Research on the Construction of Incorporating Multimodal Large Models into the BOPPPS Teaching Model

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Abstract. Multimodal large models are increasingly becoming a hot topic in the field of artificial intelligence, with significant advancements in general domains, yet they are still in their infancy in education. The BOPPPS teaching model, which is student-centered and oriented around educational objectives, has greatly enhanced teaching effectiveness and is widely applied. This paper first combines multimodal large models with the BOPPPS teaching model to explore the advantages of applying large models in the implementation of BOPPPS, establishing a BOPPPS teaching model supported by large models to promote students' active knowledge construction and the cultivation of higher-order thinking skills. Secondly, it compares the BOPPPS teaching model supported by multimodal large models with the traditional BOPPPS model from multiple dimensions. Finally, it analyzes the challenges that large models face in course teaching.

Keywords: Multimodal; large model; BOPPPS teaching model.

1 Introduction

The New Generation Artificial Intelligence Development Plan of the State Council proposes to fully utilize technologies such as artificial intelligence to construct a new intelligent learning and interactive learning education system. With the rapid evolution of artificial intelligence technology, large models of artificial intelligence have been widely applied[1]. The rise of large models such as GPT, Claude, and Wenxin Yiyan is like a powerful wave, rapidly sweeping across various fields. The education field, as the main arena for talent cultivation, has also been greatly affected. Large models, with their powerful data analysis and processing capabilities, intelligent interaction experiences, and rich and diverse forms of expression, have demonstrated astonishing natural language understanding, generation, and knowledge reasoning abilities[2]. Multimodal large models will accelerate educational transformation and promote the digital transformation of the education ecosystem.

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The BOPPPS teaching model, as an emerging teaching model that emphasizes participatory learning and feedback, has been widely recognized and has achieved certain results in practical applications[3][4]. However, some problems have gradually emerged. For example, for some courses with strong theoretical content and more abstract content, it may be difficult to design an interesting introduction section; the teaching goals are not clear and lack measurability; students' participation enthusiasm is not high, and the differences in students' levels affect the participation effect; the post-test method is single and the feedback is not timely. These problems have, to a certain extent, affected the further improvement of the teaching effect and the comprehensive development of students. However, the emergence of large models has brought new opportunities to solve the existing problems of the BOPPPS teaching model. Through advanced natural language processing technology, multimodal interaction technology, etc., large models can greatly enrich the BOPPPS teaching model,[5][6] inject new vitality into the teaching introduction section, make the teaching goals more clear and measurable, optimize the methods and effects of pre-tests and post-tests, improve the quality and fairness of participatory learning, and also provide more powerful teaching support for teachers, facilitating education to a higher level.

This paper will deeply explore the advantages of applying large models when implementing the BOPPPS teaching model, establish a BOPPPS teaching model supported by large models, and thus promote students' active knowledge construction and the cultivation of high-level thinking abilities. It provides beneficial thinking and exploration for the innovative development of education.

2 Multimodal Large Models and the BOPPP Teaching Model

2.1 Multimodal Large Models

Multimodal large models refer to artificial intelligence models that are trained based on a large amount of multimodal data (such as text, image, audio, etc.), have extremely large parameters, and can be applied to a variety of different tasks. It has experienced development stages such as single-language pre-training models, multi-language pre-training models, and multimodal pre-training models.[7] It has powerful language understanding and generation capabilities it can understand natural language text and generate high-quality text responses. It can integrate multimodal data and provide more extensive information and a more comprehensive understanding.

With the application of large models in the education field, various educational large models have gradually emerged, providing intelligent solutions for the education field. Through a large amount of data, it promotes the automatic generation of teaching resources, and according to the learning history and characteristics of students, provides personalized learning suggestions and resources. It can provide real-time feedback on students' questions and performance, helping students adjust their learning strategies in a timely manner.

2.2 BOPPPS Teaching Model

The BOPPPS teaching model originated from the Instructional Skill Workshop (ISW) project of teachers in British Columbia, Canada. It is based on constructivism and the communicative approach as theoretical bases and is a student-centered model that improves students' learning effects through clear teaching goals, effective teaching activities, and timely feedback evaluation[8]. The name BOPPPS is composed of the initial letters of English words in different teaching stages. As shown in Figure 1, it includes six stages Bridge-in (Introduction), Objective (Learning Goals), Pre-assessment (Pre-Test), Participatory Learning, Post-assessment (Post-Test), and Summary. It emphasizes that students should participate in learning in all aspects rather than just listening; it also requires timely acquisition of students' feedback information to adjust subsequent teaching activities in order to successfully achieve the teaching goals.

