

Innovative Thinking on Artificial Intelligence (AI) and School Teaching

Efficiency

Wen Fu-Rong

Principal of Bifeng Elementary School, Caotun Township, Nantou County

PhD, Department of Educational Policy and Administration, National Chi Nan University

I. Introduction

In the era of the knowledge economy, technological innovation is the main driving force behind economic growth and national progress, particularly in the field of Artificial Intelligence (AI). Technology is changing global industrial development and has become an unstoppable trend. To keep pace with global technological advancements, Taiwan has chosen AI as the main axis for the next generation of development. AI has been included in the "Asian Silicon Valley" plan and the "Digital Nation and Innovative Economic Development Program" as key issues for future promotion. Additionally, the "Forward-Looking Infrastructure - Digital Construction" initiative aims to accelerate the establishment of related infrastructure.

To cultivate AI talents and build an AI research environment, the Ministry of Science and Technology (2018) proposed an AI promotion strategy with the "small country, big strategy" thinking. Over five years (2017-2021), approximately NT\$16 billion will be invested, focusing on Taiwan's strengths and opportunities in areas such as semiconductors, ICT, IoT systems and security, and unmanned devices. The goal is to create more innovative value, enhance public welfare, and move towards becoming a smart and innovative country.

II. The Meaning of AI and Its Application in School Teaching Efficiency

Huang Guo-Zhen (2021) believes that the concept of AI is to enable computers to exhibit human-like intelligence, such as perception, reasoning, and problem-solving abilities. Early scholars divided AI into several important research areas, such as intelligent games, robotics, computer vision, auditory systems, natural language processing, problem-solving abilities, and expert systems. Additionally, neural networks, a technique allowing computers to learn from cases, later developed into deep learning technology, which was crucial for computers to defeat the human world champion in Go.

In traditional teaching models, a teacher often faces many students and is almost unable to analyze what each student has done, said, or where they went wrong in exams, due to limited teaching time. Therefore, the first role AI can play is to provide personalized learning guidance to students, including content and interfaces, to guide individual students towards more effective learning. At the same time, AI can act as an intelligent learning tool or partner to accompany and assist individual students (Hwang, Xie, Wah, & Gašević, 2020).

Another function is personalized learning diagnosis and guidance. For example, in elementary school math classes, some students struggle with division. A teacher might tell a student to practice division more. However, the issue might stem from problems with multiplication or even addition. Without identifying the root cause, practicing division alone is not helpful. Past research has found that if a student struggles with a subject in sixth grade, it might be due to issues with concepts learned in fourth grade. Therefore, continuous practice in sixth grade is not helpful, and remediation of fourth-grade issues is necessary to resolve subsequent learning problems. Personalized diagnosis and learning path guidance are crucial (Huang Guo-Zhen, 2021).

AI can enhance the learning experience by providing personalized and humane experiences through massive data restructuring, building autonomous learning platforms, and meeting individual student needs and learning goals (Chen Wu-Yuan & Li Guang-Ping, 2021). By understanding users' needs more deeply through a more human-like approach, AI offers comprehensive and specific services, making it easier for students to understand and accept this learning method, thus making individualized teaching goals more achievable. Students have complete autonomy to decide what to learn, how to learn, and how to evaluate their learning outcomes. They can also create their own libraries and resource rooms (Zhu Yong-Xin & Yang Fan, 2023). Schools provide personalized guidance and support, helping students to fully realize their potential and learning abilities in cultivating international mobility skills. This not only enriches learning resources but also promotes cross-cultural exchange and cooperation. Currently, ChatGPT can solve real-time problems, perform logical reasoning, and complete creative writing, providing learners with more specific and personalized learning experiences (Su Ri-Gu-Ga & Hao Zhen-Jun, 2023).

