Higher Education and Practice Vol. 2 No. 10, 2025

Research on the AI Talent Granary Model Based on "Optimal Design of Mechanical Engineering" Module in the Age of Digital Intelligence for Mechanical Majors

Fang Liu[1], Yawen Fan[2], Jingfeng Shen[1,*]
[1]*School of Mechanical Engineering, University of Shanghai for Science and Technology, Shanghai, China*
[2]*School of Engineering and Computing, The Sino-British College, University of Shanghai for Science and Technology, Shanghai, China*
**Corresponding Author*

Abstract: To address the challenges and opportunities of the Digital Intelligence Age in smart manufacturing and intelligent design, this paper proposes and optimizes a framework for constructing the "AI Talent Granary Model" in mechanical engineering. The paper proposed the construction and optimization of the AI Talent Granary Model for mechanical professionals in the age of digital intelligence. Based on analyzing the background of digital intelligence age, the current situation of the application of AI technology in the field of mechanical engineering, and the demand for talent in mechanical engineering majors, the structure of talents, and the mode of cultivation, the paper studied the AI Talent Granary Model for mechanical engineering majors, the innovation of teaching methods and the methods of improving teaching effects. In addition, it explored the optimal way of combining AI technology and mechanical engineering education for cultivating AI application talents with innovation ability and practical ability.

Keywords: Digital Intelligence Age; Mechanical Engineering; Artificial Intelligence; Talent Cultivation; Granary Model; Optimal Design

1. Introduction

The AI digitization age is a new phase of socio-economic development driven by digitalization and intelligent technologies, with data as the main focus. In the digital intelligence age, technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data and Cloud Computing are widely used in various industries, and enterprises and government agencies are using data analytics and smart technologies to optimise decision-making, improve efficiency and innovation services through digital transformation[1,2]. For example, smart manufacturing, smart city, telemedicine and other fields have been developed rapidly in the digital intelligence age. As a result, more challenges and opportunities are presented to the talents in the mechanical industry, which is a major platform for engineering.

Optimal design of mechanical is an important part of the informatization of fundamental technology of manufacturing. It is a modern design method to find the best results from the many design solutions of engineering activities by applying optimisation methods and computer technology to the design, manufacturing, management, decision-making and other process factors involved in the whole life cycle of the product as the research object[3].

The mechanical profession is the cornerstone of engineering development, and the historical process of its personnel training marks the progress of engineering and technology and the enhancement of social productivity. The mechanical industry is a platform for promoting cross-fertilisation and innovation between engineering fields, providing the conditions for the training of composite talents adapted to future technological developments[4]. This paper was oriented by the 'AI Talent Granary Model in the age of digital intelligence' of Geekbang Technology Double Digital Research Institute, combining with the current situation of the application of AI technology in the field of mechanical engineering, researching on mechanical optimisation design talent cultivation mechanism based on AI Talent Granary Model, and aiming at cultivating talents who can adapt to the demands of the new era.

2. Background to the Study of AI Talent Granary Model for Mechanical Profession

2.1 Background of the Digital Intelligence Age and the Demand for Mechanical Engineering Professionals

In the age of digital intelligence, the mechanical engineering profession is facing unprecedented challenges and opportunities. The traditional professional education model can no longer meet the industry's demand for high-quality AI talents[5]. The rise of concepts such as smart manufacturing and Industry 4.0 requires mechanical engineering professionals to have interdisciplinary knowledge and skills, such as data analytics, AI, and the IoT, etc. It has also changed the structure of the demand for talent, with a growing need for people who can incorporate AI technologies for mechanical design, optimisation and manufacturing.

The application of AI technology in mechanical engineering has evolved significantly: moving from early auxiliary design and automation control to high-end applications such as intelligent diagnosis and predictive maintenance. This evolution is detailed in the *Digital Talent Development System: The Granary Model White Paper*[6]. Therefore, mechanical engineering professionals need to have comprehensive qualities and skills in the cross-fertilisation of multiple disciplines such as mechanical engineering, artificial intelligence and data analysis.

2.2 Current Status of AI Technology in Mechanical Engineering

Presently, the application of AI technology in the field of mechanical engineering is mainly focused on product design optimisation, production process automation and quality control intelligence. For example, through machine learning or algorithm design, the parametric design parameters of mechanical products can be realised to improve product performance and reduce costs; in the production process, deep learning technology is used to realise real-time monitoring and fault prediction of production equipment to improve production efficiency and safety; in terms of quality control, product defects can be automatically detected through image recognition technology to improve detection speed and accuracy[7].

