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Research on Teaching Strategies Based on the ADDIE Theory in a Ubiquitous Learning Environment: A Case Study of the Creative Thinking Course

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Abstract: The ADDIE model is a systematic methodology for conducting instructional design. Applying the ADDIE instructional design model in the teaching of the Creative Thinking course can effectively promote the implementation of design thinking education. Based on the ADDIE model and using the Creative Thinking course as a case study, this research explores flipped classroom teaching models and strategies for art and design courses. The study conducts instructional design and methodological research across the five stages of the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. The research preliminarily establishes a theoretical framework for flipped classroom instructional design based on the ADDIE model within a ubiquitous learning environment for art and design majors. This framework facilitates the rationalization of the instructional system and advances the optimization of teaching content for courses in the art and design field.

1. Introduction

The ubiquitous learning environment refers to a pervasive network formed by the interconnection of various devices and resources such as computers, databases, and the internet. This environment, supported by emerging information technologies like cloud computing, mobile internet, and the Internet of Things, has brought about innovations in educational systems and provided opportunities and technological possibilities for breakthroughs in teaching models.

2. An Analysis of the Development Trends of Instructional Design in a Ubiquitous Learning Environment

2.1 Teaching Philosophy

The objective learning theories of the early 21st century have evolved into the current constructivist learning theories. Compared to earlier learning theories, constructivism emphasizes a shift in the focus of learning: from an emphasis on external input to an emphasis on internal generation; from “individual” learning to “socialized” learning; and from “decontextualized” learning to “contextualized” learning[1]. The constructivist view of learning emphasizes a learner-centered approach, highlighting intrinsic generation, social interaction, and contextual application,

providing modern education with more teaching methods centered around student experiences.

2.2 Teaching Format

In a ubiquitous learning environment, teaching formats are undergoing a transformation from a singular linear structure to a complex open system, reflecting modern education's response to the diversity and personalization of learning needs.

Open systems provide a wide range of external information resources. Whether it is online databases, multimedia learning materials, or collaborative resources in social networks, learners can access these resources anytime and anywhere. This greatly expands the boundaries of learning, enabling learners to obtain high-quality content from around the globe.

2.3 Teaching Content

In a ubiquitous learning environment, the teaching philosophy has shifted from the traditional focus on "supporting knowledge transfer" to "supporting learner learning activities as the core objective." This transformation means that instructional design no longer solely emphasizes the one-way transmission of knowledge but places greater importance on learner participation and initiative, aiming to meet the diverse needs of individual learners.

3. The Meaning and Characteristics of Flipped Classroom in a Ubiquitous Learning Environment

3.1 Characteristics of Learning Communities in Ubiquitous Learning

In traditional instructional design, teachers and students are separate entities. The role of teachers is to serve as the party responsible for the output of knowledge, while students are the passive recipients of knowledge. In the context of the ubiquitous learning environment, instructional design has evolved into a two-way interactive model where teachers interact with students and students interact with teachers. Students have transformed from passive recipients in the flow of knowledge into active participants in the classroom. Students and teachers form a symbiotic relationship in the learning of micro-courses within the ubiquitous learning environment[2].

3.2 Fragmented Characteristics of Ubiquitous Learning

In traditional teaching models, classroom time is relatively fixed. However, in a ubiquitous learning environment, learners can effectively utilize fragmented time through information terminals to study segmented knowledge content.

Learning resources in a ubiquitous learning environment include subject knowledge points, example problems, exercises, practical demonstrations, etc. Short-duration videos presented as micro-lessons are the primary form of learning resources. The characteristics of these learning resources are diversity, modularity, and rapid dissemination.

3.3 Transcendent Temporal and Spatial Characteristics of Ubiquitous Learning Environments

The ubiquitous network is formed by the integration of various devices and resources such as computers, databases, and the internet, creating a unified network environment. This characteristic allows learners to break free from the limitations of physical locations and time; as long as they are within the coverage of a network signal and have a connectable terminal device, they can access the

network and engage in personalized and autonomous learning.

4. Construction of the ADDIE Teaching Model for the "Creative Thinking" Course

The ADDIE model is a non-linear and general instructional design model, which consists of five essential teaching stages: analysis, design, development, implementation, and evaluation . These five stages are closely interconnected and mutually supportive.