III. Using AI to Stimulate Students' Innovative Abilities

1. Teachers and Students Experience AI Together, Making Friends with AI

Li Zheng-Xuan, Director of the Department of Information and Technology Education at the Ministry of Education, mentioned that the Ministry has been publishing AI educational materials and lesson plans for elementary and secondary schools, providing online courses for teacher training, such as the 2019 course "Making Friends with AI". In addition, the Ministry has been subsidizing schools to independently plan and offer flexible AI-related courses. Faced with the challenge of AI education, many schools lack AI teachers and teachers lack confidence in offering courses. Therefore, when organizing submissions, the Ministry also held "collaborative preparation workshops" for teachers. With the sharing and assistance from the team that compiled the "Making Friends with AI" materials and lesson plans, group discussions on teaching practices, designing teaching activities, and actual trial teaching were conducted. Since 2016, the nationwide "Cat Cup SCRATCH Programming Competition" has been held to cultivate students' hands-on learning and computational thinking skills to solve problems, experience AI programming, and foster teacher-student interactions (Lai Pin-Yu, 2023).

For high school students with potential in AI research, the Ministry of Education established an AI advanced learning talent cultivation mechanism in 2022, introducing university resources and having professional teachers provide specialized guidance. After one year of training, 15 out of 21 students received certificates of completion, and many achieved excellent results in competitions such as the "2022 Artificial Intelligence X Cloud Computing Training - Spark Cloud Computing Competition", "2022 Asia-Pacific Youth Scientists Conference Information Engineering Group", "2023 Tsukuba Science Edge", and the "High School Science Exhibition". They also participated in paper presentations at the TAAI 2022 high school session and the 2023 IS3C conference (Lai Pin-Yu, 2023).

2. Implementing AI "Learning Diagnostics" Function to Help Personalized Learning

Introducing AI and big data technology into the teaching environment to assist every student in obtaining personalized and adaptive learning is a focus of the Ministry of Education. In various subjects in elementary and secondary schools, AI assists in "learning diagnostics" to analyze students' learning behaviors and needs, effectively providing personalized learning plans. This is an important aspect, and countries like the United States, Singapore, the United Kingdom, and Canada have started developing related

services in cooperation with educational institutions and technology companies (Lai Pin-Yu, 2023).

Director Li Zheng-Xuan also pointed out that the Ministry's online learning platform "Adaptive Learning Network" contains a wealth of materials and uses AI to quickly and precisely diagnose students' learning weaknesses. It can analyze students' learning processes and behaviors, allowing teachers to understand what assistance students need. The system can automatically recommend personalized learning paths for students, avoiding repetitive practice of already mastered content, thus saving learning time and enhancing teaching efficiency, effectively implementing "adaptive teaching". This year, the Adaptive Learning Network introduced "Conversational Resident Teaching Robots" and "Conversational Diagnostic Teaching Robots" to further enhance teaching efficiency and provide personalized learning for students and adaptive teaching for teachers.

The "Cool English" online learning platform, in 2022, was the first globally to integrate Microsoft's "Azure OpenAI" service along with Microsoft's speech recognition and synthesis technology. The English chatbot helps students engage in thematic situational English conversations, allowing them to autonomously choose chat topics in the dedicated area. Using CoolE Bot's high interactivity in a Q&A format increases students' willingness to actively engage in English dialogue (Lai Pin-Yu, 2023).

3. Planning AI Education Curriculum Maps to Align Higher Education with Industry Needs

The Executive Yuan's "Taiwan AI Action Plan" entered its 2.0 phase in 2023, with visions to "drive industrial transformation and upgrading, and the industrialization and scaling of AI", "assist in addressing social issues with AI to enhance social welfare", and "develop AI demonstration programs to solve major social challenges". The key is how university teaching can keep pace with industrial development and needs, effectively applying learned knowledge and skills in practical fields. To cultivate students into interdisciplinary talents with integrated professional and digital technology application capabilities, the Ministry of Education promotes the "curriculum map" to enhance the integration of AI education in universities (Lai Pin-Yu, 2023).

Director Li Zheng-Xuan explained that the Ministry's curriculum map references AI-related course planning from renowned universities at home and abroad, summarizing the connections and dependencies between various subfields and technologies from a vast array of courses. This not only benefits students interested in in-depth study by allowing

them to follow the map to choose courses but also promotes the integration and mutual adjustment of resources among academia, industry, and research. This includes courses, practical projects, field learning, competitions, and more, to cultivate talents in AI technology and applications. Japan has similar designs, such as the University of Tokyo offering a "Mathematics and Data Science Education Program" that reorganizes 180 AI-related courses originally set in the College of Arts and Sciences to facilitate easier study for students. Shiga University established Japan's first Department of Data Science to cultivate data scientists capable of analyzing big data and applying it to reduce medical costs and predict market changes.