The introduction is the beginning of the entire teaching process, and its role is to attract students' attention and increase students' interest in learning, making students aware of the theme and importance of the course. The learning goals should be formulated from the perspective of learners, be clear, appropriate, achievable, and measurable, involving cognitive, skill, and affective aspects, combined with the goals of subject core competencies. The pre-test is used to understand students' interests and prior knowledge, adjust the difficulty and progress of subsequent teaching, and make the goals of the course more focused. Participatory Learning is the main part of the entire teaching process, and its purpose is to encourage students to learn actively, think deeply, and strengthen impressions. The post-test is used to evaluate students' learning outcomes and check whether the learning goals have been achieved. The summary is a summary review of the teaching content by the teacher, a summary of knowledge points, allowing students to further consolidate the learning effect. The entire teaching loop is independent of each other but closely related, which can effectively improve the teaching effect and enable students to develop the ability of autonomous exploration, thus promoting the cultivation of high-level thinking abilities.[9]

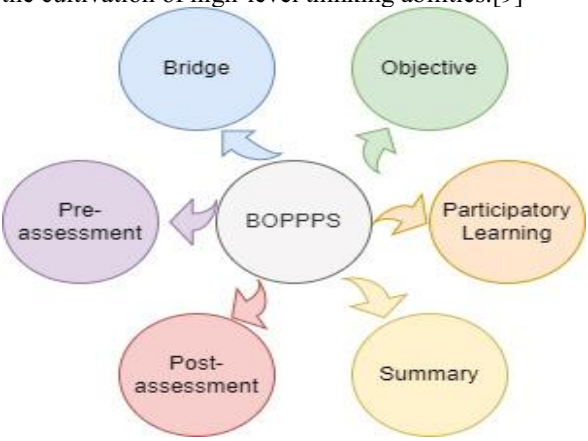

Fig. 1. BOPPPS Teaching Model

3 The Construction and Application of the BOPPPS Teaching Model of Multimodal Large Models

As shown in Figure 2, the multimodal large model establishes different large models through massive data in links such as introduction, goal, pre-test, participatory learning, post-test and summary, enriching the OBPPPS teaching mode and improving teaching effectiveness.

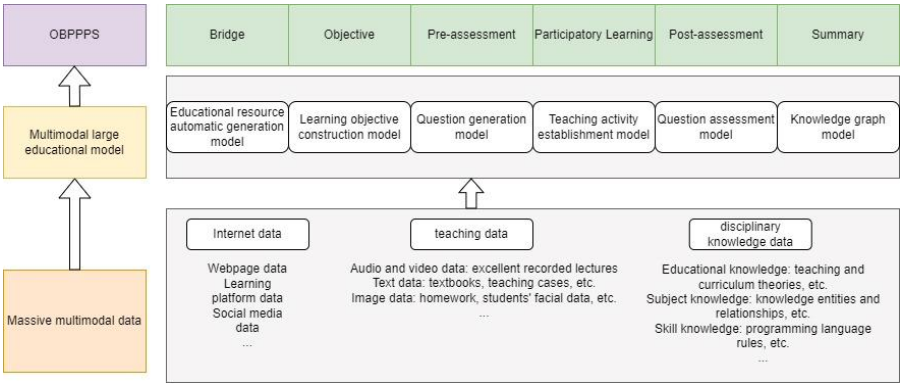

Fig. 2. OBPPPS teaching mode of multimodal large model.

3.1 The Bridge-in (Introduction) Stage

The Bridge-in is a behavior of teachers to formally guide students in classroom teaching. A good introduction can bring students into the teaching situation and arouse students' enthusiasm and initiative for learning. Usual introductions include concept introduction, story introduction, scenario introduction, video introduction, question introduction, case introduction, review of previous knowledge introduction, and interactive introduction. These introductions are inseparable from a variety of materials and diverse presentation methods. Multimodal large models can quickly integrate multimodal information, providing rich materials and diverse presentation methods for the course introduction. For example, teachers can use the model to search for text, image, video, audio[10], etc. materials related to the course theme, establish a knowledge graph supported by multimodal large models, and quickly query various related knowledge points and teaching resources presented in different carriers required for the course[11]. It is also possible to establish a teaching resource automatic generation model. Based on the characteristics of subject resources and the learning style of learners, personalized resource push can be achieved, providing contextual learning resources for learners, enriching the introduction stage, making the course introduction more in line with the needs of students, and increasing students' participation in the course. For instance, the multimodal teaching resources generated by Ou Zhigang and Liu Yuping from Minzu University of China using AIGC technology can provide a wealth of course materials for the Bridge-in phase.

