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Exploration of the Application of Artificial Intelligence Technology in Primary Education in Hong Kong

Chen Shanshan[1,2]

[1]*School of Information Technology in Education, South China Normal University, Guangzhou, Guangdong, China*
[2]*Po Leung Kuk Lam Man Chan English Primary School, Hong Kong, China*

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Abstract: With the advancement of modern information technology, the integration of artificial intelligence (AI) into classrooms has gradually become a shared understanding among educators and students. However, the focus now is on how to effectively utilize AI technology, particularly Virtual Reality (VR) and Augmented Reality (AR), to achieve a seamless integration with subject-specific teaching and enhance its effectiveness in classroom settings. In 2023, the Hong Kong Department of Education advocated for strengthening digital literacy and integrating AI technologies across various subjects. The primary objective is to improve learning outcomes, support personalized learning, and foster students' autonomy and creativity through AI technology. Consequently, this paper examines how AI technologies, especially VR and AR, can collaboratively enhance elementary students' language arts and writing skills, improve the effectiveness of collaborative learning, and provide personalized feedback through AI-driven methods. Ultimately, the goal is to enable a structural transformation in foundational education, empowered by AI technology.

1. Introduction

The Education Informatisation 2.0 Action Plan identifies the necessity to utilise advanced technologies, including artificial intelligence, big data and blockchain, to facilitate structural changes in the education sector. It is only by combining advanced technologies with subject curricula and continually exploring novel teaching methodologies that we can fundamentally alter the deficiencies inherent to traditional pedagogical practices, achieve pedagogical innovation with technological support, and enhance the quality of teaching. The Hong Kong government has recently highlighted the significance and necessity of integrating artificial intelligence into the realm of basic education. Nevertheless, the potential of AI technology in the field of language education has yet to be fully realised, with research predominantly focusing on applications such as intelligent reading, exercise generation and assisted correction, while less attention has been devoted to exploring how AI technology can support language classroom teaching and enhance primary school students' writing abilities. Furthermore, many teachers are not sufficiently attuned to the potential applications of AI technology[1]. In light of the digital transformation of education and

the rapid advancement of AI, it is imperative to investigate how virtual and augmented reality technologies can be harnessed to enhance students' language and writing abilities.

2. The Value and Significance of Artificial Intelligence Technology in Writing Instruction

(1) Empowering Writing Instruction and Supporting Student Growth

The application of artificial intelligence technology in the field of education provides educators with innovative tools for the teaching of composition. These tools facilitate the accurate analysis of students' writing, enabling educators to develop more targeted teaching strategies that are aligned with the specific needs of each student. The AI platform enables educators to enhance the assessment of students' composition data indicators, encompassing language expression, structural organisation and logical thinking. Such an evaluation, conducted with the assistance of artificial intelligence, can facilitate a more comprehensive understanding of the students' writing abilities, thereby enabling educators to implement more "tailored" instruction. Additionally, AI can assist teachers in optimising the process of essay correction by automatically assessing fundamental elements of students' work, such as grammar, spelling, sentence structure and rhetorical devices, and providing immediate feedback based on the content of the students' writing. This not only enhances the efficacy of teachers' corrections, but also enables teachers to synthesise and analyse the prevalent errors encountered by students during the writing process. This, in turn, facilitates the focus of teachers' guidance and analysis on these errors during the teaching process. In conclusion, the application of artificial intelligence technology in the field of composition teaching can facilitate improvements in both the efficiency and quality of the teaching process[2]. Furthermore, it can also encourage the evolution of innovative approaches to language writing instruction. By employing intelligent data analysis, correction assistance and resource sharing, educators can more effectively comprehend the specific writing requirements of their students, thereby enhancing the efficiency of language composition teaching. Additionally, it can stimulate students' writing potential and facilitate the overall development of their writing abilities.

