



Research on prospective scope and approaches of artificial intelligence education in vocational college of China

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Abstract. Based on a literature review of the past decade, it has been learned that over 40 disciplines in vocational colleges in China have carried out artificial intelligence (AI for short) education in different levels. However, except for a few disciplines such as computer science, big data, and automation control, the number of studies is limited. This is mainly because in the past, the application of AI technology did not cover a wide range of professional scenarios. However, the development of generative AI will completely change this situation. Since 2022, generative AI has shown great potential in generating text, images, audio, video, and code, and is becoming increasingly mature, which will affect almost all professions to varying degrees. This research analyzes the overlap between the skill requirements of various disciplines in vocational colleges and the abilities of generative AI, and conducts an impact evaluation for each discipline, providing data for the scope of AI education development. Finally, this study re-explains the connotation of AI education as an interdisciplinary field and proposes two training approaches, namely AI general education and AI embedded education.

Keywords: Generative Artificial Intelligence, Artificial Intelligence education, Vocational education, Artificial Intelligence literacy.

1 Introduction

In March 2018, the Ministry of Education of China issued the Action Plan for Innovating AI in Colleges and Universities, proposing to improve the talent cultivation system in the field of AI, attach importance to the intersection and integration of AI with disciplines such as computer science, control, mathematics, statistics, physics, biology, psychology, sociology, and law, and explore the talent training model of AI + X. Under the guidance of this policy and the background of digital transformation, vocational colleges have successively established AI majors and actively promoted AI education.

In November 2022, ChatGPT made a sensation, and the algorithm of large language model (LLM for short) started its quick iteration. Generative AI has shone in various fields, regarded as not only an important milestone in the history of AI development,

but also the beginning of the fourth industrial revolution. On one hand, its intelligence is stunning, able to generate digital content that is close to or even surpasses humans, which will inevitably reshape the structure of the digital industry. On the other hand, a large number of application tools derived from it have truly entered the daily work and life of non-computer professionals, having a profound impact on the ability structure of human beings[1]. What is more worth noting is that generative AI is just starting and is being updated and iterated at speeds beyond imagination. For example, the famous image generation tool Midjourney couldn't guarantee to draw five fingers accurately in its fourth version, but only five months later, the problem was solved in the fifth version.

Therefore, in this new situation, it is necessary for vocational colleges to re-examine the strategy of AI education, including the impact of generative AI on various disciplines, and construct corresponding training paths to help students cross the so-called intelligence gap. This is the main objective of this research.

2 Current AI education in vocational colleges

Based on literature research, from October 1, 2013 to October 1, 2023, there are 1033 articles indexed by CNKI with Artificial Intelligence and Vocational Education as the subject words, covering about 40 disciplines, nearly 40% of 104 in total in vocational college announced by the Ministry of Education of China in 2022.

Figure 1 shows the disciplinary distribution of these studies, which indicates a high degree of concentration. Over 60% of the research focuses on AI education for vocational colleges, high schools, middle schools and special schools, discussing opportunities and challenges, educational theory and educational management, and exploring how to reform education, cultivate talents, and apply intelligent technologies, etc. Considering the profound impact of AI on human cognition, a large number of education experts and innovative teachers are actively researching and experimenting. Over 11% of the research is in computer software and computer applications, referring to AI teaching theory and practice, as AI is generally taught in the department of computer science. Nearly 8% of the research is done by automation majors, as automatic control and robotics-related fields are closely related to AI. The remaining 19% of the research is shared by all other 30 disciplines, in which accounting alone accounts for 3.1%. Accounting is a discipline based on data, and with the development of big data and intelligent systems, a large amount of manual labor can be replaced by computers. Therefore, it has the strongest potential for transformation among all other categories.

