



Research and Application of Progressive Blended Instructional Mode Based on Generative Artificial Intelligence

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Abstract. Based on the background of Artificial Intelligence, this paper applies deep learning theories and methods, and combines the interaction between technology and education field to explore the effective integration mechanism of Generative Artificial Intelligence and hybrid instructional mode. It breaks through most of the traditional research categories of Instructional activities based on the three major Instructional processes of pre-class, mid-class and post-class. Based on the deep learning path, it establishes a progressive hybrid Instructional model based on Generative Artificial Intelligence, and applies this model to the course "Planning and Operation of Live E-commerce" to test its effect. The results show that this model is conducive to improving students' logical thinking ability, problem-solving ability, innovation ability and critical thinking. This model provides a new idea for the integration of Generative Artificial Intelligence and Instructional, innovates and enriches the online and offline mixed Instructional model, and provides a demonstration for subsequent relevant research.

Keywords: Blended Instructional Model, Generative Artificial Intelligence, Deep Learning.

1 Introduction

Generative Artificial Intelligence (GAI), as an important branch of Artificial Intelligence (AI), has demonstrated powerful functions such as text processing, image processing, copywriting, literary creation and paper writing, which has impacted users' new cognition of artificial intelligence. Its impact on the field of education has also triggered a heated discussion among scholars in the field of education.

In order to further clarify the relationship between generative artificial intelligence and Instructional, this study focuses on hybrid Instructional, intends to build a hybrid Instructional model embedded with generative artificial intelligence, explore a Instructional action path oriented to generative artificial intelligence, and provide ideas for promoting the integration of technology and education and innovative Instructional models.

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2 Research Status of Blended Instructional Mode

Blended Instructional has always been a research hotspot in the field of education, and the research content basically covers the whole process of research, including blended Instructional mode, Instructional design, mode application, methods and strategies, environment and technology, evaluation and reflection, etc.

Due to the limitation of Instructional content and Instructional environment, blended Instructional has the phenomenon of "standardization" and "superficial". Online Instructional in the existing blended Instructional model provides students with standardized learning, which cannot provide students with differentiated learning paths in time [1], and cannot meet the personalized learning needs of students. At the same time, the online course design explains superficial knowledge and students' knowledge reserve is insufficient, which makes it difficult for students to participate in or cooperate with teams to complete implementation projects in offline Instructional [2]. In addition, Instructional content and learning resources are only "mixed" but less "combined", resulting in a lack of Instructional mode design for cultivating higher-order thinking [1]. It leads to the "superficial" of practical application.

3 Research on the Impact of Generative Artificial Intelligence on Education

Generative Artificial Intelligence subverted the Instructional ecology of higher education, provided students with adaptive personalized learning environment and immersive learning experience, and freed teachers from tedious transactional work and concentrated on creative knowledge production activities [3]; It can significantly improve the Instructional effect and change students' learning performance, problem-solving ability, critical thinking ability, learning attitude, self-efficacy and intrinsic learning motivation [4]; It can reshape Instructional activities [5][6], it is conducive to the implementation of personalized Instructional [7][8].

It can be seen that Generative Artificial Intelligence creates a better environment for students to realize personalized learning and deep learning, and also allows teachers to get rid of transactional work and focus more on the cultivation of students' creative, critical and other higher-order thinking. Generative artificial intelligence provides an opportunity to solve the problems of "standardization" and "superficial" existing in hybrid Instructional mode.

4 Construct a Progressive Hybrid Instructional Model Based on Generative Artificial Intelligence

Although the academic community has actively explored the mechanism and practical path of effective integration of Generative Artificial Intelligence and Instructional [4][5][9], but the current research on the application of Generative Artificial Intelligence to Instructional mainly focuses on expanding new Instructional tools and fields,

even has the suspicion of showoff skills, and fails to truly solve the problems of "standardization" and "superficial" in blended Instructional.

