Design Strategy of Micro-lecture Based on Cognitive Load Theory

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Abstract: In the process of education informatization, micro-lectures are widely used in various online and offline courses. But research finds that teachers have problems such as improper selection of knowledge points when designing micro-lectures, content design of micro-learns that do not conform to the principles of instructional design, and learners' cognitive rules .This study takes high school physics as an example, and proposes a micro-lecture design strategy based on cognitive load theory, and combines specific knowledge points to explain how to design a reasonable micro-lecture based on cognitive load theory, so as to stimulate learners' interest and help students learn, improve the efficiency of autonomous learning, with a view to providing teachers with operable strategies for the design of micro-lecture content.

Introduction

The Outline of the national medium and long-term education reform and development plan (2010-2020) clearly states that, Information technology has a revolutionary impact on the development of education and must be highly valued. We must give full play to the advantages of information technology and focus on the comprehensiveness of information technology and deep integration of education, promoting fair education and achieving broad sharing of quality education resources. The short and intensive content form of micro-lectures can enable learners to quickly and effectively target knowledge difficulties and priorities to achieve fragmented and personalized learning. It is an effective way to achieve a deep integration of information technology and courses, and an emerging resource carrier for resource sharing, and it is also currently a major form of carrier. However, there are always various unreasonable points in the design of micro-lectures. Designing a reasonable micro-lecture can improve the learning efficiency of learners, reduce the burden of learning, and increase the interest in learning. At the present stage, scholars have their own opinions on how to properly design micro-lectures, and generally follow certain principles. Cognitive Load Theory has a good guiding effect on the design of micro-lectures. Starting from Cognitive Load Theory, combining the characteristics of memory and using blocks as a unit to change the organizational structure of knowledge, combining with the characteristics of human information processing, it can be reasonably processed. Moreover, memory knowledge can effectively help learners better understand and master related knowledge. The author takes high school physics as an example to further explain how to design a reasonable micro-lecture with the support of cognitive load theory to help teachers teach better , students learn better.

Related concepts

Micro-lecture. The micro-lecture is an emerging form of resource carrier, it mainly focuses on the key points, difficult points or error-prone points and key points of the teaching contents. And a complete teaching content can be scientifically and rigorously decomposed into one or several knowledge points, a micro-video, which is no more than 20 minutes by splitting the sections. It takes the primary goal of improving and deepening the students' grasp of the content of knowledge. It can be used as auxiliary materials for students' autonomous learning, and can be used as a leading organizer to guide the classroom. Learners can learn online and offline, which largely meets the needs of learners' fragmented learning and personalized learning.

Cognitive Load Theory.

Concept. Cognitive Load Theory was originally proposed by Australian educational psychologist John Sweller in the 1980s, and it has aroused widespread concern in the education community since its introduction. The Cognitive Load Theory refers to the total amount of cognitive resources that people need to invest in the information processing process. The theory believes that the ideal teaching mode is that in a short period of time, students can learn at full capacity and use valuable knowledge flexibly and autonomously.

Cognitive load theory is mainly based on Resource Constraints Theory and Schema Theory. According to Resource Constraints Theory, human cognitive resources are limited, and any learning and problem-solving activities require the consumption of cognitive resources. When the total amount of cognitive resources required to process certain information exceeds the total amount of cognitive resources owned by humans, it will cause cognitive overload and affect the efficiency and effectiveness of learning[1]. Schema Theory believes that knowledge organized around a certain topic has different representations and storage methods to achieve different results. The Cognitive Load Theory also incorporates human information processing models, as long as the form of chunks is changed for the same knowledge content, it is possible to greatly expand the limited capacity of short-term memory, and it also makes working memory process information easier.