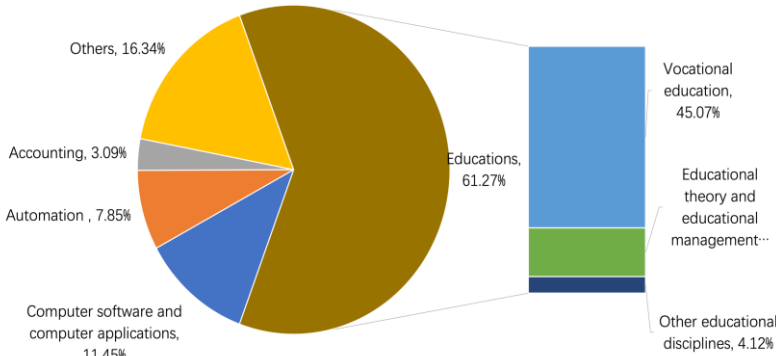


Fig. 1. Discipline distribution of research on AI education

Although there are quite a number of literatures retrieved, most of them do not focus on AI education. If AI and vocational education are used as keywords rather than subject terms to search, only 186 documents have been found in the past decade, much fewer than the number of previous papers. These documents are more dedicated to exploring AI education and relatively more profound.

According to the literature analysis, the current AI education can be divided into two categories.

One is designed for the future developers, most of which major in computer and automation. After graduation, students can engage in the development of AI applications, management and operation of AI devices, design of AI products, data services, and related technical support. Taking Sichuan Urban Vocational College as an example, the relevant departments set up courses include Python programming, computer vision technology, natural language processing, and data analysis, Introduction to AI Technology, etc. The teaching team consists of Ph.D. and Master's degree holders in computer science.

The other is designed for the future users, most of which will work with data or automatic machines. Taking the accounting subject as an example, according to a US study, the rate of accounting in industries eliminated by AI is as high as 97% [2]. Accounting graduates will face the severe challenges of big data and financial robots. Vocational colleges with accounting majors have to adjust their talent training goals in time, optimize the course structure, introduce the skills of financial robots, enhance courses of big data analysis and database applications, and innovatively utilize more flexible blended situational teaching model to replace the traditional ones.

Table 1 illustrates two types of AI education, including their career goals and curriculum systems.

Table 1. Typical curriculum of two types of AI education at this stage

Type of AI education	Job-oriented	Curriculum (AI-related courses are shaded out)
<p>Type I - for future developers who mostly major in Computer and Automation (Taking Computer Application as an Example)</p>	<p>For occupations in information and communication engineering technology, information and communication network operation management, software and information technology services, programming, data collection and analysis, network management, information system operation and maintenance, etc.</p>	<p>Basic courses: introduction to computer, Fundamentals of programming design, Data structure and algorithm analysis, Computer composition and maintenance, Computer network foundation, Network operating system etc.</p> <p>Core courses: Database technology and application, Front-end design and development, Information collection technology, Data analysis methods, Switching routing technology, System deployment and operation and maintenance etc.</p> <p>Electives courses: Introduction to AI Technology, Python Programming, etc</p>
<p>Type II - for future users (Taking accounting as an example)</p>	<p>For occupations in accounting, auditing and taxation for enterprises and institutions, bookkeeping agencies, accounting firms, tax accountant firms, management consulting companies and other intermediary service organizations</p>	<p>Basic courses: Principles of Economics, Fundamentals of Economic Law, Fundamentals of Statistics, Fundamentals of Accounting, Cashier Business Operations, Fundamentals of Enterprise Management, Fundamentals of Big Data Technology Application, Application and Development of Financial Robots.</p> <p>Core courses: Enterprise financial accounting, Intelligent cost accounting and management, Intelligent tax declaration and management, Accounting information system application, Enterprise internal control, Management accounting practice, Application of big data technology in finance, Financial big data analysis</p>

Currently, both types of AI education are focused on intelligent systems and big data processing, no matter developed by which discipline. This is because before the emergence of generative AI, the application of AI was mainly concentrated in the above-mentioned fields.

3 Impact of generative AI on various disciplines

Since 2022, a large number of generative AI tools have debut, such as text generation tools ChatGPT, Claude, Chinese Wenxinyiyan, Zhipuqingyan etc., image generation tools Midjourney, Stable Diffusion, Chinese Wenxinyige, Tongyiwanxiang, etc., as well as a series of audio and video tools. A large amount of venture capital poured into this field, making the rapid evolution of LLM technology and the explosive growth of application products.