The ADDIE model is a general framework suitable for the instructional design application requirements of higher education in industrial design. Our research team uses the ADDIE model as a theoretical basis, and the scientific and systematic methods provided by the ADDIE instructional design framework are combined with the characteristics of the industrial design discipline to construct an ADDIE flipped classroom instructional design model in the teaching practice of the 'Creative Thinking' course (see Fig 1 ADDIE Flipped Classroom Instructional Design Model)

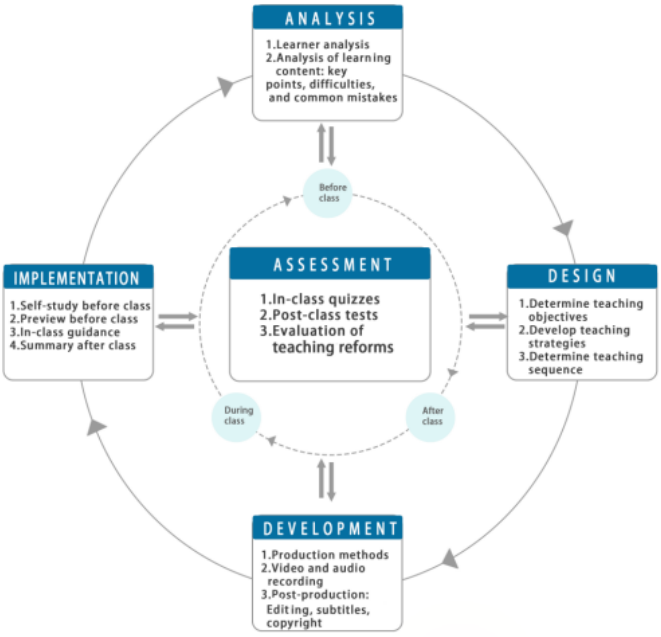

Figure 1 ADDIE Flipped Classroom Instructional Design Model

5. Application of the ADDIE Instructional Design Model in the "Creative Thinking"

5.1 Multidimensional Exploration in the Analysis Phase

The analysis phase mainly refers to a series of analyses of behaviors, tasks, audiences, objectives, environments, and benefits generated during teaching activities.

5.1.1 Dynamic Feedback Mechanism for Learning Needs

In the "Creative Thinking" class, which is part of the industrial design program, from the students' perspective, feedback in the classroom can be broken down into three stages: before class, during class, and after class. From the teachers' perspective, they extract key points and difficulties from the knowledge system based on their own knowledge background and teaching experience; these key and difficult points represent the learning needs of the "Creative Thinking" course.

In the analysis phase, the "Creative Thinking" course combines big data analysis and online surveys to not only identify students' learning status but also dynamically adjust course content

through a real-time feedback mechanism.

5.1.2 Personalized Dimensions of Learner Profiles

Constructivist learning theory posits that learners generally understand new knowledge based on their inherent experiences. Therefore, the analysis of the learning audience in the "Creative Thinking" course primarily considers students' learning habits, motivations, and the differences among the learning groups.

The analysis of students' learning characteristics, combined with technological means, further refines the personalized dimensions from cognitive traits, skill backgrounds, to cultural interests. By integrating learner data, course design can align with students' learning styles and provide differentiated learning resources.

5.1.3 Analysis of Learning Content

The learning content is based on the analysis of prior learning needs, using preliminary research to determine the knowledge areas that should be learned. In the analysis phase of the "Creative Thinking" course, "big data" is utilized to conduct a comprehensive and precise analysis of learners' data, allowing for a thorough and objective understanding of learners' characteristics, strengths, and weaknesses. The results from big data are used to organize the learning content, helping learners to "learn appropriately" and making the learning content more personalized.

5.2 Innovative Teaching Strategies in the Design Phase

The design phase is based on the research foundation established in the analysis phase, and its main content includes setting teaching objectives, formulating teaching strategies, and planning the sequence of instruction[3].

5.2.1 Determining Teaching Objectives

(1) Knowledge Objectives: The course should develop students' thinking and creative ability, master knowledge points in learning and practice, and establish a diversified knowledge structure of design disciplines.

(2) Skills Objectives: The course should guide students to master the theoretical knowledge and framework of the discipline, transfer the knowledge to the skills, and be able to apply it to industrial design and related disciplines.

(3) Through case-based design projects, students are encouraged to integrate cultural innovation into their actual designs, stimulating patriotism and a sense of national pride.

5.2.2 Modular Blended Teaching Strategies

The course learning objectives are structured around modular teaching units, establishing an interdisciplinary chain of knowledge.

The "Creative Thinking" course leverages information technology to deeply integrate teaching in design disciplines, using project-driven interdisciplinary learning in industrial design. By utilizing big data platforms, it gradually achieves a blend of individual autonomous learning and collective collaborative learning, as well as various teaching scenarios. It constructs an intelligent learning environment to create a high-level intelligent teaching model[4].