Based on the above analysis, this paper attempts to organically integrate the Instructional field formed by generative artificial intelligence platform, online Instructional platform and offline Instructional classroom on the basis of higher vocational Instructional process and deep learning theory. To construct a progressive hybrid Instructional model of "student-centered", which can gradually cultivate students' advanced thinking ability, including three main subjects of teachers, class teachers and students, four stages of goals at the beginning, middle, high and ultra-high level, and four stages of fragmented perception, structured association, abstract transfer and interdisciplinary extension.

4.1 Instructional Concept

Establish the Instructional concept of "student-oriented, teacher-oriented", build a student-centered learning environment, encourage students' active exploration, active participation and critical thinking, and teachers, as designers, guides and supporters in this process, jointly promote the improvement of Instructional quality and the overall development of students' comprehensive quality.

4.2 Instructional Objectives

According to the "nine-stage model of educational process" proposed by Robert Mills Gagne, a famous contemporary American educational psychologist, external Instructional activities should follow learners' internal psychological process, first allowing learners to learn and master new knowledge, then consolidating and reconstructing what they have learned, and finally promoting knowledge retention and transfer. Based on this, this paper divides the Instructional objectives into stages, constructs the progressive Instructional objectives of the beginning, middle, high and ultra-high levels, and adopts different Instructional methods.

The objectives of each stage are shown in Figure 1.

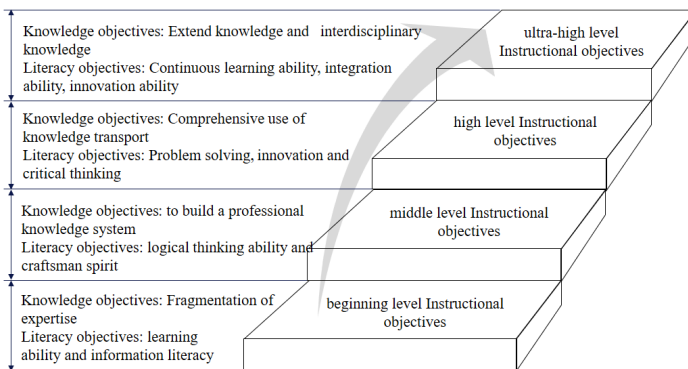


Fig. 1. Design of progressive instructional objectives system.

4.3 Instructional Content and Activity Design

Instructional Subject. In the existing Instructional process, the main body of Instructional is the teacher and the student. The Instructional subject in the era of Artificial Intelligence, in addition to teachers and students, there are also intelligent Instructional assistants derived from generative artificial intelligence systems, referred to as "humanlike teacher", and the Instructional subject is expanded to the three main subjects of teachers, humanlike teachers and students. In the case that Generative Artificial Intelligence greatly facilitates students' autonomous learning and personalized learning, the Instructional activities of "two teachers" and "students" are reasonably designed, and the strengths of "teachers" and "humanlike teacher" are utilized to design high-quality Instructional activities and effectively complete them.

Instructional Process Stage. This study relies on deep learning theory to construct the Instructional process. Deep learning refers to learning activities in which higher-order cognitive strategies are applied to achieve problem solving [10]. Compared with shallow learning, deep learning puts more emphasis on learners' in-depth understanding of knowledge, connection reconstruction, transfer and application [11]. It can solve the problems of "standardization" and "superficial" in the mixed Instructional mode very well. This article summarizes the theory of deep learning and constructs the core model of deep learning from complexity to simplicity: fragmented perception → structured association → abstraction transfer → interdisciplinary extension. Based on this, the instructional process is divided into four stages: "fragmented perception" before class, "structured association" and "abstract transfer" during class, and "interdisciplinary extension" after class.

