the existing curriculum rather than added as separate modules, and real-scenario task design can help students build relevant technical skills alongside their regular course work. This also avoids the knowledge fragmentation that often comes with setting up standalone new courses.

At the industry level, demand for big data talents has shifted from traditional data processing capabilities to the ability to mine data value with AIGC support. Around 60% of enterprises now expect employees to use AIGC tools like DeepSeek and Doubao to make data cleaning and visualization more efficient. What matters most to employers, though, is whether graduates can use these tools in real business situations, not just whether they know how to operate them. This makes it necessary to tie AIGC content closely to the professional scenarios covered in existing courses. For example, students can use AIGC to assist with data cleaning in data analysis classes, and use related tools to generate multimodal charts in visualization courses. This way, professional ability and technical application skills can be improved in parallel.

3.2. Core Dilemmas in Current Professional Cultivation

By the end of 2024, 56 universities across the country had

received engineering education accreditation for this program. In Jiangsu Province, 45 universities offer the major, and 12 have passed the accreditation process. Most of these accredited programs rely on curriculum integration as their core implementation method [7]. After comparing engineering education standards with actual industry needs [8], we found the program at Suqian University faces three main problems:

(1) Weak connection between AIGC content and existing courses Of the 10 core courses, only two: data collection and preprocessing, and big data technology and applications touching on AIGC, and the content stays at the theoretical level with no corresponding practical experiments. For example, the data analysis and mining course covers standard data cleaning methods, but does not include hands-on tasks like generating missing data with DeepSeek or identifying outliers with AI help. The Python programming course teaches students to write automated scripts, but does not cover practical skills such as calling AIGC tool APIs or processing data in batches. The end result is that students understand the theory but cannot put the tools to actual use.

(2) No real-world AIGC tasks in lab practice Most current lab sessions take the form of verification experiments. For instance, the lab for database system principles only asks students to build tables and write SQL statements, with no practical tasks like using AIGC to generate SQL or optimizing queries with AI support. The data preprocessing technology lab only requires students to clean data using Python, and does not introduce tools like DeepSeek to improve work efficiency. Because of this, students only learn to operate traditional tools and do not develop skills for working with AIGC assistance, creating a gap between what they learn and what enterprises actually need.

(3) Internships do not keep up with industry's AIGC related needs Existing internship arrangements, including cognitive internships, course projects and comprehensive training, still center on traditional data processing work such as compiling data reports and carrying out basic data processing. No AIGC related tasks are included in these arrangements. For example, students doing cognitive internships at Suqian Wanfu Yunlian Technology Co., Ltd. only use Excel for basic data analysis, with no opportunity to practice using AIGC tools. This creates a clear gap between the skills students gain from internships and the actual requirements of the industry.

4. Construction of a New Talent Cultivation Model with AIGC Integration

Guided by the core requirements of engineering education and the principle of not offering separate new courses while achieving integration across all teaching scenarios, this study constructs a four-dimensional training framework covering knowledge, ability and AIGC application (see Figure 1), along with three supporting systems for curriculum integration, government-university-enterprise collaboration and whole-process practice orientation. The overall goal is to embed AIGC fully into daily classroom teaching, laboratory sessions and internship training.

4.1. Core Framework: Four-Dimensional Collaborative Cultivation Covering Knowledge, Ability, Quality and AIGC Application

Different from the traditional three-dimensional training framework, this study adds AIGC application as a fourth dimension. All dimensions are developed on the basis of the existing curriculum system to maintain the integrity and order of training arrangements, with no standalone courses added.

(1) Knowledge dimension: integrating AIGC content into existing courses The adjustment is carried out within the existing basic and core course system. One to two AIGC related topics are added to each relevant course, allowing students to acquire professional knowledge and master tool applications simultaneously. For example, the data modeling section of mathematical analysis includes a case on function fitting with AIGC assistance, and the matrix operations section of advanced algebra adds content related to matrix optimization in large model training. In the Python programming course, instruction on calling APIs of tools such as DeepSeek and Tencent Zhiying is incorporated into the API related chapter. The data structures and algorithms course introduces methods to improve algorithm efficiency through prompt engineering. For data analysis and mining, topics including AI-generated data supplementation and DeepSeek assisted outlier identification are added. The data visualization course covers multimodal chart generation with Tencent Zhiying and AI-assisted visualization style optimization. In database system principles, content on SQL generation and optimization supported by Doubao is included. The machine learning course adds guidance on parameter tuning with the help of large models.