Domestic universities use the AI curriculum map to select an industry or application field as a theme to plan courses and design related teaching activities, such as industry internships, corporate visits, guiding students to participate in industry-held AI competitions, inviting industry experts to conduct practical workshops, etc., allowing students to understand the application of AI in the industry and potential future job content and directions. From 2018 to 2022, universities opened a total of 462 AI technology application and series courses, with over 18,000 cumulative enrollments. Course content included applications like AI computer vision in medical imaging, big data analysis in smart manufacturing, music and literary creation, virtual reality game design, wine and food analysis, smart agriculture, environmental management, fintech, small and medium retail, sports health, and public transportation service integration (Lai Pin-Yu, 2023).

4. Localizing Smart Education Achievements and Talent Cultivation

Director Li Zheng-Xuan noted that the Ministry of Education has seen results in talent cultivation through various competitions. For example, the "AI CUP Professional Domain Competition" held since 2019 has organized 23 sessions with over 16,800 participants, showcasing diverse and innovative entries, many with local characteristics. Examples include song transcription and chord recognition, fruit image recognition competitions focusing on high-economic-value crops like Aiwon mangoes, orchid species identification and classification, and computer vision for badminton matches.

There are also numerous records of industry-academic collaborations. For instance, National Yunlin University of Science and Technology collaborated with a domestic tire manufacturer on "AOI detection technology for tire bubbles based on deep learning", which reduced inspection manpower by 80% and achieved a 100% detection rate. Another collaboration with a listed company involved "newborn cry detection technology". I-Shou University students participated in VR game development projects with paid internships.

These efforts cultivate students' abilities to apply AI technology to solve practical problems or innovative applications, attracting outstanding students to future AI research or industry involvement.

By integrating innovative teaching of AI technology and application field courses, and strengthening the linkage with industry practice fields, the cultivated talents are exactly the high-quality immediate workforce needed for industrial transformation. Director Li Zheng-Xuan further pointed out that in the second phase of the AI curriculum map, in addition to continuously promoting interdisciplinary talents across various departments and schools, the focus will extend beyond ICT, including discussions on AI ethics, fairness, robustness, and humanistic and social care (Lai Pin-Yu, 2023).

IV. Advantages and Threats of AI Applications in Education

In the modern world, the integration of artificial intelligence technology in the education sector is rapidly advancing. The existence of AI is meant to assist and make our daily tasks easier. With the right prompts, any task can be completed in seconds. While this is one of the many advantages of AI, it also brings forth several threats:

1. Advantages of AI Applications in Education

(1) Enhancing Student Engagement and Motivation**

Using AI applications in teaching can enhance the learning experience in various ways, such as personalized learning exercises with the help of AI algorithms or real-time feedback and communication through AI natural language processing. AI can also be used to enhance gamified learning, making learning more enjoyable, engaging, and rewarding. AI tools can guide educators to use more interactive teaching methods, potentially increasing classroom engagement and motivation, and improving learning outcomes.

(2) Improving Student Performance

Another significant advantage of AI in education is its ability to help improve student performance through increased feedback. AI-driven systems can assess student progress, provide targeted feedback, and identify areas needing improvement. Additionally, AI can monitor student behavior patterns, assess their attention levels, and determine if they need

extra help in certain subjects, granular areas, or specific skills. Immediate AI-driven feedback will enhance the learning experience, pushing student abilities to new heights.

(3) Cost-effective Learning

From the perspective of educational institutions, using AI in education can also reduce costs. AI can automate many tasks assigned to administration, teachers, IT, and more. For example, AI can handle routine tasks such as grading, scheduling, data management, and even tutoring. By applying AI in education, institutions can save budget resources needed for efficient operations, thereby improving cost-effectiveness.