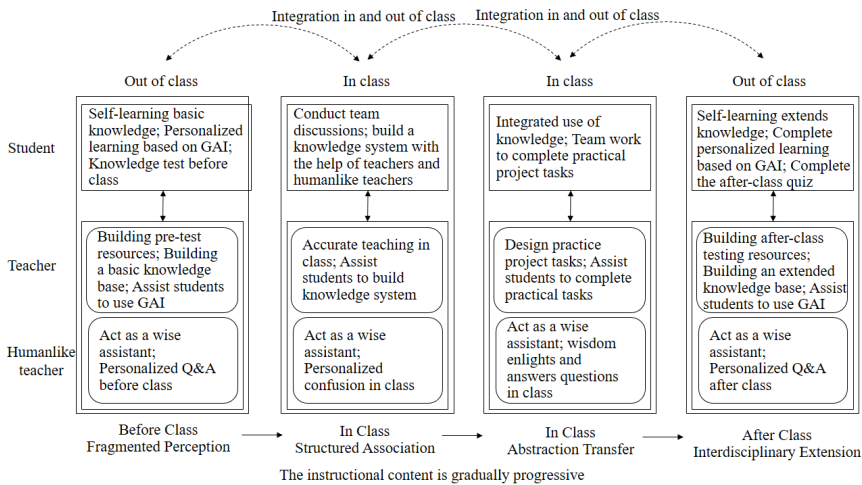


Fig. 2. Progressive blended instructional model based on GAI platform.

Instructional Content and Activities in Each Stage. Based on the above four stages of the instructional process, the Instructional activities of students, teachers and human-like teachers in each stage are reasonably designed, so that students can gradually learn and master knowledge, apply and create knowledge, and then extend knowledge across disciplines to achieve deep learning effects. The Instructional activities of teachers, humanlike teachers and students at each stage are shown in Figure 2.

5 Instructional Practice and Effect Evaluation

This study primarily focuses on the course “Planning and Operation of Live E-commerce” for marketing students of grade 2023 in Guangdong Mechanical and Electrical Polytechnic. The Instructional practice is exemplified through the module “Anchor character setting” which serves as a basis for developing instructional evaluation index system and assessing its effectiveness.

5.1 Instructional Objectives

The instructional objective of this module has been formulated in accordance with the progressive instructional objective framework.

From the primary goal of students mastering the basic knowledge of anchor character setting, to the middle goal of students building a live broadcast knowledge system, to the advanced goal of students comprehensively applying knowledge and completing the practical tasks of anchor character setting, and finally, students complete the ultra-high goal of extending interdisciplinary knowledge and higher difficulty practical tasks, so that students can gradually achieve the goal of deep learning.

The specific details are shown in Figure 3.

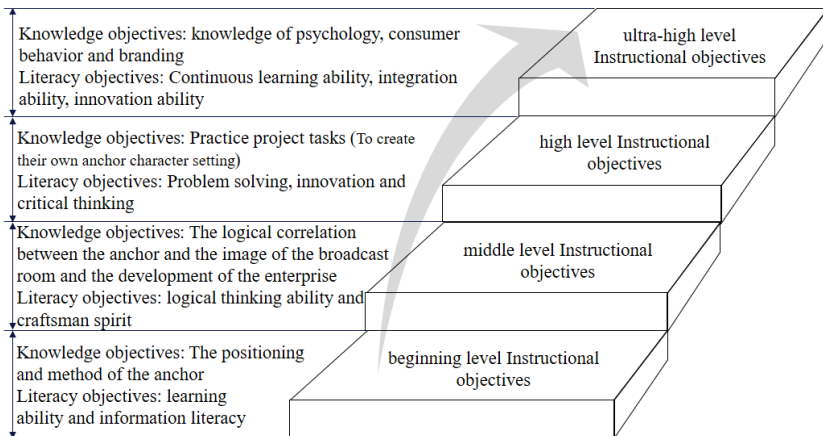


Fig. 3. Design of progressive instructional objectives system of "anchor character setting" knowledge template.

5.2 Design Instructional Contents and Activities

According to the objectives of the above stages, the Instructional content and activities are designed to achieve the purpose of gradually training and improving students' higher-order thinking ability. The specific details are shown in Figure 4.