(2) Ability dimension: developing AIGC application skills progressively through existing practice activities Training focuses on five core competencies: engineering problem analysis, AIGC tool operation, system design and development, teamwork and lifelong learning. These competencies are fostered gradually through existing laboratory sessions, course projects and internships. Laboratory practice and internship practice are connected in sequence: students master basic tool operations in lab sessions, and then apply and improve these skills in real work scenarios during internships.

In Python programming labs, for instance, students practice processing batches of text data by calling the DeepSeek API. In data visualization labs, they practice generating dynamic charts with Tencent Zhiying. These skills are later applied to optimize data reports in government internships and support fault analysis in enterprise internships. In course projects such as data analysis and mining and statistical modeling, students are required to use AIGC tools to break down complex problems. Taking the project on user behavior analysis of cross border e-commerce in Suqian as an example, students use DeepSeek to build analysis frameworks and construct multi-dimensional perspectives, which effectively exercises their problem-solving skills. Teamwork competencies are developed through group assignments, while students are also encouraged to follow updates in AIGC technology during internships to cultivate their awareness of lifelong learning.

(3) Quality dimension: integrating AIGC ethics education into existing teaching scenarios In line with the requirements of moral education and talent development, awareness of AIGC ethics is integrated into existing course cases and

internship activities, without setting up independent ethics courses. For example, the basic artificial intelligence course includes discussions on copyright issues of AI-generated content and data privacy protection. Cases related to government data processing cover norms for using AI to generate official reports. Clear rules for AIGC tool use are specified during internships, such as prohibiting the use of AI to generate false data in enterprise work and prohibiting the sharing of desensitized data in government internships. The elective course on innovation and entrepreneurship training teaches students to design innovation plans with AIGC support. In summer social practice activities, students use AIGC tools to produce big data science popularization posters and short videos, which helps foster their creative thinking and sense of social responsibility.

(4) AIGC application dimension: aligning AIGC practice with three key professional fields Three key professional fields are taken as the main carriers: government data governance, industrial data processing and cross-border e-commerce data application. AIGC application is closely combined with these fields through existing course practice

and internship arrangements.

In course projects of data visualization and data analysis and mining, students are required to use AIGC tools to optimize government data reports, for example, creating dynamic charts with Tencent Zhiying. During internships at the Suqian Municipal Data Bureau, students participate in tasks such as AI assisted interpretation of government data and data support for intelligent question-and-answer robots.

In lab sessions of machine learning and data preprocessing technology, students use DeepSeek to identify abnormal data patterns in industrial scenarios and generate fault analysis suggestions. During internships at Suqian Wanfu Yunlian Technology Co., Ltd., they use AIGC tools to optimize production data reports and assist with data labeling work.

In course projects of Python programming and data visualization, students use AIGC to generate multilingual product descriptions and dynamic marketing charts. During internships at local cross-border e-commerce enterprises, they take part in work including AI-assisted user profiling and data support for market trend prediction.

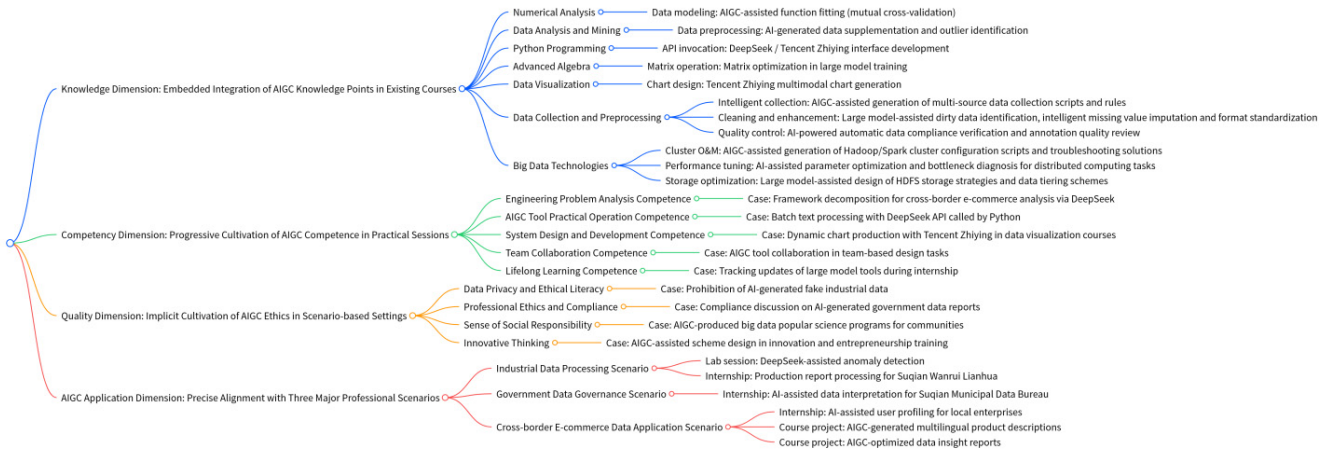


Figure 1. Knowledge-Ability-Quality Knowledge Map for Data Science and Big Data Technology Majors