(2) Assisting Writing Instruction to Improve Teaching Efficiency

The application of artificial intelligence (AI) technologies has proven to be an invaluable aid in the field of language composition teaching, particularly in the context of natural language processing (NLP)[3]. NLP technologies are capable of conducting rudimentary spelling, grammar, and logic assessments on students' compositions, thereby enabling educators to swiftly identify prevalent issues in the writing process. Concurrently, Virtual Reality (VR) and Augmented Reality (AR) technologies offer a novel supplementary experience for writing instruction. They can facilitate students' engagement with realistic virtual scenarios, such as historical settings or imagined futures, thereby diversifying their writing topics and stimulating their creativity and imagination. Concurrently, virtual reality (VR) and augmented reality (AR) technologies can reinforce classroom interaction, enabling students to experience the impact of virtual scenes in an immersive manner. Such a multi-sensory experience has the potential to not only enhance the students' classroom experience, but also to stimulate their emotional resonance, which may in turn facilitate the development of more nuanced and authentic writing content. Additionally, these artificial intelligence technologies can assist teachers in expanding the composition material, thereby enabling the use of more intuitive means to guide students in understanding complex writing themes or scenes. This, in turn, can improve the overall teaching efficiency of the class. In summary, through intelligent correction, automated error detection, and rich contextual simulation, these technologies not only provide teachers with powerful auxiliary support but also enhance students' initiative and enthusiasm in learning to write.

(3) Innovating Writing Models to Inspire Creative Ideas

An optimal writing environment can facilitate students' expression of thoughts and feelings with increased confidence, thereby enabling them to gradually enrich their writing ideas and stimulate their writing enthusiasm through activity exchange. Consequently, with the assistance of AI technology, educators can construct engaging writing instructional environments, such as interactive whiteboards and virtual settings, to present students with thought-provoking writing prompts or social issues that can stimulate their cognitive processes, personal experiences, and so forth. This approach can effectively capture students' attention and stimulate their imagination and enthusiasm for active creation[4]. Concurrently, AI technology generates a comprehensive writing environment and an array of writing resources for students through diversified resource recommendations and context simulation, including writing templates and sentence alterations, among other features. This ensures that students are consistently engaged in an active and interactive learning environment, which in turn motivates them to freely explore diverse writing styles and expression techniques, thereby enhancing their personalised expression and independent creativity.

3. Building Support Structures for Artificial Intelligence Technology in Writing Instruction

(1) Clarifying Objectives to Guide Learning Direction

In the context of writing instruction, it is incumbent upon educators to design learning tasks and teaching objectives pertaining to writing topics in a manner that is aligned with the specific learning situation and curriculum standards. The intelligent analysis and data support of AI technology enables teachers to clarify the teaching objectives of different writing topics and formulate specific learning objectives according to the students' writing ability level, learning progress and personalised needs. This allows teachers to provide students with a clear learning path[5]. Concurrently, AI technology facilitates students' observation and reflection on their surrounding environment, enabling them to articulate their insights, experiences, and ideas pertaining to these observations. This process, which involves developing an accurate description, vivid expression, and in-depth analysis, ultimately fosters the growth of students' innovative and logical thinking abilities.

(2) Flexible Strategies to Optimize Learning Methods

The utilisation of artificial intelligence technology in the process of writing teaching can facilitate the provision of flexible and diverse learning strategies for teachers and students, thereby promoting the further optimisation and improvement of students' writing style. Artificial intelligence technology can provide students with personalised writing materials and reference cases according to their writing level and progress, thereby enabling them to gradually improve the accuracy and richness of language use and to strengthen the integrity and logic of the structure of the article[6]. Concurrently, AI technology can assist educators in real-time adjustments to their pedagogical approaches through adaptive learning, thereby facilitating more efficacious student learning outcomes. To illustrate, AI technology is capable of identifying errors and difficulties in essay structure through the utilisation of intelligent detection tools. Subsequently, the system will automatically promote pertinent writing skills and writing templates in accordance with the specific circumstances of the students, thereby assisting them in optimising paragraph articulation and logical structure.

(3) Enriching Resources to Expand Creative Horizons

The utilisation of artificial intelligence technology provides students with a plethora of writing learning resources, encompassing a vast array of intelligent storage functions. These include, but are not limited to, theme writing guides, model essay analyses, writing styles across diverse genres, rhetorical references, essay structure templates, and more[7]. This vast repository of writing

materials allows students to explore a multitude of topics, including current events, news, exemplary characters, and more. Concurrently, AI technology is also capable of disseminating pertinent material libraries and background information to students in accordance with the specific essay topics and their individual interests. This facilitates the expansion of students' writing perspectives and enables them to enhance the intention and emotion of their writing content through the utilisation of materials such as diverse cultural backgrounds and historical events.