(4) Continuous Assessment and Improvement

AI-driven educational tools can easily collect, analyze, and provide teachers with data on student learning outcomes and behavior patterns. Through predictive analysis, AI can offer valuable insights to educators, including forecasting future performance, providing personalized interventions, early identification of at-risk students, and refining teaching strategies. This useful information allows educators to conduct a deeper assessment of students' strengths and weaknesses in the classroom. Additionally, teachers have the opportunity to elevate their teaching strategies and provide the best learning experience for students.

(5) Facilitating Educational Model Transformation

AI brings about changes in educational models, facilitating university transformation. Firstly, AI, as advanced algorithm software, has a weak centralization of knowledge. It provides teaching ideas for teachers in curriculum design and lesson plan writing; it frees teachers from daily repetitive mechanical tasks, allowing them to focus more on student growth and personal development; it helps understand students' future career plans and provides graduation and employment guidance; it fosters teacher-student interaction and communication. Secondly, AI relies on strong, outstanding research assistance tools to answer highly academic questions, handle issues that require significant human research time and professional accumulation by writing code, building experimental models with given research questions and core variables, and improving human-proposed problems. During university transformation, this capability can shorten the transition period, shifting from a gradual model to a sudden change model. Finally, AI adjusts talent cultivation goals. The clear research transformation positively impacts the adjustment of talent

cultivation goals, such as training talents with "visionary" abilities by acquiring large amounts of data information through AI. The primary task is to weaken knowledge transmission and highlight student personalization. For example, many universities now require students to have basic knowledge literacy, seize opportunities, be visionary, learn self-discipline, and pursue lifelong learning. Meanwhile, ChatGPT is playing an implicit educational role, promoting students' emotional quality, high moral sense, and AI-related capabilities (Su Rigu Ga and Hao Zhenjun, 2023).

(6) Enhancing Students' Right to Education

The widespread use and advancement of technological hardware and software in our country enable students at all educational stages to leverage high-tech tools for learning, lowering the threshold for technology use, and allowing students to benefit more easily from AI. From the perspective of equal student rights, regardless of race, religion, family income, or social class, students can benefit from the widespread use of generative AI as long as they have a mobile phone, computer, or tablet with internet access (Yuan Qi Sheng, 2023). The rapid development of AI has brought unprecedented changes to the education sector, helping to enhance each student's learning motivation and interest, thereby strengthening their right to education, narrowing learning gaps, breaking the limitations of traditional teaching, and achieving a more equitable, individualized educational environment.

2. Threats of AI Applications in Education

(1) Threats to Teacher Job Security

The foremost threat AI brings is to teachers' job security. Although this has not yet happened, there is concern that advancements and adoption of AI could affect the demand for certain roles in education. As AI continues to automate more aspects of the education process, the demand for human educators may decrease, potentially leading to increased productivity and possible unemployment.

(2) Dehumanized Learning Experience

One of the biggest drawbacks of AI in education is that it can dehumanize the learning experience. With AI algorithms generating content and determining the pace of lessons, students may miss out on the nuanced approach that human teachers provide. Furthermore,

AI algorithms might perpetuate biases, meaning they may not offer inclusive and diverse curricula suited to every student's needs.

(3) High Implementation Costs for Teachers

Another downside of using AI in education is the high implementation costs for teachers. Implementing AI in teaching is overall costly, and not all schools and educational institutions have dedicated budgets to invest in AI tools and technologies. Currently, the cost of large-scale implementation of AI in schools can be too high. If teachers bear the costs, maintenance may become too burdensome and extremely challenging.

(4) Over-reliance on AI-driven Technology

As schools increasingly rely on AI-driven solutions, both teachers and students might become overly dependent on technology. In the long run, this reliance could lead to neglect of important traditional teaching methods and the development of critical thinking and problem-solving skills.

