

Micro-lesson Design Strategies for Teaching Based on Meaningful Learning Theory

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Abstract: As a vital instructional resource, micro-lessons significantly support classroom teaching, and their rational design serves as a core determinant of overall teaching quality. Based on the essential elements and cognitive assimilation modes of meaningful learning theory, this study fully incorporates students' cognitive laws and the disciplinary characteristics of learning content. It proposes a four-dimensional design strategy featuring systematic content analysis, logical script design, hierarchical learning task presentation, and practical material selection. With appropriate technical tools, this strategy facilitates the development of high-quality micro-lessons and effectively guarantees students' learning outcomes during micro-lesson viewing.

Keywords: Meaningful Learning Theory; Micro-Lesson; Instructional Design Strategies; Advance Organizer

1. Research Background

Micro-lessons are compact video-based learning resources with distinct themes and concise durations, serving as powerful instructional tools for teaching and learning. Within the context of educational informatization, such video resources allow repeated viewing and convenient dissemination, rendering them an indispensable medium for both online and offline instruction. Importantly, the overall quality of micro-lessons is predominantly determined by their design rationality, with every frame embodying the pedagogical considerations of designers. A systematic literature review indicates that existing studies have comprehensively explored micro-lesson design strategies, which can be classified into several major research dimensions.

First, micro-lesson design is guided by systematic educational theories. Based on the cognitive load theory, Zhu and Wang (2020) proposed practical principles for micro-lesson

design and explored corresponding implementation strategies from the dual perspectives of instructional design and media design [1]. Taking senior high school mathematics as the research subject, Wang (2023) investigated the procedural framework of micro-lesson design to facilitate students' deep learning based on the cognitive load theory [2]. Grounded in the TPACK theory, Chang et al. (2024) analyzed the internal relationships among disciplinary knowledge, pedagogical knowledge, and technological knowledge, aiming to realize the in-depth integration of information technology and classroom teaching and further improve the overall quality of micro-lessons [3]. By deeply embedding the outcome-based education concept into micro-lesson teaching, Zou (2025) achieved the concretization of teaching objectives, personalization of learning paths, and proceduralization of teaching evaluation [4].

Secondly, micro-lesson design strategies have been explored from diverse research perspectives. From the viewpoint of visual psychology, Wang (2021) put forward micro-lesson design strategies that attach importance to learners' prior experience, expand information capacity, and fully utilize visual focus and the optimal viewing field [5]. From the perspective of disciplinary teaching methodology, Gao and Li (2022) proposed micro-lesson design strategies featuring accurate selection of disciplinary content, effective application of pedagogical methods, and rational adoption of technical means [6]. Song (2023) systematically elaborated targeted design strategies for physics micro-lessons from three application scenarios: pre-class preview, in-class explanation, and after-class consolidation [7]. From the dimension of students' core competency cultivation, Shang (2025) illustrated the fundamental principles and key strategies of micro-lesson design for senior high school biology courses [8].

Thirdly, existing studies have focused on the

innovative teaching modes of micro-lessons. Zhang et al. (2020) adopted the ARCS motivation model to guide micro-lesson design. Through case analysis and teaching practice, they verified that the designed micro-lessons could effectively improve classroom teaching efficiency [9]. Shi et al. (2023) constructed a contextualized micro-lesson teaching mode by integrating Huxiang cultural resources, which was proven to enhance senior high school students' thinking ability and core literacy in history discipline [10]. Cai and Xia (2024) summarized a systematic micro-lesson design mode covering five teaching links, including pre-class preview, in-class introduction, key and difficult points explanation, after-class consolidation, and independent learning during vacations [11].

Fourthly, scholars have explored the prevailing problems and optimization strategies of current micro-lesson design. Jiang (2020) proposed targeted optimization measures for common problems in junior high school Chinese micro-lesson design, including accurate content positioning, student-oriented concept, scientific teaching methods, complete structural design, and reasonable duration control [12]. Yang (2024) analyzed and summarized the insufficient interactivity of traditional micro-lessons and proposed optimization schemes based on AI technology and interactive games. The effectiveness of these optimization strategies has been validated through practical teaching applications [13].