Despite the promising application of AI technology in mechanical engineering, there are still some bottlenecks and challenges. For example, the integration of AI technology and mechanical engineering expertise is not deep enough, and there is a lack of a systematic talent training system; enterprises have not invested enough in the application of AI technology, and there is a lack of professional AI talents[8].

2.3 Analysis of Talent Structure and Cultivation Mode of Mechanical Engineering

Currently, although the personnel training mode of mechanical engineering has made some progress in the reform of the education mode combining theory and practice, there are still problems such as ‘heavy on theory but light on practice, heavy on technology but light on innovation’. In the context of the age of digital intelligence, the cultivation of mechanical engineering professionals need to pay more attention to the cultivation of practical ability, strengthening the learning of interdisciplinary knowledge, as well as the cultivating of innovative thinking.

3. Research Content of AI Talent Granary Model for Mechanical Professionals in the Digital Intelligence Age

3.1 Characterisation of Talent and Analysis of the Talent Granary in the Field of Mechanical Engineering

The characteristics of talents in the mechanical industry include the following aspects[9]:

Professional and Technical skills: solid knowledge of mechanical design, automation control, electrical engineering and other specialised fields is required to be able to carry out equipment design, process improvement and technological innovation.

Management and Operational Skills: Ability to effectively manage and operate the business with competence in project management, supply chain management, and quality management.

Market Development and Sales ability: able to make product positioning and sales strategy according to market demand.

Adaptation to new technologies: In the age of digital intelligence, talents in the mechanical industry need to adapt to the application of new technologies such as Industry 4.0, AI and Big Data.

Sustained Learning and Innovation Capability: People in the mechanical industry need to be

able to learn and innovate on a continuous basis to keep up with the rapid technological developments in the industry.

At the centrepiece of the AI Talent Granary Model, for Mechanical Professions is the view that the cultivation and development of talent is seen as a vital asset for the development of nations and societies, as vital as food. By optimising the talent structure, building a digital talent pool, and implementing effective talent training and development strategies, it is possible to ensure that the talent granary of the mechanical engineering profession is sufficient to meet the development needs of the digital intelligence age. Table 1 shows the creativity and significance embodied in comparing the talent pool to a granary.

Table 1. Characterisation of the Granary and the Granary of Talent

Feature	Granary	Granary of Talent
definition	Buildings or premises used for the storage of food, which is an important guarantee of national food security	The analogy of the talent pool as a granary reflects the fact that talent is the 'spiritual food' for social development and the key to guaranteeing the security and competitiveness of the State and enterprises in the fields of science and technology, education and the economy.
strategic reserve	It is a strategic reserve of food	Stockpiling talents for future needs in areas such as smart manufacturing and smart design
safety and security	Regulating market food prices and responding to disasters	Regulating the labour market and responding to technological challenges and market changes
sustainable development	Compact design, effective protection against humidity, moisture, insects and fire prevention	Talent cultivation system is well-designed to effectively prevent talent loss and improve talent quality.
emergency preparation	Providing much-needed food support in emergencies such as disasters or wars	Ability to provide much-needed talent support in the face of technological challenges or market changes
infrastructure development	It is the infrastructure of agrarian society	It is a critical infrastructure for the knowledge economy that requires long-term investment and careful management
cultural inheritance	Ancient granaries are well-designed, inheriting the wisdom of the ancients	The construction of a talent granary requires the inheritance and development of the wisdom of the ancients and the cultivation of talents to solve the problems of the future.
maintaining social stability	Granaries help maintain social stability	The granary of talent maintains social stability and scientific and technological development through the provision of adequate employment opportunities and the supply of talent

3.2 Constructing a Mechanical Optimisation Design Talent Cultivation System under the Framework of AI Talent Granary Model

The AI Talent Granary Model in the age of digital intelligence aims to build a systematic and comprehensive framework for talent cultivation and layout for enterprises. The model provides an in-depth interpretation from five aspects: policy, industry change, enterprise demand, AI value, AI Talent Model and talent cultivation, providing a clear and operable guide to the layout of AI talent for enterprises, and helping them to quickly build an AI talent echelon that meets the needs of the digital intelligence age[10].

According to the White Paper on the AI Talent Granary Model of the Digital Intelligence Age, the AI talent granary model of the Digital Intelligence Age for mechanical majors, from the top to the bottom, is in order of AI engineering optimization thinking talents, AI engineering application talents, AI technology + business composite talents, and AI technology specialised talents, shows in figure 1.