4. Practical Approaches for Implementing Artificial Intelligence Technology in Writing Instruction

(1) Using AI Technology to Create Real-Life Scenarios and Ignite Writing Passion

The implementation of artificial intelligence (AI) technologies in writing instruction, particularly virtual reality (VR) and augmented reality (AR) technologies, has the potential to foster students' interest in writing and enthusiasm for creation by immersing them in scenarios that resonate with their lived experiences. The utilisation of virtual reality (VR) and augmented reality (AR) technologies enables educators to facilitate immersive and engaging writing experiences for students, thereby fostering their intrinsic motivation and innovative thinking[8].

To illustrate, teachers may utilise virtual reality technology to facilitate students' engagement in narrative writing about travel. This could entail immersing students in virtual environments representing diverse tourist destinations, such as beaches, forests, city museums, and so forth, thereby enabling them to experience a range of natural landscapes and cultural scenes. Such an immersive experience not only allows students to experience the enjoyment of travel, but also enables them to observe details, listen to the sounds around them, and even interact with virtual characters, thereby providing them with a wealth of material and inspiration for writing essays. The essay, entitled 'Sunrise on the Beach', was influenced by the virtual beach scene and expressed the author's love of nature and longing for travel. It depicted the details of waves lapping at the reef, the sea breeze blowing on the author's cheeks, and the sun shining on the surface of the sea. The content of the writing is characterised by vividness, interest and an infectious quality. This serves to illustrate that AI technology has the potential to enhance students' immersive experience and facilitate interactive learning, whilst also strengthening their perception of the writing materials, thereby stimulating greater creative inspiration under multi-sensory stimulation.

(2) Utilizing AI Technology to Expand Writing Materials and Enhance Essay Quality

The utilisation of artificial intelligence technology provides students with a plethora of resources that facilitate the expansion of their writing materials and enable them to delve deeply into their chosen writing topics, thereby enhancing the quality of their compositions. In the context of classroom-based composition instruction, educators employ artificial intelligence to facilitate the provision of real-time writing material recommendations and the customisation of relevant reference materials and material libraries for students, based on the specific writing theme. To illustrate, when a teacher is guiding students in composing an argumentative essay on the topic of environmental protection, the teacher will search for pertinent news reports, images, and data charts with the assistance of the artificial intelligence system. This provides students with material support for their writing and guides them in analysing the issue from multiple perspectives, thereby enhancing the persuasive and contagious power of the essay. In conclusion, AI technology can provide students with a plethora of writing materials through intelligent material recommendation, thereby enhancing their ability to integrate information and logical expression in writing, thus improving their writing ability and the quality of their compositions.

(3) Relying on AI Technology for Detailed Observation and Capturing Writing Highlights

In the field of writing instruction, educators can leverage intelligent analytical tools based on

artificial intelligence to gain a nuanced understanding of student writing. These tools can identify the strengths and areas for improvement in students' compositions, facilitating the development of their writing abilities. For instance, some AI-assisted writing tools are capable of analysing students' compositions sentence by sentence and comparatively through natural language processing and text analysis, evaluating them in terms of structure, language, style and expression. To illustrate, when learning prose about landscape description, the AI system will automatically analyse the vocabulary used by students in describing the landscape, identify vivid metaphors, beautiful words and phrases, or delicate descriptions quoted, imitated and borrowed by students, and then provide recognition and mark them as 'highlights'. The AI system will collate these highlights in a resource library, thus providing a reference point for subsequent writing instruction or guidance. In conclusion, AI technology can assist students in identifying and refining their descriptions by providing intelligent and detailed feedback and observation opportunities through VR and AR technologies, thereby enhancing the vividness and expressiveness of their writing.

(4) Leveraging AI Technology for Feedback and Evaluation to Improve Writing Skills

In the field of writing instruction, artificial intelligence (AI) technology has the potential to not only provide students with tailored, real-time feedback but also to assist educators in optimising the correction process and enhancing students' writing abilities. The AI essay evaluation system can assist teachers in providing comprehensive and detailed analysis and feedback on students' essays. To illustrate, upon completion of a composition by a student on the topic of anticipation of the future, the AI evaluation system will initially identify the syntactic and lexical features of the text, highlight any grammatical errors, and offer recommendations for their correction. To illustrate, the system will identify instances of repetition in expression within the sentence structure of some students and recommend the use of alternative sentence patterns to enhance the impact and fluency of the essay. Furthermore, the system identifies students' sentence structures and proposes alternative vocabulary to improve the precision and richness of their expressions. In the event that students utilise vivid metaphors or details when describing a familial scene, the system will identify these elements as noteworthy and provide constructive feedback on their expressions. Such a process enables students to become aware of both their strengths and weaknesses in writing, while also facilitating the enhancement of their writing skills through the iterative process of feedback.