Due to its wide application and rapid development, more and more people's work and life will be exposed to AI tools. According to a study published by OpenAI in March 2023, about 80 percent of the U.S. workforce is likely to have at least 10 percent of their work tasks exposed by LLM, while about 19 percent of employees have at least 50% of work assignments will be exposed [3]. Herein, the LLM is the right underlying technology of generative AI.

Vocational education must prepare students for AI. In order to have a clear picture of which disciplines in vocational colleges will be affected to what extent, a detailed text analysis was completed.

In the discipline catalog of vocational college published by the Ministry of education of China in 2022, the expected professional skills are presented in detail. Some skills are related to digital content, such as various reports writing, arts design etc. which generative AI is doing very well sooner or later. The proportion of skills related to digital content in all required skills means the exposure to generative AI, which indicates the impact of generative AI on this discipline.

In the catalog there are 3 levels and 783 subjects in total. For example, the leaf subject, packaging planning and design has 8 terms of required skill, list in the first column in Table 2. The first row presents 6 terms of ability of generative AI.

Among the skills, market research could be enhanced by AI text generation and data processing ability, so 1 point is scored in the two corresponding column; several packaging design skills could be equipped by AI image generation tools, which are scored 1 in the corresponding column; digital marketing often requires the production of poster, short video, of course, with the help of AI generative, 1 points for related column; last but not least, ability to explore learning, lifelong learning and sustainable development is a must for all subjects in the catalog, are unlikely to avoid AI literacy, so each column is awarded 1 point. Then, sum by column and divide by the total number of rows to get the column score, which is the monomial impact factor of the AI on the subject (maximum is 1). As can be seen from the above table, the influence factor of AI image generation on the packaging planning and design is the highest 0.63, the im-

fact factor of AI programming is only 0.13. Therefore, the college could have a quantitative clue and construct AI curriculum based on the idea of profession-ability-courses [4].

Table 2. The monomial generative AI impact factor on Packaging Art Design subject

Skills required for packaging art design (8 in total)	AI text	AI image	AI data	AI audio	AI video	AI programming
1. Have the ability to design the combination of packaging design material selection and printing process;	0	0	0	0	0	0
2. Have the ability to design finished products and make them;	0	0	0	0	0	0
3. Have the ability of packaging design task analysis, market research, data collection and analysis;	1	0	1	0	0	0
4. Have the ability of packaging carton structure and container shape design;	0	1	0	0	0	0
5. Creative ability of different styles of packaging design;	0	1	0	0	0	0
6. Have the creative ability of serial packaging design;	0	1	0	0	0	0
7. Have the ability to use digital marketing and integrated marketing knowledge to build packaging design;	1	1	1	1	1	0
8. Ability to inquire into learning, lifelong learning and sustainable development	1	1	1	1	1	1
total	3	5	3	2	2	1
Monomial Impact factor = column total divided by the number of rows (8).	0.38	0.63	0.38	0.25	0.25	0.13

The same algorithm can be used to calculate the impact factor of generative AI on various level of subjects. The impact factors of the first level discipline, as shown in Table 3.

Table 3. The impact factors of the first level discipline

1st level discipline	AI text	AI image	AI data	AI audio	AI video	AI programming
41 Agriculture, forestry, animal husbandry and fishery	0.33	0.15	0.19	0.12	0.12	0.14
42 Resources, Environment and Security	0.3	0.17	0.31	0.12	0.12	0.16
43 Energy, power and materials	0.22	0.14	0.24	0.11	0.11	0.13