Nevertheless, a critical review of existing literature reveals notable research gaps. Although current theories provide basic guidance for micro-lesson design, their practical operability remains limited. The lack of universal design paradigms hinders the standardized promotion and popularization of micro-lesson teaching. Furthermore, extant discussions on instructional modes tend to be overly generalized, rarely focusing on the adaptive matching between disciplinary content and individual student learning conditions. Despite this limitation, the summarized design problems and optimization strategies from previous studies offer valuable theoretical references for the present research. Owing to their short duration, micro-lessons are widely adopted for autonomous learning, enabling learners to efficiently utilize fragmented time. However, most existing micro-lessons

excessively pursue exquisite visual production while neglecting internal content rationality. Many studies fail to fully consider learners' cognitive characteristics and knowledge construction rules, with insufficient learner-oriented design strategies to enhance learning efficiency. Accordingly, it is worthwhile to further explore how to design micro-lessons grounded in students' cognitive laws and disciplinary attributes. Such micro-lessons should fully activate learners' prior knowledge, establish logical connections between new and existing knowledge, and ultimately facilitate students' meaningful learning.

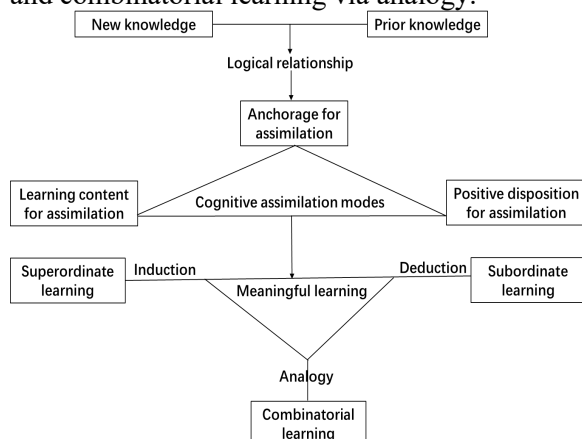
2. Compatibility between Meaningful Learning Theory and Micro-Lesson Design

The American psychologist Ausubel proposed the meaningful learning theory, which rejects rote and indoctrinated learning. This theory emphasizes that learners should actively internalize knowledge, refine their cognitive structures, and achieve meaningful learning based on learning materials. Meaningful learning needs to satisfy three essential conditions: first, new knowledge can be anchored to the existing cognitive structure of learners; second, logical connections can be established between new and prior knowledge; third, learners possess a positive learning disposition to actively assimilate new knowledge.

According to the logical relationship between new and existing knowledge, meaningful learning can be categorized into three modes: superordinate learning, subordinate learning, and combinatorial learning. By adopting inductive, deductive and analogical thinking respectively, learners are able to assimilate new knowledge into their original cognitive frameworks. Referring to the internal psychological mechanism of meaningful learning [14], this study constructs a meaningful learning model based on cognitive assimilation by integrating the logical relationship between new and prior knowledge as well as the essential elements of meaningful learning, as illustrated in Figure 1.

When learning new knowledge, it is necessary to analyze learners' prior knowledge and experience, and present learning materials that facilitate the connection between new and existing knowledge. Through cognitive assimilation, meaningful learning can be promoted, enabling learners to comprehend new

knowledge more easily. As shown in Figure 1, the model depicts how learners construct new knowledge by anchoring it to their existing cognitive structures through three core assimilation modes: superordinate learning via induction, subordinate learning via deduction, and combinatorial learning via analogy.



**Figure 1. Model of Meaningful Learning
Based on Cognitive Assimilation**

Ausubel argued that the most effective strategy for enhancing learning and reducing cognitive interference is to employ appropriate, relevant, inclusive, clear and stable introductory learning materials [14], which are defined as advance organizers. When applying the above model to guide micro-lesson design, it is essential to fully consider students' existing cognitive structures and cognitive laws. The advance organizers should be incorporated into micro-lessons following logical arrangements. In this way, students can naturally transition from prior knowledge to new knowledge during micro-lesson viewing, effectively assimilate new information into their original cognitive frameworks, continuously enrich their knowledge reserves, and ultimately achieve meaningful learning.

