

Research on the Professional Development Path of Vocational Education Teachers in the Era of Artificial Intelligence

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Abstract

Under the pattern of digital transformation of education, smart technologies such as artificial intelligence and big data are gradually being applied in the field of vocational education. Intelligent technology brings opportunities to vocational education, but also brings a lot of impact and challenges. What is the development history of the application of artificial intelligence in education? What are the challenges to the professional development of vocational education teachers? This paper combines the development history of artificial intelligence, analyzes in detail the impact of artificial intelligence on education, and focuses on the four aspects of improving the core literacy in the age of artificial intelligence, enhancing the teaching power to promote students' active learning, enhancing the infectious power to promote students' psychological and emotional development, and enhancing the innovative power of vocational education theoretical research to explore the professional development strategies of vocational teachers, so as to provide a professional development for the vocational education teachers in the new era.

Keywords: Artificial intelligence; vocational education; teacher professional development; core literacy

Introduction

Since 1956, when the term "Artificial Intelligence" (AI) was introduced at the Dartmouth Symposium, the development of AI has made great strides. Especially in recent years, the rise of deep learning and big data has brought about the explosion of AI, such as intelligent voice interaction, natural language processing, machine vision, autonomous driving, etc., so that the machine becomes as perceptive and judgmental as a human being. Artificial intelligence has penetrated all walks of life in society and is playing an increasingly important role, such as intelligent robots have now replaced humans in many fields, helping to complete repetitive, low-creativity manual labor and some complex mental labor.

In the field of education, the Horizon [1] Report states that "AI technology is profoundly impacting global education development as a key part of the global education development 'tech trend'[1]. The current digital transformation and intelligent upgrading of education is accelerating. Artificial intelligence technology has

begun to fully and deeply integrate with all aspects of education and teaching, creating a new form of smart education. The application of intelligent technology spans teaching, learning, research, management, and evaluation, driving the development of ubiquitous learning and personalized learning [2].

Similarly, the virtual learning scenarios and intelligent teaching revolution brought about by artificial intelligence have provided new opportunities for the development of vocational education. Cai [3] have proposed that the deep integration of new-generation information technology, led by artificial intelligence, with education and teaching has become the core driving force for disruptive innovation and transformation in vocational education classroom teaching. As important participants in the innovative reform of vocational education and teaching, vocational education teachers are also facing many new challenges and opportunities. What is the development trajectory of the application of artificial intelligence in the field of education? How can vocational

education teachers promote their professional development in the context of the new era?

The Evolution of Artificial Intelligence in Education

The development of artificial intelligence has roughly gone through three stages of increasing levels from computational intelligence to perceptual intelligence and then to the current cognitive intelligence. The current pace of application of artificial intelligence in various fields is not entirely consistent, and the scope of application in the field of education is gradually expanding with its own development. With the continuous integration of artificial intelligence and education, the requirements of educational practice for teachers' professional development are also changing.

Machine learning period

Machine learning, which emerged in the 1990s, represents the first paradigm shift in artificial intelligence technology: the generalization of algorithms. Instead of being tailored to specific domains, general learning algorithms are designed to apply data across different fields. Classic machine learning algorithms include linear regression, logistic regression, deciding trees, naive Bayes, k-nearest neighbors, and random forests [4].

Machine learning is mainly used in the field of education to analyze learning styles, construct student profiles and predict learning effectiveness. In terms of learner style analysis, Keshtekar, Burkett, Li and Graesser [5] proposed to use learners' discussion interaction data to automatically detect learners' personality traits; [6] proposed to identify the state of learner's knowledge (misinterpretation, comprehension, etc.) through learning behaviors (cooperation, practice, etc.). In terms of student portrait construction, Chen, Dai, Han, Feng and Huang [7] used machine learning models to construct learner portraits from four dimensions: learners' basic attributes, knowledge point interests, types and learning style preferences; Qiao and Xiao [8] used a machine learning approach based on the xAPI data standard to build an analytical framework for learner behavioral profiling. In terms of predicting learning outcomes, Dalbiri, Imran and Kastrati [9] compared various machine learning methods to predict student dropout rates in MOOCs based on parameters such as course design and classroom interaction frequency; Lakarayu et al. [10] predicted students' academic effectiveness based on identifying key factors of students' academic outputs by combining multiple machine learning methods to provide decision support for administrators.