4.2. Modular Integration of AIGC into Existing Courses and Practices

On the basis of the existing basic, core and practice course modules, we define clear entry points for AIGC integration in each module. By updating course content, optimizing lab tasks and adjusting assessment criteria, we integrate AIGC deeply into regular course teaching. We work with government and enterprise partners including Suqian Wanfu Yunlian Communications Co., Ltd., Suqian Zhongwu Big Data and Guangzhou Teddy Technology to upgrade existing internship activities with AIGC elements, without adding new separate internship programs. We also build a practice platform linking course training, internship placement and AIGC task implementation, to ensure internship practice is closely aligned with actual industry needs.

(1) Division of responsibilities and resource upgrading Responsibilities are distributed among all parties to upgrade relevant teaching and practice resources. Suqian University takes charge of designing AIGC integration schemes for existing internship tasks. For example, subtasks such as AI generated multimodal reports are added to routine government data sorting work. The university also arranges for teachers to participate in enterprise AIGC projects, so as to improve their ability to guide internship work. Government

bodies including the Suqian Municipal Data Bureau and local data groups provide real government AIGC application cases, invite industry experts to participate in internship task design, set clear specifications for AIGC use, and sign formal cooperation agreements with the university. Enterprises such as Suqian Wanfu Yunlian integrate AIGC content into their existing internship positions. For the industrial data analyst role, for instance, tasks including DeepSeek assisted fault prediction and AI-supported data labeling are added. Enterprises also provide real application cases and assign on-site mentors to help students complete AIGC related tasks.

(2) AIGC optimization for courses and internship scenarios Improvements are made to tasks in existing courses and the three types of internship scenarios, without changing the core content of courses or overall internship arrangements. Instead, AIGC assisted subtasks are added to help students improve both traditional professional skills and AIGC application abilities at the same time. At the course level, AIGC subtasks are arranged progressively. Basic courses such as mathematical analysis and Python programming focus on introducing AIGC tools and their basic operations, helping students understand theoretical knowledge and improve work efficiency. Core courses such as data preprocessing technology and machine learning emphasize practical AIGC application in professional scenarios, strengthening the

connection between professional skills and tool use. For the three types of internships, practical AIGC subtasks closely related to core business work are added, and clear assessment standards are set to ensure these tasks are carried out effectively.

(3) Development of a teaching team with both academic and practical competencies Relying on the government-university-enterprise cooperation platform, we build a teaching team capable of delivering AIGC integrated teaching, without recruiting additional full-time teachers. This is achieved mainly through improving the competencies of existing teachers and inviting enterprise mentors to participate in teaching. Every year, 3 to 5 teachers are sent to partner enterprises for a three-month placement, where they take part in AIGC related R&D projects. For example, the industrial data AIGC optimization project at Suqian Wanfu Yunlian Technology. This helps teachers improve their ability to integrate AIGC into daily teaching. We also hold two AIGC tool training sessions each semester to ensure teachers can guide students through AIGC tasks in lab sessions. Enterprise technical experts are invited to serve as internship mentors, assisting students with AIGC tasks during their internships. Once per semester, we host a lecture on enterprise AIGC application cases, providing teachers with real industry examples that can be incorporated into classroom teaching.

4.3. Full-Process Practice-Driven Ability Cultivation Mechanism

On the basis of existing practice activities, we build a complete learning path covering AIGC tasks in course labs, AIGC modules in curriculum design, AIGC scenarios in internship practice, and AIGC optimization in competition projects. This allows students to develop their AIGC application abilities step by step.

(1) AIGC tasks in course labs: basic tool training In lab sessions of each course, we set 1 to 2 basic AIGC tasks focused on tool operation and simple application. For example, in Python programming labs, students practice processing batches of text data by calling the DeepSeek API. In data visualization labs, they practice generating dynamic charts with Tencent Zhiying. In data analysis and mining labs, they practice identifying outliers with AI assistance. These tasks help students master the basic use of AIGC tools, and account for 30% of the final lab grade.