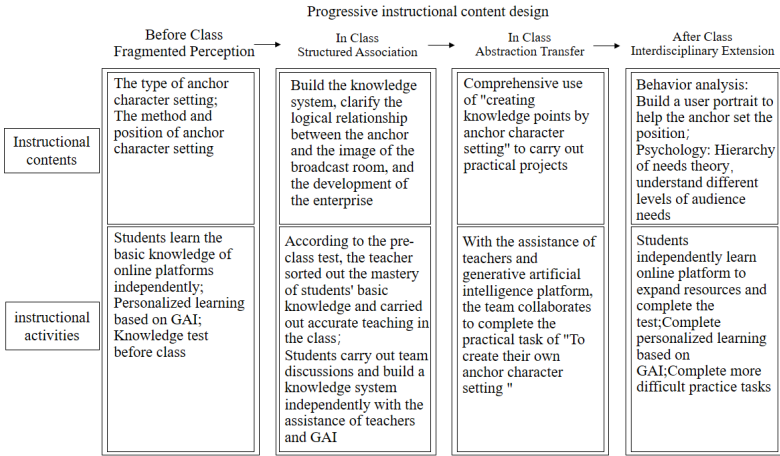


Fig. 4. Instructional contents and activities design of "anchor character setting" knowledge template.

5.3 Instructional Evaluation

Preparation Stage.

Set up an evaluation team. Establish an evaluation team composed of marketing director, professional leader and marketing planning course teacher team, and clarify the responsibilities and division of labor of each member to ensure that the evaluation team has sufficient professional knowledge and evaluation experience.

Discuss the construction of evaluation system and evaluation table. The evaluation team determined the evaluation index system by reviewing the literature, referring to the Instructional quality evaluation and curriculum construction evaluation standards formulated by the education and Instructional departments, and combined with the actual situation. The specific details are shown in Table 1.

Table 1. The instructional evaluation index system of knowledge module "anchor character setting".

First level index	Second level index	Description of indicators
Test before class (10 scores)	<i>Pre-class test (10 scores)</i>	<i>Assess students' ability to master basic knowledge</i>
Class participation (30 scores)	<i>Classroom learning task completion quality (10 scores)</i>	<i>Assess students' logical thinking ability and</i>

	<i>Quality of challenging tasks in the classroom (10 scores)</i>	<i>knowledge integration ability</i>
	<i>Ability to solve problems independently (10 scores)</i>	
Practice in class (40 scores)	<i>Team division and cooperation (10 scores)</i>	<i>It examines students' ability to use knowledge, solve problems, innovate and think critically</i>
	<i>Logical thinking of project plans (10 scores)</i>	
	<i>Practical application value of plans (10 scores)</i>	
	<i>Innovation of project plans (10 scores)</i>	
Extension after class (20 scores)	<i>Knowledge extension testing (10 scores)</i>	<i>To assess students' ability of interdisciplinary learning, system thinking and integration</i>
	<i>Quality of challenging tasks (10 scores)</i>	

Determine the evaluation object. This study takes 204 marketing students of grade 2023 in Guangdong Mechanical and Electrical Polytechnic as the evaluation object, and 217 marketing students of grade 2022 as the control group to carry out the research, and determine the effect of progressive blended instructional mode based on generative artificial intelligence platform by comparison.

Data Results and Analysis.

According to the above evaluation index system, the evaluation team first observed and evaluated the instructional performance of marketing students of grade 2022 and grade 2023 in the module of "Anchor character setting", then jointly discussed and determined the score of each index of the evaluation module, finally calculated and determined the total score of each student. The descriptive statistical analysis is completed according to the total score, and the specific results are shown in Table 2.

Table 2. Descriptive statistical analysis of the results of the knowledge module of "anchor character setting" for marketing students of grade 2022 and 2023.