3.2 The Objective (Learning Goals) Stage

The learning goals are to make students clear about the learning tasks of this class and what they should be able to do after learning this class. The learning goals should be closely related to students' cognitive development level, national policies, curriculum standards, subject core competencies of the curriculum, and knowledge points of the curriculum. The learning goals should be specific, measurable, achievable, relevant, and have a time limit. Multimodal large models can clearly display the hierarchical structure, key and difficult points, and the relationships between goals of the learning goals. Teachers can use multimodal large models to analyze the teaching content and the actual situation of students, more accurately formulate learning goals that meet the abilities and needs of students. At the same time, according to the performance and feedback data of students during the learning process, the model can help teachers to adjust the difficulty, progress, or emphasis of the learning goals in real time, ensuring that students can better achieve the learning goals.For example, by leveraging big data to survey students' knowledge levels and interests, the basis for setting learning objectives can be hierarchically categorized, assisting teachers in establishing more specific and clearer learning goals.

3.3 The Pre-assessment (Pre-Test) Stage

The Pre-test is to understand the mastery of relevant basic knowledge of students for this class before learning, in order to decide the teaching strategy of this class, whether to review basic knowledge in more detail or simply review and focus on teaching new knowledge points. The questions of the Pre-test must be able to accurately measure the mastery of students and the interest direction of students. Multimodal large models can support various forms of assessment, such as short-answer questions in text form, multiple-choice questions, image recognition questions in image form, and case analysis questions in video form, which can comprehensively understand students' prior knowledge, learning interest, and learning ability. The model can quickly process and analyze students' assessment data, providing detailed analysis reports, helping teachers understand the overall level and individual differences of students, so that teachers can adjust the depth and progress of subsequent teaching content. For instance, by creating a knowledge graph that connects textbook content, a question generation model can be established based on this knowledge graph.

3.4 The Participatory Learning (Participatory Learning) Stage

Participatory teaching is an important part of a class. Teachers need to carefully design activities, choose appropriate scenes, and have various interactions. Only in this way can students be encouraged to self-construct and cultivate high-level thinking. Multimodal large models can simulate various experimental scenes, allowing students to operate experiments in a virtual environment, cultivating practical abilities and scientific thinking. The large model can also rely on voice synthesis, voice recognition, natural

language understanding, digital people, etc. abilities, can play the roles of virtual examiners, foreign language partners, etc., meeting various interaction forms such as oral training in language learning scenes,[12] simulated exams, open topic dialogues. These resources can make students more active in participatory learning, increasing the fun and effectiveness of learning.For example, Tong Hui's research established the ATMB multimodal analysis framework for smart classroom teaching interactions, spanning four dimensions: teaching activities, technology use, location movement, and body posture, aiming to enhance student engagement.

3.5 The Post-assessment (Post-Test) Stage

The Post-test is to detect the teaching effect. Teachers understand what learners have obtained in this class and check whether the teaching goals have been completed. Multimodal large models can design comprehensive post-tests, including questions of various types and modalities, comprehensively examining students' mastery and application abilities of knowledge. Multimodal large models can quickly correct homework and give detailed feedback and suggestions, helping students discover their own shortcomings in a timely manner. Teachers can according to the feedback results of the model understand students' learning situation, evaluate the teaching effect, summarize teaching experience, discover problems existing in teaching, so that they can adjust teaching strategies and improve teaching methods. For example, the intelligent assessment and feedback within Tsinghua University's AI tutoring system.

3.6 The Summary (Summary) Stage

The Summary is a process of guiding students to review and sort out the content learned in this class, aiming to strengthen the understanding and memory of key and difficult points. Multimodal large models can help teachers to sort out and integrate the knowledge points of this class, presenting them to students in various forms, such as mind maps, knowledge cards, animation summaries. These forms can make students more clearly see the relationships and logical relationships between knowledge points, deepening the understanding and memory of knowledge. Through analyzing the learning data of students in the entire teaching process, multimodal large models can evaluate students' learning effect, providing a basis for teachers' teaching reflection. At the same time, the model can adjust the difficulty and content of homework according to students' learning situation, providing personalized homework for students. At the same time, according to the answers of students, the model can give detailed feedback and suggestions, helping students understand their knowledge holes and thinking biases, helping students make a subsequent learning plan, improving learning efficiency. For example, Luo Jianghua's research on the evolution of subject knowledge graphs driven by multimodal large models and their educational applications.

4 Comparison between Multimodal Large Model BOPPPS and Traditional BOPPPS

To more intuitively demonstrate the enhancing effect of multimodal large models on the BOPPPS teaching model, we compare and analyze some evaluation indicators of the teaching model. As shown in Table 1, overall, the traditional BOPPPS teaching model does not have as many modalities as the BOPPPS teaching model supported by large models. Teaching resources and content largely depend on the teacher's knowledge base and the content presented in textbooks; the carriers for presenting knowledge points also do not have as many styles as those supported by multimodal large models. With the support of large models, teaching content can be enriched, compensating for the limitations of a teacher's knowledge scope. It can use data to accurately evaluate students, propose personalized learning objectives and content, and provide timely and effective feedback on students' learning situations, enabling teachers to adjust their teaching strategies.