Artificial Intelligence at this stage can hardly achieve high recognition capability, but after transforming raw data into high-dimensional features by domain experts, it can be applied to solve the analysis and prediction of educational statistics such as click-throughs, evaluation scales, and interactive evaluation rates [4].

Deep learning period

Around 2010, with the emergence of large datasets and increased computational power, deep neural networks under the name of deep learning began a revival, representing a second paradigm shift in AI technology: architectural generalization, which eliminates the need for manually designing features, and the design of generic deep neural network architectures suitable for a wide range of applications. Compared to machine learning, deep learning can automatically extract high-dimensional semantic features, enabling near-human recognition capabilities such as image recognition and speech recognition. From an application perspective, deep learning includes computer vision, natural semantic processing, speech recognition, recommendation and reinforcement learning [4].

Deep learning's ability to automatically extract high-dimensional features makes it more suitable for text, image, video, and other data that are difficult for machine learning to automate, and it has been widely used in classroom teaching behavior analysis, student sentiment calculation, intelligent marking of exam papers, and personalized resource recommendation [4]. The analysis of classroom teaching behavior based on deep learning can effectively address issues such as the dependence on experts, low efficiency, and inaccuracy in traditional classroom teaching behavior analysis. By leveraging techniques such as object detection, action recognition, and speech recognition, it analyzes teachers' and students' movements and speech from two dimensions: behavioral activities and behavioral subjects. This includes behaviors such as students raising their hands, responding, reading and writing, listening and speaking, discussing, as well as teachers' instructions, writing on the board, and asking questions [11]. In terms of student affective computing, Zhao et al. [12] noted that technologies such as action recognition, expression recognition, and speech recognition are used to analyze changes in learners' facial expressions, gestures, and intonation expressions, to quickly analyze and determine learners' attitudinal preferences and cognitive styles for that learning content, and then provide motivation and assistance. In the area of intelligent exam grading, text recognition technology and natural language processing technology are utilized for recognizing objective questions and evaluating subjective questions on digital exam papers, such as assessing grammar, voice, and word choice in writing, and even providing revision suggestions. This can significantly enhance the teaching efficiency of teachers and the learning efficiency of students. In terms of personalized resource recommendation, technologies such as graph convolutional neural networks are used to analyze the correlation between learning resources and learners' styles and preferences. The recommendation has evolved from being based on learning records to being based on learning contexts and

learning preferences [13].

Deep learning has expanded from educational statistics to multimodal teaching resources such as instructional videos, learning materials, and exam papers, enabling machines to possess near-human recognition capabilities. They can automatically “see” and “hear,” identify teachers’ and students’ movements, gestures, and conversations during the teaching process, and make personalized recommendations based on this recognition. While artificial intelligence at this stage does not possess human-like “creative” abilities [12] it has already been able to empower education in many aspects.

Generalized large model period

In 2018, the emergence of the GPT large language model marked the beginning of the era of general large models and represented the third paradigm shift in artificial intelligence technology: the generalization of models. Instead of training different models for each domain, a single general large model is trained to be applicable across all domains. Compared to deep learning, general large models possess contextual learning abilities, enabling rudimentary “creative” capabilities such as generating news articles, human-like conversations, and code. Current educational applications of artificial intelligence must collect extensive training data from scratch, and the privacy nature of educational data exacerbates the difficulty of collecting large datasets. Wu and Zhou [14] noted that the transfer of general knowledge possessed by general large models to the field of education will address the dependence of intelligent educational application development on large-scale data.

At present, it can be said that AI has developed to a level close to that of general-purpose AI, where it has achieved the goal of “being able to understand and create [4].

Challenges to professional development of vocational education teachers in the era of artificial intelligence

Neglect of teachers’ subjectivity

We should recognize that the impact of artificial intelligence on education has both advantages and disadvantages. While intelligent technologies such as artificial intelligence help vocational education to improve teaching equipment and enrich teaching resources, there is also a tendency to pay too much attention to educational technology and neglect the essence of education. Su [15] noted that with the continuous development of AI technology, what human beings really need to worry about is not that machines are like people, but that people become like machines to think and do things. Currently, numerous schools are increasingly emphasizing the need for teachers to master modern information technology as a requirement for professional competence that is integral to teaching. However, this trend sometimes leads to an overemphasis or even misuse