Statistical Index	Scores for the grade of 2022	Scores for the grade of 2023
Average value	78.52 scores	84.41 scores
Standard deviation	6.09	7.36
Minimum value	63.5 scores	64 scores
Median score	77.15 scores	83.43scores
Maximum values	91.5 scores	94.5 scores
Sample size	217 students	204 students

According to the above data, the average score, median and maximum value of marketing students of grade 2023 have been greatly improved compared with those of grade 2022, indicating that under the new instructional mode, students' mastery of the knowledge points of the module of "Anchor character setting" and their ability to apply what they have learned have been greatly improved.

There is little difference in the minimum value between the two grapes of students, and the standard deviation does not decrease but increases. In the new instructional mode, generative artificial intelligence technology is introduced to assist students' autonomous learning and personalized learning. Its effect is greatly affected by students' self-discipline, and it is difficult to play its effect for some students with insufficient learning motivation. Therefore, the performance of students with poor self-discipline will not be improved due to the change of instructional mode. However, students with good self-discipline have been greatly improved because of more scientific instructional design, which leads to a larger achievement gap between students.

According to the data in Figure 5, in the pre-class testing module of instructional evaluation, the average score of grade 2023 students is 9.02 points, and that of grade 2022 students is 8.57 points, increasing by more than 5%, indicating that with the help of Generative Artificial Intelligence, students have made further breakthroughs in the mastery of basic knowledge and can basically master basic knowledge. In the classroom participation module, the average score of class 2023 students is 25.67 points, and that of class 2022 students is 23.95 points, with an increase of more than 7%, and the ability of students to integrate knowledge has been further improved. In the classroom practice module, the average score of grade 2023 students is 35.19 points, and that of grade 2022 students is 31.86 points. The score of students is increased by more than 10%, which is a large improvement. Students can better use the knowledge they have learned to solve problems, and their innovation ability and critical thinking are greatly improved. In the after-class extension module, the average score of 2023 students is 13.53 points, and that of 2022 students is 14.14 points, a decrease of 3%. The extension and interdisciplinary knowledge mastery are not improved but decreased, and it is difficult to complete the practical task of integrating interdisciplinary knowledge. This may be due to the limitation of professional knowledge and the increase of the number of students in the five-year continuous system of secondary and higher vocational educations. As a result, students' thinking is limited early, and it is difficult to accept and master non-professional knowledge.

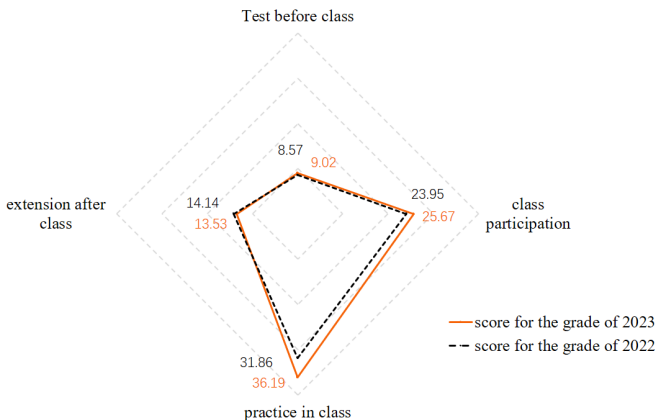


Fig. 5. Scores of each module of "anchor character setting" knowledge of marketing students of grade 2022 and 2023.

The secondary indicators in each module of teaching evaluation were analyzed according to the data in Figure 6. Students of Grade 2022 perform well in pre-class test, classroom learning task completion quality, team division and cooperation and after-class test, indicating that students have a good grasp of basic classroom knowledge, and marketing students generally have high emotional intelligence, which makes the team division and cooperation harmonious. However, their performance in challenging tasks in class, ability to solve problems independently, logical thinking of project plans, practical application value of plans and innovation is average. Students are generally in the low-price thinking ability of remembering basic professional knowledge. But they are deficient in higher-order thinking skills such as comprehensive using of knowledge to solve practical problems, logical thinking ability and innovation ability, especially lacks the ability to use interdisciplinary knowledge to solve professional problems.