3. Instructional Micro-Lesson Design Strategies

In the instructional design of new knowledge, teachers should first clarify teaching priorities and determine students' learning content. Next, it is necessary to decide teaching approaches by analyzing students' prior knowledge and cognitive rules, exploring the logical connection between new and existing knowledge, and transforming prior knowledge into advance organizers. Subsequently, teachers need to identify appropriate thinking approaches to help students effectively understand new knowledge

and assimilate it into their existing cognitive structures. Finally, reasonable questions and exercises should be designed to evaluate students' learning outcomes.

An instructional micro-lesson refers to a short video produced based on instructional design via appropriate technical means. Such analytical procedures are essential to both micro-lesson design and overall teaching quality. Micro-lesson design is a systematic project involving content analysis, script design, learning task arrangement, and material selection. These aspects require detailed exploration to form a standardized and operable framework for micro-lesson development.

3.1 Systematic Content Analysis

Learning content serves as the starting point and core object of micro-lesson design, which is ultimately presented in the form of short videos. As the fundamental carrier of micro-lessons, short videos are characterized by conciseness and focused themes. Such features require precise selection of learning content, enabling reasonable presentation within students' limited span of voluntary attention. This arrangement helps improve learning efficiency and maximizes the educational value of core knowledge points.

3.1.1 Systematic theoretical analysis

Classroom teaching is a joint activity for teachers and students to achieve learning objectives and complete learning tasks. In accordance with cognitive laws, learning with active and conscious involvement tends to produce better outcomes. Given the limited duration of voluntary attention, such attention should be allocated preferentially to key learning content. Restricted by various practical factors, a single lesson cannot maintain highlights throughout the whole process; teaching climaxes usually revolve around certain core points, which are often learning emphases, difficulties, examination focuses or confusing concepts. Therefore, the determination of learning content is of great significance. Teachers should conduct systematic analysis based on teaching materials, curriculum standards and student characteristics, fully consider learners' cognitive traits and learning demands, and identify key points, difficult points, examination focuses and confusing points within the learning content.

3.1.2 Targeted refinement processing

After identifying key, difficult,

examination-oriented and confusing points, further screening is required. Some intuitive and concrete content is easy for students to understand and thus unnecessary to be made into micro-lessons, which would otherwise waste educational resources and students' learning time. From the screened core points, designers should further extract logically complex, confusing symbolic, abstract conceptual, and microscopically obscure knowledge fragments as the targeted content of micro-lessons.

3.2 Logical Script Design

The determined micro-lesson content provides new knowledge to be assimilated for meaningful learning, laying a foundation for subsequent script design. To facilitate students' understanding of new knowledge, it is essential to activate learners' prior knowledge related to new content, establish internal logical connections, and form appropriate cognitive anchoring points for new knowledge within existing cognitive structures.

Furthermore, learning objectives should be formulated according to curriculum content and student characteristics and explicitly displayed in micro-lessons. Clear objectives can stimulate learning motivation, foster learners' willingness for active assimilation, promote the internalization of new knowledge into original cognitive frameworks, and ultimately support the realization of meaningful learning.

3.2.1 Logical relationship analysis

To effectively facilitate knowledge assimilation, advance organizers must maintain stable logical connections with new knowledge and be easily recognized and applied by learners. Accordingly, when selecting refined knowledge fragments for micro-lessons, designers should clarify the logical relationship between new content and learners' prior knowledge, which can be categorized into superordinate relationships, subordinate relationships, and combinatorial relationships.

Based on different logical relations, prior knowledge can be properly processed and designed as advance organizers. Inductive integration is adopted for superordinate learning, deductive reasoning for subordinate learning, and analogical transfer for combinatorial learning. Such arrangements help students comprehend and master new knowledge efficiently and promote meaningful learning.

3.2.2 Visualized optimization processing

If prior knowledge related to new content involves generalized concepts, abstract principles or theoretical summaries, directly applying them as advance organizers may lead to learning difficulties and boredom for students. Considering learners' cognitive psychological characteristics and learning abilities, such knowledge should be visualized through diversified media forms, including text, images, audio, animation and video. The organic integration of multiple media resources can effectively serve as qualified advance organizers and boost knowledge assimilation.

Comparatively speaking, video materials are more vivid and intuitive, capable of stimulating multiple sensory organs, enriching perceptual information input, and enhancing students' comprehension of new knowledge.