of technology, where technology is adopted merely for its own sake. Rather than effectively assisting teaching, it may become a distracting factor in the teaching process. This is extremely detrimental to the professional growth of teachers, as it easily causes them to forget the original intention of education in such a technology-oriented educational environment. They may become bogged down in the mire of intelligent algorithms, gradually losing the humanizing characteristics of teaching and becoming mechanical and soulless. Laura and Chapman [16] have pointed out that such excessive educational technologization not only fails to give sufficient attention to the subjectivity of the teacher’s role but also has significant negative effects on teacher-student relationships and student-student relationships. It weakens the influence of teachers’ personal qualities on nurturing students, dilutes the educational goals of teachers, and significantly hinders their professional development.

Neglect of students’ comprehensive skills development

Sun [17] has pointed out that the deep involvement of AI technologies in education may result in a diminution of the pedagogical nature of the educational process, as well as a spiritual crisis for teachers. Artificial intelligence has now evolved to the stage of general large models, capable of “hearing” human language, “seeing” human behavior, and “understanding” the meanings behind human language and actions. However, there are still many shortcomings in the application of AI in education, mainly manifested in the “lack of humanity.” For example, AI excels in convergent thinking but lacks divergent thinking, lacks the ability for complex communication, lacks emotions such as empathy and curiosity, lacks comprehensive abilities, and cannot be as versatile as the human brain [18]. At present, the fundamental task of our education is to “establish morality and nurture people”, but artificial intelligence has no emotion and self-awareness, and it is difficult to understand how to “establish morality and nurture people” in the education process like teachers do [19]. In vocational institutions, we need to recognize that there are gaps in students’ self-awareness and management, learning and communication skills, and emotional and mental health compared to general education students. However, the significant advantage of vocational students is that they have strong hands-on skills and a strong desire to explore. In view of this, vocational education teachers should not rely solely or excessively on AI tools when carrying out educational and teaching activities.

Lack of awareness and quality to proactively deal with the smart era

In today’s era of increasingly deep integration between artificial intelligence technology and vocational education, teachers in the field of vocational education face the issue of lacking the awareness and quality to actively adapt to the demands of intelligent reform and the development of vocational education.

The primary problem lies in the fact that most of the teaching staff in vocational colleges are primarily composed of graduates from non-teacher education majors in regular universities, who have a relatively weak knowledge base in vocational education theory and information technology, meaning their professional competence and IT literacy both need to be enhanced. Secondly, given the rapid development of AI technology and the widespread emergence of its applications, if vocational education teachers do not actively pay attention, promptly learn and master relevant technologies, it will be difficult to achieve effective integration of AI with their respective disciplines. Furthermore, the path to cultivating “dual-qualified” teachers – those who possess both theoretical teaching and practical teaching abilities – remains long and challenging. The “National Plan for the Implementation of Vocational Education Reform” has clearly stated that the professional development of vocational education teachers should be oriented towards becoming “dual-qualified,” and in the AI era, this further requires teachers to utilize intelligent educational technology to deepen the integration of technology with education and teaching and engage in self-reflection. The growth of “dual-qualified” teachers depends both on systematic training provided by schools and practical experience gained in enterprises. Compared to the school environment, enterprises offer teachers more opportunities to meet the latest AI equipment, technologies, and processes. However, the reality is that many vocational education teachers lack close ties with enterprises, resulting in a lot of “working in isolation” situations, which highlights the urgent problems that need to be addressed on the path of professional development for vocational education teachers.

Exploration of Professional Development Path of Vocational Education Teachers in the Age of Artificial Intelligence

The concept of teacher professionalization was first put forward in Europe and the United States in the 1960s, and the study of teacher professionalization in China started relatively later, after the 1990s. 1966, UNESCO and the World Labor Organization first made the following definition of teacher professionalism in an official document in the Recommendation Concerning the Status of Teachers: “Educational work should be regarded as a profession. It was defined as follows: “The work of education should be regarded as a profession. It is a profession which requires rigorous and continuous study for teachers to acquire and maintain specialized knowledge and expertise”[20]. Due to the specificity of vocational education, teachers should not only teach the curriculum, but also can guide students in practical training and employment, etc., and need to have teacher literacy, professional knowledge, professional skills, and professional practice ability at the same time, the so-called professional literacy. Therefore, in the context of the era of artificial intelligence, Tang and Shi [21] have pointed out that vocational education teachers not only need to have the professional knowledge and practical ability to adapt to the development of the industry, but also need

teachers to reasonably use educational technology to realize the diversified learning needs of students. Specifically, development can be sought in four aspects: the core competencies, teaching abilities, theoretical innovation capabilities, and emotional influence of vocational education teachers.