Table 1. Comparison between Multimodal Large Model BOPPPS and Traditional BOPPPS

Aspect	Dimension	Traditional OBPPPS	OBPPPS Supported by Large Models
Bridge	Learning Interest	Presentation methods rely on teacher's explanation or simple visual aids. Lack of vividness and interactivity.	Utilize various media forms such as video, images, and audio. Attract students through related short videos or interactive images.
	Rich Teaching Content	Content presentation is not rich. Information transmission is single-modal	Rich and diverse teaching content, using different modalities to enhance the transmission and understanding of information.
	Utilizing Teaching Resources	Resources are not diverse and not easily obtained. relying on the teacher's knowledge base.	Resources are diverse and easily obtained. Effective integration and utilization of various teaching resources.
Objective	Clarifying Learning Objectives	Objective setting lacks specificity. dynamic adjustment is not obvious.	Personalized learning objectives tailored to students, supporting dynamic adjustment.
Pre-assessment	Question Chain Generation	Teachers develop appropriate pre-assessment questions based on the course content.	Utilize big data to analyze the consistency of knowledge to develop targeted pre-assessment questions.
Participatory Learning	Activating Classroom Atmosphere	Requires teacher's humorous and witty tone and intonation.	Innovative digital humans, virtual teaching assistants, activate the classroom atmosphere through visual, auditory, and tactile multimodal teaching.
	Increasing Student Engagement	Six stages to increase student engagement, with little modal diversity.	Various ways to participate in the learning process, such as using image recognition technology to assist in learning geometry, and using speech recognition technology for language learning.

Post-assessment	Feedback and Assessment	Feedback is slow, and assessment accuracy is low.	Use technical means to quickly collect and analyze student feedback and learning data, providing timely assessment and feedback.
Summary	Summarizing Trivial Knowledge Points	Teachers and students summarize orally or in writing. Knowledge points are presented linearly or unstructured.	Present the correlation of knowledge points using a modal knowledge graph. Structured presentation shows the logical relationships and hierarchical structure between knowledge points.
Others	Personalized Learning	Requires teacher intervention and adjustment for personalized learning support.	Utilize learning data analysis to provide personalized learning resources and teaching methods. Dynamically adjust according to student habits and preferences to achieve personalized teaching.
	Occupies Extracurricular Time	Does not occupy extracurricular time.	Requires students to upload personal data, requires teachers to analyze data, and utilize models.
	Broadening Learning Perspectives	Not conducive to interdisciplinary and life-integrated teaching. Relies on the teacher's experience and ability.	Flexibly integrates knowledge from other disciplines, combines with practical life for learning. Provides a broader perspective and deeper analysis to help students broaden their learning perspectives.

5 Challenges of the BOPPPS Teaching Model with Multimodal Large Models

The application of multimodal large models in the BOPPPS teaching model shows significant advantages, but it also faces some challenges. The following are specific challenges analyzed from three perspectives: data privacy, resource availability, and teacher preparedness:

5.1 Data Privacy

Multimodal large models need to process and analyze a vast amount of student data, including learning habits, grades, feedback, etc., which all involve student privacy. It is essential to ensure the security of this data to prevent data breaches or unauthorized access. For instance, a privacy protection method based on modal consistency in collaborative training for multimodal learning has been proposed, which can protect data privacy while utilizing multimodal data.

5.2 Resource Availability

Multimodal large models typically require substantial computational resources and data storage capabilities, which may pose a challenge for some educational institutions. Moreover, the training and maintenance of the models also require professional technical support. Developing resource-efficient strategies to support the scalable and environmentally sustainable development of these large models has become a priority.

5.3 Teacher Preparedness

Teachers need to have the appropriate technical knowledge and instructional design skills to effectively utilize multimodal large models to support the BOPPPS teaching model. This may require additional training and professional development opportunities. When implementing the BOPPPS teaching model, teachers need to prepare pre-course knowledge videos, pre-assessment questions, teaching cases, key course videos, and post-course assessment questions, which may increase the workload of lesson preparation. It is also important to avoid the misuse of large models, such as blindly trusting the data and content provided by the models without thoughtful consideration in teaching.

6 Conclusion

Multimodal large models have brought new vitality and innovation to the BOPPPS teaching model. Through the application in the links such as introduction, objective, pre-assessment, participatory learning, post-assessment and summary, multimodal large models can improve the interestingness, personalization and effectiveness of teaching and promote the all-round development of students. However, in the process of applying multimodal large models, teachers also need to pay attention to the rational use and avoid excessive dependence on technology to ensure that the dominance of teaching is always in the hands of teachers. At the same time, it is also necessary to continuously explore and innovate, combine with the teaching reality, and give full play to the advantages of multimodal large models to make greater contributions to improving the teaching quality and students' learning effects.

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