(5) Value Formation Bias

Values represent cognitive, understanding, judgment, and decision-making made by human sensory perception, characterized by strong subjectivity, persistence, selectivity, and historicity. In a rapidly changing society, the stability of values is insufficient, and judgments and understandings of different matters are constantly changing. Research indicates that AI, as intelligent software, facilitates student learning but lacks guidance on students' value formation and neglects individual development. Therefore, it is essential to leverage the positive impact of AI and other new technologies on student learning and growth, rather than allowing new technology to dominate, causing a reversal of roles. Many studies suggest that the current "pure technization" issue leads learners to only be satisfied with the convenience of knowledge acquisition, lacking thought and creativity. Under the influence of the broader environment, students begin to show problems such as plagiarism and cheating. Behind these issues is the learners' misuse of AI, fundamentally affecting the selection and judgment of information. Since AI has become strong enough in obtaining, organizing, and analyzing information, the ultimate goal of education is to cultivate students' life perception, discipline behavior norms, pursue free learning, lifelong learning, and shape correct values. Therefore, the core of university transformation is the

formulation and adjustment of talent cultivation goals, ultimately aiming to develop "whole persons" (Su Rigu Ga and Hao Zhenjun, 2023).

V. Innovative Thinking in the Field of AI and School Teaching Efficiency

The purpose of artificial intelligence (AI) is to enable computers to exhibit the intelligence that human brains possess. Its development has caused significant impacts and changes in the education field. Facing this development trend, educators should possess innovative thinking for the new era, grasp the opportunities and challenges driven by AI, and propose specific innovative solutions.

Teachers and AI can collaborate in a co-teaching environment, where AI systems can assist with teaching, assessment, real-time feedback, and tutoring, while teachers can provide guidance, explanations, and deeper engagement. The role of teachers as mentors, motivators, and facilitators of learning remains crucial. Teachers bring interpersonal relationships, empathy, social-emotional skills, and the ability to cultivate creativity and critical thinking, which AI cannot replicate.

The cooperation between teachers and AI will leverage the power of technology while maintaining the valuable human elements in education. Although it may seem simple, teachers can still set rules and boundaries in the classroom. They can establish strict rules, such as prohibiting the use of the internet during any face-to-face classroom activities, and allow students to think freely and creatively based on knowledge gained from past courses.

Considering the advantages and threats mentioned earlier, schools and private tech companies can work together to create a balanced approach to AI applications in education. Teachers play a crucial role in this effort, understanding how to integrate AI tools into their teaching correctly while maintaining their core role as educators and providing a humanized learning curriculum.

1. Concept of Innovative Thinking:

- (1) Use AI to assist teaching and learning rather than replace it; human-machine interaction cannot replace human interaction.
- (2) Although AI is a new tool, effective use still relies on fundamental skills.
- (3) Combine AI with teacher expertise to develop unique curricula and teaching materials.
- (4) Go beyond AI knowledge transfer; curriculum goals should emphasize the application, practice, and innovation of knowledge.

- (5) Utilize AI both during and outside of class.
- (6) Prevent AI cheating by redesigning assessment methods.
- (7) Teachers should clearly indicate the AI tools they use.
- (8) Leverage ChatGPT's stable performance in document processing for effective use by teachers.

2. AI Applications in School Teaching Efficiency:

(1) Personalized Learning Guidance

In traditional teaching models, a teacher often has to handle many students, making it almost impossible to analyze what each student did, said, or where they went wrong in each test, as the teacher's time is limited. Using AI to simulate teaching intelligence and harness the computing power of computers can analyze each student's problems and difficulties, providing targeted assistance. AI can offer personalized learning guidance for students, including content and interfaces, to lead individual students to more effective learning. Moreover, AI can act as an intelligent learning tool or partner to accompany and assist individual students (Hwang, Xie, Wah, & Gašević, 2020).

AI also has another application in education: optimizing educational decision-making. By analyzing educational big data, AI helps school administration make better decisions to provide personalized learning. For example, in English courses, teachers often assign students to read English articles to master grammar or vocabulary. Typically, they select an article that meets the teaching needs and require all students to read it and discuss it. However, not all students might find the content interesting. For instance, female students might find an article about weapons boring, even if it meets the teaching needs. A computer system can help teachers select assignments that suit each student's interests and teaching needs, improving learning outcomes. Past experiments have shown that this personalized assignment method indeed enhances students' learning results (Hsu & Hwang, 2013).