To address future challenges in industrial intelligence, it is crucial to cultivate composite talents with expertise in both AI technology and mechanical engineering. This approach underscores the enduring importance of the mechanical industry, which serves as the foundation for all engineering disciplines. Based

on the hierarchical talent structure of the AI Talent Granary model, this paper constructs a cultivation mechanism for AI application talents and AI technology + business composite talents in mechanical engineering based on the demand for mechanical optimisation design talent cultivation.

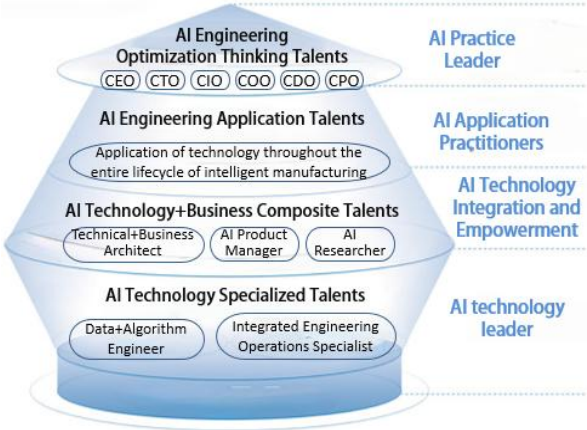

Figure 1. AI Talent Granary Model for Mechanical Engineering of the Digital Intelligence Age

3.2.1 AI mindset manager development

Cultivation objectives: Cultivate AI mindset managers with the ability of strategic planning, innovation driving, team integration and talent building, so that they can become the forerunner in promoting AI application in the field of mechanical optimisation design.

Implementation of the programme: Incorporate modules related to AI thought management into the graduate Micro-Spec curriculum; Experts, scholars and entrepreneurs in the field of AI are invited to give lectures and seminars to share the development trend and business value of AI technology; By studying the excellent cases of AI application in the field of mechanical optimisation and design at home and abroad, students' understanding and knowledge of AI technology application will be enhanced; Encourage students to participate in project practice of AI technology application, such as participating in the R&D and implementation of enterprise AI projects, to enhance students' practical ability and innovation ability.

3.2.2 AI application talent development

AI applied talent capability focus shows in figure 2. It involves in the four capacities of professional, AI digital mindset, AI digital synergy and AI digital tool.

Cultivation objectives: To cultivate AI application talents with the ability to use AIGC (Artificial Intelligence Generated Content) tools for generating, evaluating and optimising mechanical optimisation design solutions.

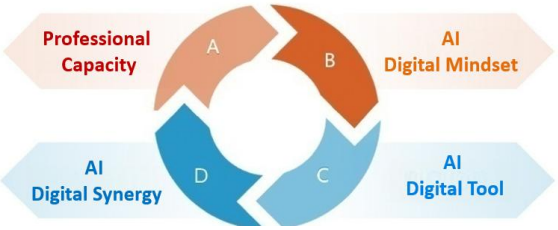

Figure 2. AI Applied Talent Capability Focus

Implementation of the programme: Incorporate the use of AIGC tools into relevant courses and practices, such as 'ChatGPT in Mechanical Optimisation Design' and 'Midjourney in Commercialisation Design of Mechanical Equipment'. Applying AIGC tools to mechanical optimisation design project practices, e.g., generating mechanical optimisation design solutions using ChatGPT. To organise AIGC application competitions to encourage students to use AIGC tools for the generation, evaluation and optimisation of mechanical optimisation design solutions, and to enhance students' work efficiency, practical ability and innovation.

3.2.3 AI technology + professional composite talent training

Cultivation Objectives: Cultivate AI technology + professional composite talents with comprehensive ability and knowledge fusion in the fields of mechanical design, material science, computer science, etc., who are capable of technical research and development and application work in the field of mechanical optimisation design required in the transformation of digital intelligence of enterprises.

Implementation of the programme: Enhance the integration of mechanical optimisation design and AI technology, and integrate engineering professional and technical modules such as Fundamentals of Mechanical Design and Mechanical Optimisation Design with computer science related modules. Combine mechanical optimisation design project practice with computer science related project practice. E.g. combine mechanical structure optimisation design project with finite element analysis software application project. Strengthen cooperation with enterprises and industry-university-research cooperation bases, provide students with internship and employment opportunities, enhance students' competitiveness in employment, and enable students to be competent in the research and development and

application of technologies in the field of optimal design of mechanical required in the transformation of digital intelligence of enterprises.