Improving Core Literacy in the Age of Artificial Intelligence

Data literacy

With the rise of big data, artificial intelligence has now entered the stage of general artificial intelligence, and the two are complementary to each other. The rapid development of mobile internet and the Internet of Things has led to an explosion of data volume. Since the era of big data is coming towards us, vocational education teachers must possess data literacy - that is, the ability in data collection, organization and management, processing and analysis, as well as sharing and collaborative innovation [22]. Data literacy enables teachers to identify meaningful data from the flood of information and convert it into valuable knowledge, thereby facilitating instructional decision-making, improving teaching methods, enhancing teaching quality, and advancing their professional development [17]. Specifically, vocational education teachers should possess data literacy and a data-driven mindset, capable of keenly perceiving data and demonstrating exceptional insight, efficiently analyzing and processing data, and making informed decisions based on it. To cultivate high-quality technical and skilled talents that meet the demands of the times, teachers should actively integrate big data technology into professional teaching, continuously update professional standards and curriculum outlines, and ensure that the teaching content keeps pace with technological advancements.

Technological literacy

Technological literacy requires that vocational education teachers not only master the basic concepts and applications of AI technology, but also have the ability and quality to explore its principles and the logic behind it, so that they can more efficiently and deeply utilize these emerging skills. Just as when we learn mechanical equipment, we not only need to understand how to operate it, but also understand its basic structure and why it operates the way it does. In the age of intelligence, we need to understand the mathematical models behind intelligent technology, computer language, big data and other computer and Internet-related knowledge and basic principles. In this way, we can maximize the utility of software and hardware and maximize our power to achieve and create [23]. Only when the technological literacy of vocational education teachers is improved can they effectively integrate technological elements into educational teaching practice, thus training new-age technologically skilled talents who are proficient in both basic theoretical knowledge and practical skills, and who can keep up with the pace of technological development. However, improving the technological literacy of vocational education teachers is not an overnight

task, but a complex and systematic one, which requires teachers to have a strong sense of crisis and proactively seek ways to improve their technological literacy. Once they have established the determination of self-improvement, teachers can gradually accumulate and master the latest scientific and technological knowledge in their daily teaching and life by studying, participating in training or practicing in enterprises.

Humanistic literacy

In the era of artificial intelligence, the most critical core competency, more so than information literacy and technological literacy, is humanities literacy. This is determined by the essence of artificial intelligence; no matter how advanced AI technology becomes; it cannot replace the human brain. This is especially true in the field of education, where nurturing human beings is the fundamental purpose. A research report titled "The Future of Employment" was jointly published by Frey and Osborne of the University of Oxford. The report systematically analyzes the probability of different occupations being eliminated in the next twenty years. Among them, typists, waiters, cashiers, bank clerks, tour guides, and delivery personnel are highly likely to be replaced by intelligent machines, with an elimination rate exceeding 90%. Conversely, musicians, scientists, physiotherapists, architects, and other professionals are difficult to replace, with an elimination rate of less than 5%. Teachers are almost impossible to replace, with an elimination rate of only 0.4% [24]. Education should not only teach people how to survive but also how to live, empowering them with the ability to pursue truth, goodness, and beauty, and ultimately achieve comprehensive development. This includes a worldview, values, and outlook on life built upon traditional quality education, as well as scientific spirit, artistic spirit, and moral spirit [17]. Vocational education is not merely confined to the imparting of knowledge and skills; its core lies in guiding students to comprehend the true meaning of life, shaping goodwill and behavior, and enlightening their minds. The humanities literacy of vocational education teachers is crucial in cultivating technical and skilled talents with balanced development in morality, intelligence, physique, aesthetics, and labor, returning education to its human-centered essence, and preventing students from becoming mere appendages of knowledge and skills or being constrained by narrow cognitive frameworks. Teachers should inspire students to actively explore and relentlessly pursue the value and meaning of life, ensuring that vocational education truly returns to its essence and original intention.