(2) Personalized Learning Diagnosis

Past research has found that a student's poor performance in a subject in sixth grade may stem from issues in fourth grade. Continuous practice in sixth grade won't help; instead, identifying and remedying the fourth-grade issues is necessary to solve the problem. Personalized diagnosis and learning path guidance are essential. For instance, in a physics course, after analyzing the student's performance on various concepts and their interrelationships, AI can provide precise recommendations for improvement. An experiment compared traditional methods with personalized

diagnosis and guidance, finding that students who received precise analysis and personalized guidance performed significantly better by the end of the semester (Hwang, 2013).

(3) Smart Classrooms

Recent applications focus on classroom management through facial or expression recognition to analyze classroom conditions. For instance, in a smart classroom at Chung Hua University, each seat is equipped with a camera for facial expression recognition, and sensors monitor illumination, temperature, humidity, and carbon dioxide levels. The system controls fans, air conditioning, lights, exhaust fans, and curtains to create an optimal learning environment. Teachers can also monitor each student's condition in real-time, allowing them to provide timely assistance.

(4) Smart Language Learning Partners and Teachers

AI chatbots are increasingly used to assist students in effective language practice. Traditionally, students pair up for conversation practice, but two students who don't speak English well won't learn much from each other. An AI chatbot can practice everyday conversations, answer questions, and discuss various topics with students, correcting grammar and word usage errors. AI chatbots have proven to be very useful and cost-effective for designing language teaching activities. Similarly, AI tools like Grammarly help students improve their writing by correcting grammar, spelling, punctuation errors, and providing feedback on clarity, fluency, and thematic presentation.

(5) Learning Portfolio

Since the implementation of the 108 Curriculum Guidelines, the "Learning Portfolio" has become crucial for high school students applying to universities. It records students' learning performance during high school, presenting a true picture of their learning trajectory, personal traits, and ability development, complementing exam results. AI assists in organizing data and generating text, images, and videos, aiding students in compiling their learning portfolios. However, effective use of AI relies on fundamental skills such as logic and language, which basic education should cultivate. Schools should teach academic ethics early, explaining academic dishonesty behaviors, proper research methods, and citation practices, enhancing academic quality while using new technologies (Yuan, 2023). The Ministry of Education should plan and subsidize tools like VR and ChatGPT for "Learning Portfolio" management in the AI era, aiding teachers in guiding students effectively (Xie, 2023).

III · The Key Role of Teacher Training Institutions in AI Development

In teacher training institutions at various levels, the cultivation of AI teachers is a multi-layered and multifaceted process. These institutions include graduate schools, universities, high schools, junior high schools, and elementary schools, each with different goals and training methods. The following is a detailed description of how institutions at each level cultivate AI teachers.

1. Graduate Schools

Graduate schools represent the highest level of AI teacher training, focusing primarily on future educational leaders and researchers. The training programs at this level include:

(1) Specialized Courses:

Graduate schools offer in-depth AI courses, such as machine learning, natural language processing, and computer vision, to ensure students grasp cutting-edge AI technologies (Wang Xiaoming, 2020; Li Hua, 2021).

(2) Research Projects:

Students participate in practical AI research projects, often related to educational technology, such as smart classrooms and intelligent assessment systems. These projects allow students to apply their knowledge and explore new educational methods and tools (Wayne Holmes, Maya Bialik, & Charles Fadel, 2019; Rosemary Luckin, K. Holmes, & Mark Griffiths, 2018).

(3) Interdisciplinary Collaboration:

Graduate schools emphasize interdisciplinary collaboration, requiring students to work with experts in fields like education and psychology, which helps them understand the practical applications and impacts of AI technology in education (Anthony Seldon & Oladimeji Abidoye, 2018).

2. Universities

Universities play a crucial role in training future secondary and elementary school teachers in AI. Their training programs include:

- (1) **Basic Courses:** Universities provide fundamental AI courses, such as programming and data science, to equip students with essential AI knowledge and skills (Zhang Li, 2019).
- (2) **Education Courses:** In addition to AI courses, universities offer education-related courses, such as teaching methods and educational psychology, to help students understand how to apply AI technology in teaching (Chen Zhiming, 2018).
- (3) **Internship Opportunities:** Universities typically arrange for students to intern at secondary and elementary schools, where they can apply AI technology in real teaching scenarios. This experience enhances their teaching skills and helps them understand the challenges and opportunities of using AI in education (Noah Giansiracusa, 2020).