3.3 Teaching Method Innovation and Teaching Effect Enhancement Based on AI Talent Granary Model

Table 2 shows the teaching reform and curriculum construction achievements of the Optimal Design of Mechanical module in the past ten years. These have provided rich resources and deep soil for building the granary of AI talents in mechanical. Through the implementation of these teaching innovation projects, it not only enhances the quality of teaching and students' learning experience, but also promotes the transformation of scientific research results and cultivates a group of high-quality talents with innovative and practical abilities.

Table 2. Teaching Innovation and Effectiveness Enhancement of Optimal Design of Mechanical Course Based on AI Talent Granary Model

Time Interval	Project Title	Teaching outcomes and beneficiaries	Form of the project's proposed outcomes in the Talent Granary Model
2013-2015	'Optimal Design Methods and Applications for Mechanical' Professional Degree Postgraduate Practical Programme Development	Enhanced postgraduate students' practical skills and experience in enterprise cooperation	AI-driven hands-on curriculum, AIGC-assisted school-enterprise partnership case base
2015-2016	'Mechanical optimisation design' Flipped classroom and MOOC, SPOC construction	Enhanced independent learning and student engagement through flipped classrooms and online resources	AIGC-supported online modules, intelligent interactive platforms
2016-2018	International Talent Collaborative Innovation Capacity Development and Other Projects	Promoted the integration of undergraduate and postgraduate education and improved the quality of teaching and internationalisation	AI technology-integrated teaching materials, international exchange programmes, joint research projects
2021	Construction of PLM-based case base for optimised design of classical products	Enriched teaching and learning content and improved students' ability to solve practical problems	AI-driven case library, real project case studies
2021-2022	'Optimal Design Methods for Mechanical and Fundamentals of Mechanical Design' Integrated curriculum development for this research	Achieved resource sharing, optimised course structure and enhanced teaching effectiveness	AIGC-assisted integrated curriculum system, modularised teaching content
2023	The ideological and political education project for 'Optimal Design of Mechanical'	Enhanced students' sense of social responsibility and professional ethics	AI-driven Civic Education Module, Moral and Ethical Discussion Course
2022	Module 'Fundamentals of Mechanical Design' Teaching Competition Award	Demonstrated effectiveness of teaching methods and increased visibility and impact of the school	AIGC-supported Teaching Competition Results Showcase, Winning Portfolio
2019-2023	First Prize of 'HUJIANG CUP' Intelligent Manufacturing Innovation Competition, Graduate Student Group	Demonstrate students' innovative and practical abilities and enhance their enthusiasm to participate in scientific research activities	AI-driven innovation competition results, case studies of participating projects
2019-2023	Numerous awards for competition of China Postgraduate Mathematical Modelling	Exercised students' mathematical modelling skills and teamwork spirit	AI-assisted mathematical modelling competition results, simulation topics and solutions
2019-2023	Patent Application and Licensing	Demonstrates the ability to translate scientific research results and stimulates students' sense of innovation and practical ability	AIGC-assisted training materials on patented technology, intellectual property rights
2016	Editor-in-chief of the textbook 'Practical and Innovative Design for Advanced Mechanical Design Modules'	Systematic teaching resources are provided to help standardise and improve the quality of teaching and learning	AIGC-assisted teaching materials, teaching guides, practice manuals

3.4 Construction of AI Talent Evaluation System

Establish a mechanical optimisation design talent competence evaluation system based on the AI talent granary model, and comprehensively evaluating students in terms of AI thinking, AI application ability, AI technical ability and business understanding ability[11].

3.4.1 Capacity assessment and evaluation criteria

AI Mindset: Strategic planning capability, innovation-driven capability, team integration capability, talent building capability, etc.

AI application capabilities: Ability to use AIGC tools, ability to generate mechanically optimised design solutions, ability to evaluate mechanically optimised design solutions, etc.

AI technology capabilities: Programming skills, algorithm design skills, model development skills, etc.

Professional comprehension: Knowledge of mechanical design, material science, computer science, etc.

Evaluation methodology: Written tests, interviews, and project practice are used for evaluation.

3.4.2 Process evaluation

Incorporate the learning process of students into the evaluation system, and keep abreast of students' learning and progress through regular programme assessment and feedback. Simultaneously, according to the feedback of students and changes in industry demand, the course content and teaching methods are continuously adjusted and optimised to ensure that the course can continuously meet the needs of enterprises and the industry, and stimulate students' learning enthusiasm and initiative, and provide a scientific basis for the cultivation of talents in optimal design of mechanical.