Specifically, firstly, in the era of artificial intelligence, we should always keep in mind that the fundamental purpose of education is to promote the development of students' potential, the perfection of their personality, and the full realization of their self-worth. At the same time, vocational education needs to be even more committed to enhancing students' cognitive ability, cooperation ability, innovation ability and vocational ability as its core goal.

Furthermore, vocational education teachers should aim to foster an awareness and acceptance of diversity in their students. The Internet is a window into a colorful world from which no one is excluded. This diverse world is made up of different countries, races, ethnicities and beliefs that together weave a rich tapestry of human culture. In the face of such diversity, vocational education teachers should actively lead students to understand and respect those social forms and cultural backgrounds that are different from ours, and incorporate these diversified elements into classroom teaching, so that students can immerse themselves in learning in an atmosphere of diversity, thus enriching their ideological connotations, broadening their horizons of thinking, and helping them to build a correct perception of the world and the future, as well as fostering valuable humanistic qualities. At the same time, vocational education teachers need to deepen their research, understanding and application of regional culture, industrial culture, professional culture, traditional culture and labor culture, and constantly improve their cultural literacy. More importantly, it is crucial to closely integrate these cultural elements into the process of talent cultivation, realizing a comprehensive and all-time educational function of culture, enhancing students' cultural confidence, and allowing them to thrive under the nourishment of culture.

Finally, teachers of vocational education should also pay attention to the issue of ethicality in the age of artificial intelligence. The rapid development of artificial intelligence has triggered the concern of some experts in society, and the problem of ethicality between artificial intelligence and human beings is urgent to be solved. As early as 1942, Isaac Asimov proposed "The Three Laws of Robotics," which include: 1) A robot may not injure a human being or, through inaction, allow a human being to come to harm; 2) A robot must obey the orders given it by human beings except where such orders would conflict with the First Law; 3) A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws [25]. These three laws establish behavioral rules for robots concerning their interactions with humans and other robots, but they do not provide clear and unified definitions of humans and robots. In 1983, he added Zeroth Law on this basis, stating that a robot may not harm humanity, or, by inaction, allow humanity to come to harm, and the other three laws are valid only under this premise [26]. The new "Three Laws of Robotics" are considered the beginning of human reflection on the ethics of artificial intelligence. Currently, in the context of artificial intelligence, vocational education teachers should pay special attention to issues closely related to students' vital interests, such as the privacy protection of student data, safety and responsibility issues arising from AI vulnerabilities, and discrimination caused by algorithms [27].

Enhancing the power of teaching that promotes active student learning

Brubacker [28] of the United States believes that "the most exquisite teaching art of teachers is to let students ask their

own questions, think independently, and learn consciously". In the era of artificial intelligence, education should focus more on competencies and abilities while maintaining a student-centered approach. Teachers need to make a seamless transition from emphasizing knowledge transmission to emphasizing guidance, shifting from being traditional conveyors of knowledge to activators of students' internal learning motivation, and from dominating the teaching process to guiding it [29]. This point is particularly crucial for teachers in vocational education, as students in vocational schools often exhibit weaker study habits and persistence compared to those receiving general education. Therefore, they require teachers with immense patience to use heuristic teaching methods to inspire their minds, continuously guiding them to actively explore and understand the world around them, thereby fully unlocking their inherent talents and potential. In an era where knowledge is increasingly accessible, teachers who persist with traditional "spoon-feeding" teaching methods will undoubtedly face the risk of being left behind by the times. Nowadays, what teachers urgently need to enhance are their adaptability, judgment, and knowledge construction abilities. The idea of "teaching someone to fish rather than giving them a fish" is even more relevant in today's era. Teachers should actively leverage artificial intelligence technology to strengthen their instructional leadership, motivate students' active learning, and thus improve teaching efficiency.

Specifically, this requires instructional leaders to possess a proactive mindset and strive to cultivate themselves into vocational education teachers with charismatic personalities. This involves continuously updating the core principles of vocational education, transforming traditional teaching mindsets, and exploring innovative teaching methods aimed at answering students' fundamental questions: "Why should I learn?", "For whom am I learning?", and "Do I have the willingness to learn?" Through such guidance, the goal is not only to stimulate students' enthusiasm for active learning but also to make them deeply recognize the value and importance of the knowledge and skills acquired through learning. Only in this way can students maintain their passion for learning throughout their academic career and even after graduation, fostering a mindset of lifelong learning.