3.3 Hierarchical Task Presentation

It is essential for students to clarify learning objectives and tasks when studying through micro-lessons. Without clear goals, instantaneous sensory memory fades rapidly, making it difficult for learners to internalize and retain knowledge effectively. Therefore, designing learning task sheets is particularly crucial. By transforming curriculum content into structured tasks, learning task sheets can enhance students' learning initiative, evaluate learning effects, and serve as vital support for achieving preset learning objectives.

3.3.1 Problem-oriented design

Questions act as an effective approach to inspire thinking and promote deep learning. Well-designed questions can stimulate learning motivation, activate thinking activities, and enable students to acquire knowledge and develop abilities in the process of problem-solving. Transforming learning tasks into question-based forms is conducive to guiding autonomous learning and assessing learning outcomes.

Questions can be teacher-designed confusing points and exercises, student-initiated knowledge doubts, closed-ended inquiries, open-ended discussions, or reflection-based learning experience questions. All types of questions can concretize learning tasks and enhance operability. In addition, learning task sheets should closely align with micro-lesson content, reflect learning objectives, assist in interpreting key teaching points, break through difficult knowledge, consolidate examination focuses, and resolve

confusing concepts, thereby improving the overall educational function of micro-lessons.

3.3.2 Progressive hierarchical presentation

Learning task sheets should follow reasonable presentation logic and comply with students' cognitive laws and knowledge hierarchy. Tasks can be designed progressively from easy to difficult, including basic tasks, core tasks and extended tasks, and presented sequentially alongside micro-lesson learning procedures.

Basic tasks cover fundamental knowledge and skills to assess the mastery of basic content, which are designed to be accessible to all students. Core tasks focus on key knowledge to evaluate the development of learning abilities, suitable for most students to complete with inspirational guidance. Extended tasks expand on key and difficult content to cultivate innovative ability, enabling advanced students to expand their knowledge breadth and depth through after-class learning.

Hierarchical task presentation respects individual learning differences, guides students to engage in deep learning, and enables learners at all levels to gain a sense of achievement.

3.4 Practical Material Selection

Micro-lesson production is influenced by multiple factors, including learning content, logical relations between new and prior knowledge, design ideas, micro-lesson types and video production technology. Ultimately, all design concepts rely on the reasonable application of rich and practical teaching materials. Micro-lesson materials are the fundamental foundation of video production and the most direct perceptual information source for learners, exerting a decisive impact on learning effects. Hence, material selection is a core link in micro-lesson design.

3.4.1 Practicality-oriented analysis

Micro-lessons aim to provide multi-sensory video learning resources, enabling students to process information and understand new knowledge through observation, listening, thinking and imitation. Designers should identify prior knowledge closely associated with new content as cognitive anchoring points for knowledge assimilation. By clarifying the logical connection between new and existing knowledge, designers can reasonably integrate diversified resources such as text, pictures, audio, video and online materials according to learning demands and micro-lesson types. From a

practical perspective, materials should be combined elaborately to achieve concise, targeted and efficient presentation within limited video duration.

3.4.2 Visualized material processing

Educational psychology indicates that multi-sensory collaborative perception achieves better learning effects than single-channel perception. Therefore, selected practical micro-lesson materials should be processed and visualized in a logical sequence through the integration of text, color, sound, animation and video. Visualized presentation can fully mobilize students' multiple senses, enrich perceptual experience and improve learning efficiency.

Visual processing can be completed with convenient recording tools such as digital cameras, mobile phones and computer screen-recording software. These tools facilitate the integration of text, images, audio and animation, and support post-editing and beautification, enabling the production of micro-lesson videos with clear images and high-quality audio effects.

4. Conclusion

Instructional micro-lessons serve as vital learning resources that assist students in acquiring new knowledge, with micro videos typically presenting the core content of curriculum knowledge. Nevertheless, isolated knowledge, no matter how elaborately interpreted, cannot facilitate students' smooth comprehension during the learning process.

By applying meaningful learning theory and following students' cognitive laws, embedding advance organizers into micro-lesson design helps establish logical connections between new and prior knowledge. On the basis of learners' existing knowledge and experience, knowledge assimilation and transfer enable students to acquire new knowledge naturally and effortlessly. Meanwhile, this approach continuously optimizes their cognitive structure and enhances overall cognitive ability. Furthermore, it strengthens students' confidence in independent learning and ultimately promotes the transformation of their learning styles.

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