Classification of cognitive load theory. Sweller divides cognitive load into internal cognitive load, external cognitive load and related cognitive load. The internal cognitive load refers to the load formed by elemental associations. It depends on the interaction between the material itself and the learner's professional knowledge, that is, the difficulty of learning the subject and the learner's knowledge experience. The internal cognitive load is generally fixed. The learner experience is also fixed, which can change the difficulty of choosing a topic. External cognitive load refers to the extra load that exceeds the internal cognitive load, and generally depends on whether the knowledge design is reasonable. The design of unreasonable knowledge will increase the external cognitive load and can be changed through instructional design. Relevant cognitive load refers to the related load in the process of facilitating learner schema construction and pattern automation, and is the cognitive resource occupied by students in the process of constructing knowledge patterns and transforming them into internal knowledge. Internal cognitive load, external cognitive load, and related cognitive load are interrelated, and the sum of the three must not exceed the total resources obtained by working memory. The external cognitive load is related to the presentation of learning materials. The more reasonable the presentation form is, the more consistent it is with the learner's cognitive level, the fewer the interference factors of the learner's information processing, the lower the external cognitive load and the more conducive to learning. The internal cognitive load is related to the difficulty of knowledge[2]. The harder the knowledge is, the larger the internal cognitive load is, which is more unfavorable to learning. The related cognitive load is related to the student's effort level. To improve the related cognitive load, the remaining cognitive resources of the student can be used to process the related knowledge. Related cognitive load is affected by external cognitive load and internal cognitive load.

Strategies for Designing Micro-lectures Based on Cognitive Load Theory

In order to better study the guiding role of Cognitive Load Theory in the design of micro-lectures, this study selects high school physics as the design object of micro-lectures and explores the design strategies of micro-lectures. High school physics includes theory courses and experimental operation courses, it has the characteristics of a large amount of knowledge points, strong theoretical, strong systematic, comprehensiveness, and high ability requirements, and is representative of subject knowledge points to a certain extent.

Reducing the Internal Cognitive Load.

Isolating related elements. Knowledge is systematic, and teachers should try to reduce the internal cognitive load when choosing knowledge points to design micro-lectures. Intrinsic cognitive load is related to the complexity of the learning content, and it is also related to the

students' existing cognitive experience. The reduction of internal cognitive load requires the separation of related elements[3]. By changing the form of the block, the complex problem that originally exceeded the short-term memory capacity and difficult to memorize into a simple problem that is easy to remember. The more complex the knowledge, the cognitive load will become greater , the greater the learning pressure, and the more difficult the processing of working memory. Once the learner will be excluded, and it does not meet the requirements of learning interest and motivation, it will occupy more cognitive resource space and cause overload.

Implementing gradual reduction of guidance to avoid negative effects. When separating related elements, we must also learn to implement gradual reduction of guidance to avoid negative effects. As the learner deepens and the working memory space is released, the relevant knowledge is gradually understood and familiarized. At this time, reducing relevant guidance will promote the learner's active learning. In a subjective sense, learners will choose to exclude learning-related content in a subjective sense, so learning passion is not enough, it will have a negative effect and fail to meet the teaching-related requirements[4].

Ausubel's motivation theory believes that cognitive drive can best make learners' sense of achievement in learning. This sense of achievement can be obtained in the task itself and is the most important and stable part of the three components of achievement motivation. Only by finding the learning interest in the learning content can we really improve the learning fun of the students and reduce the psychological rejection. The cognitive-driven refers to the psychological tendency of students who are eager to seek knowledge and eager to learn actively. Based on the Cognitive Load Theory, the micro-learning of high school physics experimental knowledge, in the design process, appropriate separation of relevant elements, but also learn to implement guidance to avoid negative effects. This can help students build spatial imagination, improve learners' logical thinking ability, stimulate students' interest in learning, and facilitate students' memory processing. Students can constantly feel, repeat, establish experimental related experience, and build abstraction to guide students to try and explore by themselves.

Knowledge is interrelated and affects each other. If all knowledge is selected to be presented at one time, it will cause learners to burden working memory processing and cause cognitive load to be overloaded. We can first select the key knowledge point concept according to the Elaboration Theory, and then design a micro-lecture based on Cognitive Load Theory to reduce the learner's external cognitive load to help learners understand.

Reducing External Cognitive Load.