44 Civil engineering and construction categories	0.29	0.2	0.21	0.11	0.13	0.14
45 Water conservancy categories	0.32	0.23	0.21	0.11	0.11	0.17
46 Equipment manufacturing categories	0.2	0.16	0.21	0.12	0.11	0.17
47 Biological and chemical categories	0.2	0.16	0.3	0.11	0.11	0.15
48 light industry and textile categories	0.3	0.15	0.25	0.13	0.12	0.21
49 Food and medicine and grain categories	0.28	0.15	0.29	0.12	0.12	0.15
50 Transportation categories	0.28	0.14	0.25	0.11	0.11	0.14
51 Electronics and Information Category	0.27	0.18	0.31	0.13	0.16	0.31
52 Medicine and health	0.22	0.15	0.2	0.12	0.12	0.13
53. Finance, commerce and trade	0.58	0.19	0.39	0.12	0.14	0.17
54 Tourism categories	0.42	0.22	0.19	0.13	0.14	0.16
55 Culture and art	0.44	0.39	0.18	0.24	0.2	0.18
56 News dissemination categories	0.44	0.33	0.2	0.26	0.37	0.22
57 Education and Physical Education	0.55	0.24	0.19	0.15	0.13	0.14
58 Public Security and Justice	0.35	0.32	0.17	0.13	0.14	0.14
59 Public Administration and Services	0.4	0.22	0.28	0.12	0.15	0.16
total	0.33	0.2	0.24	0.13	0.14	0.16

As can be seen from the table above, all first level disciplines are affected by generative AI. In terms of AI writing ability, the average score is 0.33. That means over 33% required skills could be involved by generative AI. Due to the large number of tertiary majors, it is impossible to list them all here. While teachers design AI courses for each specific subject, the detailed assessments should be done. For example, the packaging has two subjects, packaging engineering technology and packaging planning and design, the scores of which are quite different.

4 Connotation of AI education

AI education is essentially an interdisciplinary education. The connotation of interdisciplinary education is to train students to use two or more subject knowledge to solve real problems [5, 6]. In the same way, the connotation of AI education is to cultivate students' ability to solve problems in real scenarios collaboratively with AI applications.

Firstly, human-machine collaboration will be emphasized. Students should exert their subjective initiative to maintain independent judgment, and cannot blindly rely on AI tools. After ChatGPT went public, students in many colleges and universities used it to complete homework, which caused vigilance and resistance from schools. It mainly

because teachers worry that students would lose the ability to think independently, much less creativity. Besides, current generative AI still have problems in faithfulness and factualness, and if students lack independent judgment, they will be misled and even bring immeasurable losses.

Secondly, the real scene should be applied for education. No matter how strong AI is, human needs are essential. Taking poster design as an example, AI can generate thousands of posters with different styles and contents in a few minutes. Teachers should spend more time on training students how to understand the customer's needs, how to translate them into the right prompts, and how to evaluate the generated results. This is much higher-level thinking training.

Thirdly, confidence in problem solving should be established step by step during training. The students in Chinese vocational college have less successful experience in learning. Teachers have better start with some simple practice other than the complicated principles of AI. Solving problems can bring students a great sense of achievement and stimulate students' interest in subsequent learning by themselves.

5 Approaches of AI education

After generative AI was born, the type I AI education for future developers has no obvious difference. As to the type II AI education for future users, there are two approaches to carry out.

One is AI general education. Teachers introduce the basic concepts of generative AI, the industrial application, the latest tools and usage in all various fields, and guide students to fully understand relevant laws and regulations and ethical and moral risks.

The general education is conducive to broadening students' horizons, improving creativity, extending students' employment chances, enabling students to have AI literacy, and being aware of continual learning. However, general education requires teachers to follow the latest applications closely, master tools in various fields, seek true scenarios and cases, and apply diverse teaching methods to enthuse students.

The other is embed AI education, namely to blend AI application in original professional courses. For example, in the professional course Brand Packaging Planning, when the teacher talks about how to draft a design proposal for customers and how to find inspiration, the generative AI tools could be introduced to help on an outline or as a knowledge base.

This embedded teaching is extremely beneficial for building real-world application scenarios, and teachers have the expertise in the field, from analyzing customers requirements to assessing the AI delivery.

6 Conclusions

According to statistics, the number of students in vocational colleges in China exceeded 16 million in 2022. How to enable them to keep pace with the development of AI and possess the ability of human-machine collaborative work when they graduate is a very important research topic. This article conducts a cross-analysis of the current vocational

schools' disciplines and the capabilities of generative AI, evaluates the degree to which each subject is affected by AI, provides a basis for the implementation of AI education in vocational colleges, and proposes the connotation and implementation path of AI education based on the characteristics of vocational education.

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