5. Reflecting on the Effectiveness of Artificial Intelligence Technology in Writing Instruction

(1) Emphasizing "Models" Without Solely Relying on Them to Enrich Teaching Methods

The utilisation of artificial intelligence technology for the purpose of facilitating the teaching of writing can assist educators in circumventing the conventional, inflexible approach to pedagogy. By employing an engaging and interactive methodology, educators can foster a tranquil, uninhibited and receptive ambience conducive to students' intellectual growth and the cultivation of their independent thought processes and imaginative expression. Nevertheless, AI technology can also furnish beginners with standardised writing templates and language guidance, thereby facilitating students' rapid comprehension of structured writing methods. Nevertheless, it is challenging to cater to the diverse needs of students by relying on a singular, fixed model, particularly for those who are driven by a passion for self-expression and creativity. Consequently, while AI technology offers a structured reference for students' writing, it also encourages them to adapt and refine the teaching content and methodology as they develop their fundamental writing abilities. This approach enables continuous stimulation of students' creative faculties, ensuring that their individual differences and diverse needs are met.

(2) Combining Traditional and Modern Approaches to Transform Learning Styles

The utilisation of artificial intelligence (AI) does not signify the total displacement of the teacher

in the classroom setting, nor does it imply that educators will relinquish their role in fostering students' communication skills, including speaking, reading, and writing. The advent of artificial intelligence technology has infused traditional writing instruction with new vitality, gradually giving rise to a student-centred, structured teaching and instrumental teaching mode. The integration of artificial intelligence technology has effectively extended traditional teaching methods, making the classroom learning and writing process of students more interactive and diversified. This has prompted students to optimise their thinking and expression in the process of writing, and has gradually transformed the traditional teacher-led mode into a mode of teacher-student joint participation and technical assistance. Furthermore, the utilisation of artificial intelligence technology facilitates the enhancement of students' interest in learning, the cultivation of their independent learning abilities, and the nurturing of their innovative thinking and comprehensive quality. This results in the creation of a personalised and interactive learning experience, which ultimately serves to complement the advantages of traditional and modern teaching.

(3) Collaborative "Dual-Teacher Guidance" to Enhance Educational Outcomes

The advent of artificial intelligence has paved the way for the implementation of a novel tutoring approach, namely 'two-teacher tutoring', which has the potential to enhance students' writing abilities while simultaneously optimising the efficacy of teacher training. The traditional 'single-teacher' model is constrained by the limitations of the individual tutoring ability of teachers, which is often restricted by the number of students in the classroom, teaching time and other factors. This can result in some students' needs not being fully met. However, the assistance provided by artificial intelligence technology is not limited to the guidance and feedback that teachers can offer students. It can also facilitate independent learning for students, removing the constraints of time and space that have traditionally limited the scope of teacher-led instruction. Furthermore, the incorporation of virtual reality technology enhances the 'dual-teacher tutoring' approach, rendering it more three-dimensional and comprehensive. The creation of virtual teacher tasks and virtual reality environments enables students to promptly access the counsel of the AI system, as well as engage in face-to-face discussions and counseling with virtual teachers. This collaborative educational model between AI and teachers not only addresses the need for students to enhance their writing abilities but also facilitates the cultivation of students' emotional expression and creative thinking. This approach diversifies and synthesises educational objectives, ultimately achieving the effect of multiple parenting, encompassing both writing skills and personality development.

6. Conclusion

Overall, the implementation of AI in language writing instruction has yielded significant outcomes, prompting substantial advancements in fundamental education in Hong Kong. From enhancing the efficacy of pedagogical practice in the classroom to optimising the efficacy of evaluation and feedback, AI technology has not only augmented the resources available to teachers, but also stimulated students' creative thinking and enthusiasm for writing through immersive experiences and interactive learning. The judicious application of AI technology enables educators to more effectively assist students in enhancing their writing abilities, while simultaneously enhancing the overall quality of instruction. In the future, teachers will continue to enhance their digital literacy, monitor the advancements in AI technology, and facilitate the seamless integration of AI into traditional pedagogical practices. This will enable students to benefit from a more expansive learning environment and holistic development.

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