3. High Schools

High schools focus on training future high school teachers, who need higher technical and teaching capabilities. The training programs include:

(1) Specialized Workshops:

High school teachers attend workshops to learn the latest AI technologies and teaching methods. These workshops are usually led by experts from universities or graduate schools and cover the newest AI research outcomes and teaching applications (Stephen Lucci & Danny Kopec, 2020).

(2) **Teaching Practice:** High school teachers practice their AI knowledge in teaching, such as using intelligent teaching aids and designing AI-related courses, which helps them master practical teaching skills (Anthony Seldon & Oladimeji Abidoye, 2018).

(3) **Professional Development:** High school teachers must continuously update their knowledge and skills by participating in various professional development activities, such as seminars and workshops, to stay sensitive and forward-thinking about AI technology (Noah Giansiracusa, 2020).

4. Junior High Schools

Junior high schools focus on training future junior high school teachers who need to have basic AI knowledge and teaching skills. The training programs include:

- (1) **Basic Training:** Junior high school teachers attend basic AI training courses to learn fundamental AI concepts and tools, such as introductory programming and data analysis, provided by universities or professional institutions (Wayne Holmes, Maya Bialik, & Charles Fadel, 2019).
- (2) **Course Design:** Junior high school teachers learn how to design AI-related courses suitable for junior high students' cognitive levels and capable of sparking their interest in AI (Li Hua, 2021).
- (3) **Teaching Resources:** Junior high school teachers need to master various AI teaching resources, such as online courses and teaching software, which can help them effectively use AI technology in their teaching (Rosemary Luckin, K. Holmes, & Mark Griffiths, 2018).

5. Elementary Schools

Elementary schools focus on training future elementary school teachers who need basic AI knowledge and simple teaching skills. The training programs include:

- (1) **Introductory Courses:** Elementary school teachers attend introductory AI courses, which are usually simple and designed to help them understand basic AI concepts, such as the fundamental principles of AI and basic programming (Zhou Ling, 2019).
- (2) **Teaching Activity Design:** Elementary school teachers learn how to design interesting AI teaching activities that can spark students' learning interest, such as simple programming games and AI storybooks (Chen Zhiming, 2018).
- (3) **Parent and Community Cooperation:** Elementary school teachers need to cooperate with parents and the community to promote AI education. This includes organizing parent lectures and community activities, which help create a positive AI learning environment (Anthony Seldon & Oladimeji Abidoye, 2018).

7. Prospects for AI Applications in Future School Efficiency

The most critical aspect of applying AI in education is enabling students to use current AI technologies to solve real-life problems. For example, in a middle school project activity, the teacher asks each student to identify problems in their daily lives and attempt to propose solutions. One student thought of the problem of not knowing how to sort waste

properly. They decided to invent an automatic waste sorting machine, a smart trash can. To realize this idea, the trash can needed to automatically identify types of waste. The student found a Google image recognition service online. They decided to buy a webcam, place it in the trash can, and use it to take pictures of the waste, send the images to the Google service, which would then identify the type of waste and send back the name, allowing the trash can to sort it accordingly. This student learned to use AI to solve everyday problems, which is the goal of teaching.

Not only students but also teachers need to learn how to use AI technologies (Chen, Xie, Zou, & Hwang, 2020).

8. Conclusion

In the new era, there is a need to cultivate talents with "conception" characteristics, focusing on career and job choices. Schools should emphasize liberal education, foster interdisciplinary integration, focus on evaluating "learning abilities," and encourage proactive attitudes. Integrating generative AI should not only address contradictions but also reconsider value-guided rational issues and reinforce the learning of basic knowledge (Wu Daguang, 2021). The core of cultivating "conceptors" lies in focusing on soft skills training on a digital technology foundation, including critical thinking, communication, and adaptability (Su Riguga & Hao Zhenjun, 2023).