Selecting the right knowledge. Not all knowledge points are suitable for micro-lectures. Therefore, in order to reduce the relevant cognitive load while designing the micro-lecture according to the knowledge points, the teacher can first choose the learning content of the micro-lecture according to the principle of Regelus's Elaboration Theory. The Elaboration Theory holds that knowledge is organized in a hierarchical structure, and knowledge with a higher level of abstraction is at a higher level. As the level of abstraction decreases, the level of knowledge gradually decreases; and knowledge of cognitive structure is interactive and interrelated. The knowledge is selected according to this theory meets the knowledge needs of the learners and meets the teaching goals. According to the learning characteristics of learners and the characteristics of high school physics knowledge, the strategy of reducing the external cognitive load is particularly important in the design of high school physics micro-classes. Fragment theoretical knowledge appropriately, while satisfying the system, also meets the characteristics of the memory blocks in the process of information processing, reduces the students' external cognitive load, and releases the space of cognitive resources to make students gain a sense of accomplishment from the knowledge itself in the learning process, and promote learning active of students[5].

Using multi-channels. Different knowledge points have different requirements for students' creative ability and logical thinking, and they also need students to have spatial imagination. In the process of expressing some knowledge, it is reasonable to use multiple ways to present the same knowledge point, and allow students to accept it through multiple channels. In this way, while making full use of working memory processing space, it can also help students understand the

knowledge more deeply and satisfy the learner's thirst for knowledge. For example, high school physics knowledge is closely related to life phenomena, and can be combined with specific examples in life to allow students to understand relevant content in an information-based environment and use multi-channel expressions to reduce the student's psychological rejection.

Reducing redundant information. Knowledge points cannot be chosen at will in micro-lectures. The premise of designing micro-lectures is to use textbooks as the center and expand the content of textbooks and the pressure of students' knowledge. Meanwhile, bad micro-lecture videos will consume learners' cognitive resources and increase their external cognitive load. High school physics micro-lectures should appropriately reduce redundant information, grasp the important and difficult points, reduce the processing of irrelevant information and the space for memorizing, so that students can learn more easily.

Increasing the Relevant Cognitive Load. Constructivism believes that learning should be placed in a certain context and connected with a certain social and cultural background. Putting knowledge in a certain context, that is, increasing the relevant cognitive load. According to Gagne's information processing model, it can be known that moderately increasing the relevant cognitive load of micro-lecture videos can improve learning effects and increase the load of external cognitive knowledge enables students to proactively acquire new knowledge. Although high school physics knowledge puts higher requirements on students, high school students already have a certain learning ability. In terms of knowledge processing, although the learning abilities of different learners are different, the theoretical knowledge and learners' memory processing abilities are different, which will have different effects. For example, the experiment called horizontal projectile motion , we can use the life example reasonably in the design of the micro-lecture, put it in the situation of class, increase the relevant cognitive load can better enhance students' learning interest and facilitate understanding of knowledge. In this way, conditions can be created to help students connect experiments and life to understand knowledge and find fun in it.

Conclusion

With the gradual advancement of the new curriculum concept, the Cognitive Load Theory has gradually entered into teaching, which provides a psychological basis for the design of teaching materials[6]. Cognitive Load Theory grasps the characteristics of memory in human learning, which is more meaningful for the guidance of micro-lecture design. In the process of informatizationeducation, design micro-lectures based on Cognitive Load Theory to reduce students' psychological rejection, rationally control cognitive load, promote students to actively learn, improve learning efficiency and teaching efficiency, and make micro-lectures be more effective teaching and learning tools. For teachers, we should not blindly pursue the form of micro-lectures, instead, we should focus on designing micro-lectures that conform to the students' cognitive rules. Therefore, teachers should strengthen mastery of cognitive theory. Of course, the design and production process of micro-lecture involves many aspects, soon, the guidance of cognitive load theory is far from sufficient, but what kind of knowledge point is selected by the cognitive load theory and the content how to be presented can help students understand the knowledge point has a positive effect.

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