Enhancing the contagious power of promoting students' mental and emotional development

German educator Jaspers [30] said, "The essence of education means that one tree shakes another, one cloud pushes another, and one soul awakens another." The core of education lies in awakening the individual's soul and guiding the formation of their beliefs and values, which is difficult for artificial intelligence lacking emotions to comprehend and practice. With the proliferation of artificial intelligence technology, people's increasing reliance on technology has led to a gradual cooling and alienation of social relationships maintained through face-to-face interactions. Therefore, teachers need to shoulder the important responsibility of promoting

students' psychological and emotional well-being. They must not only impart knowledge and skills but also teach students how to behave as humans, guiding them through words and actions to learn interpersonal skills and to adopt the correct attitudes towards success and failure, opportunities and challenges, and ordinariness and glory. These aspects of emotional education are something that artificial intelligence cannot convey through emotions. In summary, vocational education teachers should transform their roles from traditional knowledge transmitters to companions on students' learning journeys, cultivators of skills, and guides of values. They should help students establish correct worldviews, outlooks on life, and values, and strive to cultivate outstanding talents with excellent qualities and innovative abilities who can meet the requirements of the artificial intelligence era.

Enhancing innovation in theoretical research on vocational education

Achieving high-quality development in vocational education is impossible without the guidance of advanced theories. However, contemporary research on vocational education theories remains relatively weak, and vocational education teachers lack sufficient mastery of modern vocational education theories to guide educational and teaching practices. Theoretical innovation leads to practical innovation, and innovation in vocational education theory research serves as a crucial foundation for vocational education practice. It is also key to the long-term development of vocational schools. Yet, innovation cannot be achieved solely through enthusiasm; it must be supported by a rich knowledge base in educational theories, pedagogy, psychology, and other related disciplines. Currently, from the perspective of artificial intelligence technology, it is imperative to conduct in-depth research on various reforms in the field of vocational education, with a focus on analyzing emerging situations and issues, seriously discussing common problems in modern vocational education, summarizing and refining theoretical innovations and enhancements, and ultimately achieving a high degree of integration between AI and education [31]. Teachers should refine, innovate, and advance the development of smart education theories through educational teaching practices that emphasize interpersonal collaboration. At the same time, they also need to conduct in-depth research on the status and future trends of various industries and sectors in the context of artificial intelligence, actively explore effective strategies for integrating industry and education, and thereby continuously enrich and improve the theoretical system of vocational education [32].

Conclusion

The advancements in artificial intelligence technology have brought about many exciting opportunities for the intelligent development of education. However, the broader potential impacts of AI-empowered education on students, teachers, and even society have not yet fully manifested. Nonetheless, in the

areas where we have gained clarity, enhancing our understanding of AI technology deserves significant attention from all industries and sectors. Vocational education teachers should keep abreast of the trend of the times. Based on a thorough understanding of the development logic and history of AI, they should strive for their own professional development as “dual-qualified” teachers by focusing on four main paths: enhancing core literacy in the AI era, improving teaching abilities to promote students’ active learning, fostering influence to promote students’ psychological and emotional development, and advancing innovation in modern vocational education theory research. By doing so, they can further promote the overall professionalization of “dual-qualified” teaching teams and contribute to the professional development of vocational education teachers in the new era.