5.2.3 Determining Teaching Sequence

The teaching sequence refers to the arrangement of the entire teaching process in a flipped classroom. The “Creative Thinking” course meets the needs for progressive learning both inside and outside the classroom by subdividing the unit lessons into three stages: before class, during class, and after class, with teaching activities designed according to the characteristics of each stage.

(1) Before Class: Through online surveys and the use of “big data,” a comprehensive and precise analysis of learners’ data is conducted to objectively understand their characteristics, strengths, and weaknesses, and to assign pre-class preparation tasks.

(2) During Class: Relying on new technology course innovation platforms, a multimodal learning context that extends across space and time is constructed[5], guiding students to choose learning content, methods, and approaches actively. This breaks the limitations of learning time and space, encouraging students to be willing, happy, capable, and proficient learners.

(3) Big Data Management: The teaching and learning evaluation system is restructured. The course platform in a ubiquitous environment records students’ learning processes and submitted learning outcomes, optimizing and improving the existing teaching assessment and evaluation system. Students evaluate the teaching model, activity design, and resources, truly implementing a student-centered approach.

(4) After Class: Arranging “learning by doing.”Students can utilize their after-class time to complete practical assignments and produce innovative designs. These learning achievements can be disseminated through the ubiquitous network via platforms such as Chaoxing Learning Pass, the Internet, and self-media.

5.3 Intelligent Teaching Resources in the Development Phase

The development phase is the focus of the ADDIE teaching model, where targeted teaching resources are developed to achieve the teaching objectives. This mainly includes establishing micro-classes, creating electronic courseware, developing course scripts, and designing learning task objectives.

5.3.1 Dynamic Micro-Course System

The micro-course system not only covers knowledge points and case teaching but also incorporates an intelligent learning path recommendation system. Based on learner behavior data, it provides personalized learning tasks and feedback, ensuring the efficient use of course resources.

5.3.2 Expansion of Virtual Simulation Experiments

By integrating virtual simulation experiment technology, course development further enhances practical training in design methods, providing students with a highly simulated design environment that improves their intuitive experience of design thinking and creative expression.

Currently, the “Creative Thinking” course has 111 teaching videos, totaling over 2,700 minutes, more than 2,200 non-video resources for extracurricular learning, 487 quiz questions, and a question bank of 46 exam questions, facilitating students’ autonomous learning.

5.4 Construction of Ubiquitous Learning Scenarios in the Implementation Phase

5.4.1 Integration of Online and Offline Learning Scenarios

In a ubiquitous learning environment, the course innovation platform leverages new technologies

to achieve “online and offline multimodal integration,” “personalized autonomous learning for more effective learning,” and “integration of information technology with professional learning,” using various methods to promote students’ active learning abilities and habits.

5.4.2 Collaborative Learning and Real-Time Interaction

The learning community in a ubiquitous learning environment centers around group collaborative projects, combining online discussions and classroom practice activities to facilitate bidirectional interaction and creative sharing among students.

The course platform records students’ learning processes and submitted learning outcomes, providing timely feedback and data on academic performance. Learners can use this feedback to identify areas for improvement, stimulating their intrinsic motivation to learn, optimizing their learning methods, and enhancing learning efficiency, ultimately leading to a sense of achievement.

5.5 Iterative Optimization in the Evaluation Phase

Each stage of the ADDIE teaching model requires formative assessment, which focuses on the process and permeates the four stages of analysis, design, development, and implementation.

5.5.1 Multilevel Evaluation Model

The existing teaching assessment and evaluation system is optimized and improved to assist in managing teaching quality and student learning status. The evaluation process emphasizes the organic combination of formative and summative assessments, covering all aspects of the course comprehensively. In particular, big data technology is utilized to track student learning behaviors in real time, generating personalized assessment reports that aid in the precise adjustment of teaching strategies.

5.5.2 Data-Driven Optimization of Teaching and Learning

Data-driven approaches provide immediate feedback on learning status and performance, enhancing learners’ interest and experience. By analyzing student feedback data, teaching resources and activity designs can be adjusted promptly. Teachers in the course team can also reflect and optimize their teaching practices, creating a positive teaching cycle.

6. Conclusion

The flipped classroom teaching design in a ubiquitous learning environment can integrate offline classrooms with online spaces, providing students with diverse interdisciplinary knowledge. It breaks through the limitations of traditional knowledge acquisition methods in teaching design, allowing learners to access knowledge through various pathways. This effectively enhances students’ innovative abilities and improves learning methods. The reform of the teaching model based on the “ADDIE” theory in a ubiquitous learning environment effectively promotes learners’ learning experiences, capabilities, learning outcomes, and the enhancement of core competencies.

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