The evaluation scores of all indicators of students of grade 2023 have been significantly improved compared with those of students of grade 2022, especially in the three dimensions of logical ideas of schemes, practical application value of schemes and innovation of schemes in the classroom practice module, the scores have been increased by more than 15%. In the class participation module, students' ability to solve problems independently has also been improved by more than 7%, indicating that under the new instructional mode, students' autonomous learning ability can be greatly stimulated and their ability to solve problems, logical thinking ability and innovation ability can be improved through the personalized intelligent question answering function of generative artificial intelligence and the game-based teaching process design.

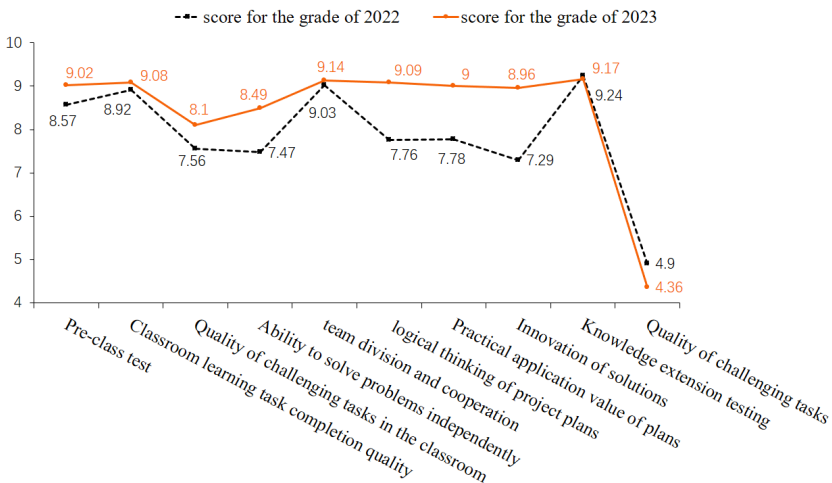


Fig. 6. Scores of each instructional evaluation index for marketing students of grade 2022 and grade 2023.

However, in terms of the quality of extension test and extension challenging tasks in after-class development, the quality of 2023 students is lower than that of 2022 students. The extension test is mainly aimed at the learning and detection of extended

knowledge, which is more difficult. This may be because there is a large proportion of students in the five-year continuous system of secondary and higher vocational educations in 2023. Due to the early acceptance of professional learning, the thinking is solidified, and the learning of cross-professional knowledge is difficult, resulting in poor learning effects.

6 Conclusions

Based on the background of artificial intelligence, this paper studies the integration mechanism of Generative Artificial Intelligence and blended instructional mode, and constructs four instructional processes of fragmented information, structured association, abstract transfer and interdisciplinary extension based on deep learning theory. This model is applied to the course of "Planning and Operation of Live E-commerce". The practice has proved that the progressive blended instructional model based on Generative Artificial Intelligence is conducive to improving students' logical thinking ability, problem solving ability, innovation ability and critical thinking and other higher-order thinking ability in this professional knowledge on the whole. This is mainly due to the fact that Generative Artificial Intelligence can provide personalized learning needs for students, timely answer students' doubts in the process of autonomous learning, and liberate the classroom from the popularization of basic knowledge to the construction of knowledge system and the development of practical projects. This is mainly due to the ability of generative artificial intelligence to provide personalized learning needs for students and timely answer students' doubts in the process of autonomous learning. The classroom can be transformed from the popularization of basic knowledge to the construction of knowledge system and the implementation of practical projects, so that students can change from shallow learning to deep learning, and more classroom time can be used to train and improve students' higher-order thinking ability such as logical thinking, problem solving, innovation and critical thinking. However, due to the limitation of professional knowledge and the popularization of the five-year continuous system of secondary and higher vocational educations, the improvement effect of interdisciplinary knowledge learning ability and interdisciplinary comprehensive application ability is not obvious. This paper provides a certain demonstration for later scholars to study the combination of Artificial Intelligence technology and blended instructional mode, but the research is relatively rough and needs to be further refined and improved.

Acknowledgments

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