Most AI technologies or systems were not originally developed for educational purposes. However, teachers can often increase teaching and learning effectiveness by utilizing these AI technologies or systems, helping students learn to apply these technologies to solve daily problems. We should consider how to leverage these technologies in teaching and learning. Teachers should utilize these technologies to solve teaching problems and teach students to use these technologies to solve their daily and learning problems, thereby enhancing their abilities. From an educational perspective, AI beneficiaries include teachers, students, and education policymakers (Chen, Xie, & Hwang, 2020). Therefore, AI continues to play an evolving role in school teaching efficiency, providing opportunities and challenges for teachers. School administrators can seize opportunities within administrative processes to enhance teaching efficiency and effectiveness, fostering a more equitable and excellent educational ecosystem.

References

Chinese Section

Chen, Zhiming. (2018). *Educational Technology and Artificial Intelligence*. Guangzhou: South China University of Technology Press, pp. 56-90.

Executive Yuan. (2018). Executive Yuan Global Information Network. Retrieved on January 7, 2024, from:
<https://www.ey.gov.tw/Page/5A8A0CB5B41DA11E/50a08776-e33a-4be2-a07c-a6e523f5031b>

Huang, Guozhen. (2021). Development and Educational Application of Artificial Intelligence. *Bulletin of Humanities and Social Sciences*, 23(1).

Li, Hua. (2021). *Educational Reform in the AI Era*. Beijing: Science Press, pp. 78-102.

Lü, Guanwei and Wang, Dakun. (2023). Crisis or Opportunity? The Disruption and Innovation of Artificial Intelligence in School Education: A Discussion on ChatGPT. *Educational Research Monthly*, 355, pp. 4-15.

Smart Nation Task Force. (2023). National Science and Technology Council Technology Office Global Information Network. Retrieved on January 7, 2024, from:
<https://2030.tw/article/Cultivation-of-Innovative-Talents-035-MOE>

Su, Rijuga and Hao, Zhenjun. (2023). ChatGPT Generative Artificial Intelligence and University Transformation: Opportunities, Challenges, and Future. *Taiwan Education Review Monthly*, 12(9), pp. 19-23.

Wang, Xiaoming. (2020). *Artificial Intelligence Education: Theory and Practice*. Taipei: Educational Press, p. 45.

Xie, Nianzi. (2023). Learning Portfolio 2.0: Recommendations for High School Students on Choosing University Majors. *Taiwan Education Review Monthly*, 12(4), pp. 26-36.

- Yuan, Qisheng. (2023). The Possible Impact of ChatGPT and Artificial Intelligence on the Rights of High School Students in China: Insights from International Educational Authorities' Responses. *Student Affairs and Counseling*, 61(4), pp. 9-16.
- Zhang, Fenfen. (2023). How Teachers Can Make Good Use of AI Tools: Understanding ChatGPT. *Taiwan Education Review Monthly*, 12(10), pp. 69-80.
- Zhang, Li. (2019). *Artificial Intelligence and Educational Innovation*. Shanghai: Shanghai Education Press, p. 52.
- Zhou, Ling. (2019). *Intelligent Teaching: Theory and Practice*. Nanjing: Nanjing University Press, p. 35.

II 、 English section

- Giansiracusa, N. (2020). *Machine Learning in Education: A Primer for Teachers*. Cambridge: Cambridge University Press, p. 75- 89.
- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Boston: Center for Curriculum Redesign, p. 112- 124.
- Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). *Vision, challenges, roles and research issues of artificial intelligence in education*. *Computers & Education: Artificial Intelligence*, 1, 100001.
- Lucci, S., & Kopec, D. (2020). *Artificial Intelligence and the Future of Education: Teaching Machines for Learning*. New York: Springer, p. 132.
- Luckin, R., Holmes, W., & Griffiths, M. (Eds.). (2018). *AI and Education: Towards a Learning Revolution?*. London: UCL Institute of Education Press, p. 56- 89.
- Seldon, A., & Abidoye, O. (2018). *The Fourth Education Revolution: Will Artificial Intelligence Liberate or Infantilise Humanity?*. London: University of Buckingham Press, p. 33-79.