(2) AIGC modules in curriculum design: comprehensive application training AIGC modules are added to course projects of core courses, requiring students to use AIGC tools to solve practical professional problems. Taking the cross-border e-commerce user behavior analysis project as an example, students need to use DeepSeek to assist with data preparation, apply AI tools to build different analysis perspectives, and use Tencent Zhiying to produce visual charts. The AIGC related part accounts for 40% of the project grade, and is evaluated jointly by university teachers and enterprise mentors.

(3) AIGC scenarios in internship practice: industry-adapted training AIGC tasks are added to existing internship arrangements, and students are required to combine AIGC tools with their daily internship work. For example, in government internships, students use AI tools to generate multimodal government reports; in enterprise internships, they use AIGC to support fault analysis work. The quality of AIGC task completion accounts for 35% of the internship grade, and is mainly evaluated by enterprise mentors to ensure

the outcomes meet actual industry requirements.

(4) AIGC optimization in competition projects: innovation ability training Students are encouraged to use AIGC tools to improve their work in existing academic competitions, including the National College Student Mathematical Modeling Competition, Statistical Modeling Competition and Market Research Competition. For example, they can use AI tools to assist with data preparation, generate visual charts and optimize report structures. The university gives additional rewards to competition projects that make good use of AIGC and achieve good results, which helps foster students' ability to apply new tools in innovative ways.

4.4. Optimization of the Evaluation System: Multi-Dimensional Comprehensive Quality Evaluation with AIGC Application

We build a multi-dimensional comprehensive quality evaluation system covering knowledge mastery, ability improvement, quality development and AIGC application. The system combines formative and summative evaluation, with formative evaluation accounting for 50% including daily completion of AIGC tasks and summative evaluation making up the other 50%, which includes comprehensive assessment of AIGC application abilities. We also establish a closed loop mechanism of evaluation, feedback and optimization. Each semester, we analyze the results of AIGC application evaluation, and make targeted adjustments to curriculum integration points and internship task designs accordingly.

5. Practical Outcomes and Verification

The program first launched this new training model in September 2023. To date, it has covered three cohorts of students enrolled from 2023 to 2025, with a total of over 300 participants. Rather than adding separate AIGC courses, the reform integrates relevant content into existing courses and upgrades practical training activities, and initial results are already apparent.

5.1. Improved AIGC Application Ability Among Students

Lab sessions now see far more frequent use of AIGC tools than before the model was introduced. Most students have developed the ability to use a range of AIGC tools competently for professional tasks. The pass rate of AIGC skill assessments has risen notably, and students also perform much better when applying tools to specific scenarios. For example, in data collection and preprocessing labs, students use AIGC tools to support data cleaning work, which significantly improves their efficiency. In data visualization course design assignments, a noticeably larger number of students now produce multimodal visual outputs.

5.2. Better Industry Alignment of Course Projects and Internship Outcomes

Course design deliverables have grown more relevant to real industry needs, and an increasing number of enterprises have adopted student work in practice. Enterprises also show much higher satisfaction with students' competence in using AIGC to assist with daily work. Some students with strong AIGC skills even received early job offers from partner enterprises during their internships. A typical example is the 2023 cohort, whose members helped raise enterprise work efficiency through AIGC assisted data labeling during their

enterprise internships.

5.3. Progress in Academic Competitions and Innovation and Entrepreneurship

Students have started applying AIGC tools to various established academic competitions, and the overall quality of their submissions has improved clearly. The program has won five additional national awards including four in the National College Student Market Research Competition and four in the Mathematical Contest in Modeling along with more than 50 provincial awards. More than 80% of students have participated in these competitions. Beyond competitions, three new national projects and several provincial projects have been approved under the College Student Innovation and Entrepreneurship Training Program.

5.4. Deepened Government-University-Enterprise Collaboration

Cooperation between the program and its government and enterprise partners has grown considerably deeper since the model was implemented. Three new local government and enterprise partners have joined the collaboration, and all existing internship activities have been upgraded to incorporate AIGC content. The number of teaching hours provided by enterprise mentors has increased significantly, and now exceeds the minimum requirements of engineering education accreditation. The three parties have also co-constructed an AIGC teaching resource library, which includes a wealth of case studies with detailed operation guidelines. This resource lays a solid foundation for further improving the training model in subsequent work.

6. Conclusion

Guided by the requirements of engineering education reform, this study explores a practical path for integrating AIGC concepts into the current talent training system. We develop a revised training model based on a four-dimensional collaborative training framework and three major supporting systems. No separate AIGC courses are added under this model; instead, deep integration of AIGC into professional education is achieved by updating existing course content, improving lab tasks and upgrading internship arrangements. This work provides a feasible reference for other emerging engineering majors to adapt to technological development

without making comprehensive adjustments to their existing curriculum systems.

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