Process evaluation content: Classroom performance, project accomplishments, internship experience, etc.

Process evaluation methods: Daily interactions, project assessments, internship evaluations, etc.

4. Conclusion

This paper proposes the constructing and optimising of the ‘AI Talent Warehouse Model’ for mechanical engineering majors and discusses the innovation of teaching methods and the improvement of teaching effect. The main research results include:

A mechanical optimisation design talent training system based on the AI talent granary model is constructed. The system contains three levels of AI engineering optimization Mindset talents, AI engineering application talents and AI technology + business composite talents, and proposes a corresponding implementation plan in combination with the teaching practice of the mechanical optimisation design module.

A teaching method innovation and teaching effect improvement strategy based on the AI talent granary model is proposed to enhance students' AI application ability and practical ability by integrating AIGC tools, strengthening discipline cross-fertilisation, and carrying out project practice.

It has constructed an AI talent evaluation system to comprehensively evaluate students in terms of AI mindset, AI application ability, AI technical ability and business comprehension, and to keep abreast of students' learning and progress through process evaluation, so as to continuously optimise the course content and teaching methods.

Future Research Directions: Further iterate the application of AI technology in the field of optimal mechanical design, develop more intelligent design tools and methods, and improve design efficiency and product quality. Strengthen school-enterprise cooperation, provide more practice opportunities for students, and cultivate composite talents adapted to the needs of enterprises; establish an AI talent pool, provide enterprises and universities with a platform for talent information exchange, and promote the flow and optimal allocation of talents. Continuously track the development trend of AI technology and changes in the industry's talent demand, adjusting the talent training programme in a timely manner to ensure that the training of talents is in line with the development of the industry.

By constructing and optimising the AI talent granary model, more high-quality AI talents can be cultivated for the field of mechanical engineering, promoting the optimal teaching of mechanical and the innovative development of the field of mechanical engineering, and providing talent support for the construction of a strong manufacturing country.

Acknowledgments

Supported by the Graduate Education Development Project(10-23-304-007), Graduate Student Teaching Achievement Award

Cultivation Project(10-24-304-024), and Graduate Teaching and Research Programme (Mechanical Engineering) of University of Shanghai for Science and Technology(10-00-304-008).

References

[1] Bai Ling, Wang Fen. Pursuing Quality through Intelligence: The Framework and Characteristics of Digital Transformation in UK Higher Education. University Education Science, 2025, (04):106-117.

[2] Yu Zhihui, Huang Shixiang, Yu Yunxi, et al. Concept for Cultivating High-Quality Innovative Talent in Computer Science for the Digital Intelligence Age. Computer Education, 2025, (06):77-83.

[3] Huang Yanlong. Discussion on the Optimization Method of Mechanical Manufacturing Process Based on Intelligent Manufacturing. Auto Time, 2025, (18):127-129.

[4] Duan Chunli. Innovative Research on Building an Application-Oriented Undergraduate Talent Cultivation Ecosystem in the Intelligent Age. Computer Knowledge and Technology, 2023, 19(28):134-136.

[5] Liao Dahai, Tu Yilang, Jiang Yi, et al. Reforming the Interdisciplinary Ceramic Talent Development System Under the New Engineering Paradigm. Journal of Higher Education, 2025, 11(17):148-151.

[6] Geekbang Technology Dual-Digital Research Institute. Digital Talent Development System: The Granary Model White Paper. Beijing: Geekbang Technology, 2022.

[7] Sun Yuangeng, Gao Hang, Tan Lu. Research on Development Trends of Large Language Model and Application of DeepSeek in Manufacturing Empowerment. Digital Transformation, 2025, 2(08):45-54.

[8] Guo Aimei. Research on the New Quality of Digital and Intelligent Transformation in Manufacturing Under the New Production Function Framework. Contemporary Economics, 2024, 41(11):15-25.

[9] Yang Yun. Synergistic Promotion of Manufacturing Servitization Transformation and High-Quality and Full Employment: Theoretical Logic and Implementation Paths. New Economy, 2024, (09):73-86.

[10] Geekbang Technology Dual-Digital Research Institute. Interpretation of the AI Talent Granary Model in the Digital Intelligence Era White Paper (2024 Edition). Beijing: Geekbang Technology, 2024.

[11] Zheng Ruiqing, Zeng Min, Tang Xin, et al. Research on Constructing a Higher Education Teaching Quality Evaluation System in the Context of "Artificial Intelligence + X". Indusrty and Information Technology Education, 2025, (07):15-19+30.