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References

- Educause (2020). 2020 Educause Horizon Report: Teaching and Learning Edition.
- Yang ZK, Wang J, Wu M, Wang MQ (2022) Development of intelligent pedagogy for sustainable development of education. *Research on Electrochemical Education* 43(12): 5-10.
- Cai B (2019) Artificial intelligence empowered classroom revolution: Substance and concept. *Education Development Research* 39(2): 8-14.
- Wu M, Li H, Chen X (2023) Exploring the impact of generalized big model educational applications of artificial intelligence. *Open Education Research* 29(2): 19-25.
- Keshtkar F, Burkett C, Li H, Graesser AC (2014) Using data mining techniques to detect the personality of players in an educational game. In A. Peña-Ayala (Ed.) *Educational Data Mining. Studies in Computational Intelligence* 524. Cham: Springer.
- Ferreira HNM, Brant-Ribeiro T, Araújo RD, Dorça FA, Cattelan RG (2016) An automatic and dynamic student modeling approach for adaptive and intelligent educational systems using ontologies and Bayesian networks. In 2016 IEEE 28th International Conference on Tools with Artificial Intelligence (ICTAI) (pp: 738-745). San Jose, CA, USA.
- Chen H, Dai Y, Han D, Feng Y, Huang X (2017) Exploration of learner portrait and personalized teaching under open teaching. *Open Education Research* 23(3): 105-112.
- Qiao H, Xiao J (2018) Research on an open learner behavior analysis model based on xAPI. *Research on E-Chemical Education*, 39(4): 32-37.
- Dalipi F, Imran AS, Kastrati Z (2018) MOOC dropout prediction using machine learning techniques: Review and research challenges. In 2018 IEEE Global Engineering Education Conference (EDUCON) Tenerife, Spain: IEEE. pp: 1007-1014.
- Lakkaraju H, Aguiar E, Shan C, Miller DI, Bhanpuri N, et al. (2015) A machine learning framework to identify students at risk of adverse academic outcomes. In *Proceedings of the 21st ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*. Sydney, NSW, Australia: ACM. pp. 1909-1918.
- Huang KQ, Chen XT, Kang YF, Tan TN (2015) A survey of intelligent visual surveillance technology. *Chinese Journal of Computers* (6): 1093-1118.
- Zhao G, Song J, Ge Y, Liu Y, Yao L, et al. (2016) Research progress on emotion recognition based on physiological big data. *Computer Research and Development* 53(1): 80-92.
- Xie HR, Chen XL, Zheng GC, Wang FL (2022) Artificial intelligence enabling personalized learning: Research hotspots and prospects of E-Learning recommendation systems. *Modern Distance Education Research* 34(3): 15-23.
- Wu X, Zhou Z (2017) Domain knowledge-guided model reuse. *Science China Information Sciences* 60(11): 1483-1492.
- Su L (2018) On the teacher-student relationship in the era of artificial intelligence. *Open Education Research* 24(2): 23-30.
- Laura RS, Chapman A (2009) The technologization of education: Philosophical reflections on being too plugged in. *International Journal of Children’s Spirituality* 14(3): 289-298.
- Sun B (2021) Exploration of the development path of vocational education teachers in the era of artificial intelligence. *China Electrified Education* (10): 113-119.
- Wang Z (2017) *The education revolution in the age of artificial intelligence*. Beijing: Beijing Joint Publishing Company Pp: 66-75 referred to in text)
- Yang Y, Lin X (2019) Artificial Intelligence + Education: Vocational education in perspective-“Golden lessons” construction. *China Vocational and Technical Education* 23: 69-74.
- Wan Y (1984) Suggestions on the status of teachers. *Foreign Educational Materials* (4): 1-5.
- Tang WB, Shi WP (2020) Research on the professional development path of teachers in vocational colleges and universities in the era of education informatization 2.0. *China Vocational and Technical Education* (21): 46-53.
- Zhang J (2013) Data literacy education in the era of big data. *Science* (7): 29-32.
- Aune JE (2020) *The Future of Education: Educational Change in the Age of Artificial Intelligence* (translated by H. Li & Q. Wang). Beijing: Mechanical Industry Press. (pp: 71-73).
- Frey CB, Osborne MA (2017) The future of employment: How susceptible are jobs to computerization? *Technological Forecasting and Social Change* 114: 254-280.
- Moran M (2008) Three laws of robotics and surgery. *Journal of Endourology* 22(22): 1557-1560.
- Coeckelbergh M (2010) Moral appearances: Emotions, robots, and human morality. *Ethics & Information Technology* 12(3): 235-241.
- Mo H (2018) Reflections on the ethical issues of strong artificial intelligence and weak artificial intelligence. *Science and Society* 8(1): 14-24.

28. Brubaker JS (2012) History of Educational Problems. Translated by Shan Zhonghui & Wang Qiang. Shandong Education Publishing House.
29. Feng Y, Chen Y (2021) Changes and constancy in the role of teachers in the era of smart education. China Electronic Education (4): 8-15.
30. Jaspers (1991) What Is Education? Translated by Zou Jin. Shanghai: Xinzhi Sanlian Publishing House.
31. Zhang G, Li Y (2016) The second path beyond the application of information technology in education: Reflection on the deep integration of information technology and education. China Electrified Education (5): 13-17.
32. Zhai P, Zhang LH, Dong ZY, Wan S, Guo YC, et al. (2020) Machine intuition. Science China Information Sciences (10): 1475-1500.



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