DOI:10.18686/ahe.v7i22.9736

The Integration of Optimal Experience Theory and Advanced Mathematics Teaching: A Case Study of Private Applied Undergraduate Universities

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Abstract: Taking Qingdao Hengxing University as an example, this paper uses survey methods to analyze the five main problems that exist in the learning of advanced mathematics for students in private applied undergraduate university, explores the feasibility of applying the optimal experience theory to the teaching of advanced mathematics.

Keywords: optimal experience theory; teaching of advanced mathematics; feasibility; private applied undergraduate universities.

1. Question Raising

Currently, there are a total of 36 applied undergraduate universities in Shandong province, including 10 private applied undergraduate universities, with Qingdao Hengxing University being one of them. The author conducted a questionnaire survey with students majoring in electrical automation, network engineering, civil engineering, logistics engineering, and mathematics teachers, and summarized the five main problems that currently exist in the process of students learning advanced mathematics: weak mathematical foundation and greater fear of difficulties; lack of interest in learning mathematics, and poor overall learning atmosphere; problems with the connection between secondary school mathematics and undergraduate mathematics knowledge; weaker learning initiative; and a lack of clear learning objectives.

Therefore, improving the quality of advanced mathematics teaching in private applied undergraduate universities should start with addressing the above-mentioned problems, enhancing students' initiative in learning, stimulating their interest in studying mathematics.

2. Research Foundation

The concept of optimal experience was first proposed by Mihaly Csikszentmihalyi, one of the founders of positive psychology, in his book "Flow: The Psychology of Optimal Experience." Csikszentmihalyi discovered that people experience happiness when they fully immerse themselves in an activity, reach a state of self-forgetfulness, and achieve a sense of internal order and peace. This state of mind is called "optimal experience" or "flow." He believes that optimal experience is the best form of intrinsic motivation, and is a powerful source of attraction, engagement, satisfaction, and expertise.

Some scholars have applied the theory of optimal experience to education and teaching with certain achievements.Wang Zhe introduced the theory of optimal experience into vocational education, believing that its application can help vocational school students learn, experience and enjoy growth. Shang Wenlan explored the design and teaching activities of English reading deep learning based on optimal experience in applied undergraduate universities. Bai Xiaohan and others finded that the theory of optimal experience had a good effect on improving students' classroom focus and weakening learning difficulties.Based on previous research, taking Qingdao Hengxing University as an example, this study explores the feasibility of applying the theory of optimal experience to the teaching of advanced mathematics.

3. Feasibility Analysis of Applying the Optimal Experience Theory to Advanced Mathematics Curriculum Teaching

Csikszentmihalyi's optimal experience theory holds that "flow" is not a constant state of the human mind, nor is it a "realm," but rather a moment of brilliance that appears when people struggle in life. For example, when solving a relatively difficult math problem, such as when the hour hand and minute hand of a clock overlap and will overlap again in a few minutes,when you think of the solution $(12\times 60)\div(12-1)=720$, your brain is particularly excited and feels a sense of excitement, which is a flow experience.So what is the relationship between the teaching of advanced mathematics courses and "flow"? Combining the constituent elements and characteristics of "flow," analysis is conducted from three aspects below.

3.1 Balance of Challenge and Skill

This theory suggests that the key to optimal experience lies in the balance of challenge and skill. If the challenge is too easy, people will feel bored, and if it is too difficult, it can lead to frustration. Since learning mathematics is a dynamic process, the balance of knowledge and skills should also be dynamic.Using Csikszentmihalyi's "flow" diagram (see Figure 1) ,take the study of mathematical limits in advanced mathematics as an example,the dynamic balance of this kind of learning can be divided into four stages.

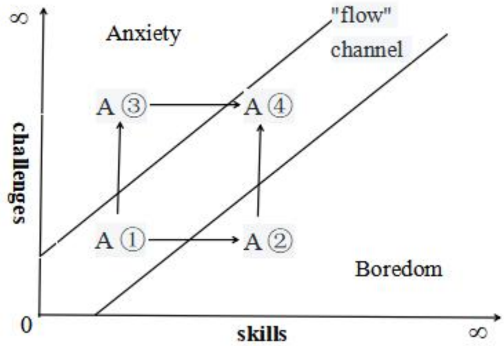

Figure 1 "Heart Flow" Experience Diagram

Before learning about the limits of functions, students have just learned the concept and methods of sequence limits. At this point, students will be relatively smooth in solving problems related to sequence limits and may feel a sense of flow as shown in A①. However, if they continue to study this part of the content, they may become bored and deviate from the "flow" channel into A②. Alternatively, they may encounter a relatively difficult problem that cannot be solved with their current knowledge and skills, such as the problem "proof $\lim_{x \to x_0} x = x_0$ ". However, in this problem, exploring the limit of a function when the independent variable tends to a fixed value ($x \to x_0$) is beyond the student's ability range, causing them to feel anxious and deviate from the "flow" channel into A③.

Neither A② nor A③ are in the "flow" channel, and the student will be motivated to return to the "flow" channel. There are two options to do this: (1) increase the challenge difficulty (targeting A②), such as finding the limit of a simple function through observing its graph, which allows the student to return to the "flow" channel along the path A②-A④. (2)improve their own knowledge and skills (targeting A③), learn the concept of function limits, master the geometric, qualitative, and quantitative descriptions of function limits under the changing conditions of the two independent variables, and match them with the new challenge, which enables the student to re-enter the "flow" channel along the path A③ - A④.

Although both A① and A④ are in the "flow" channel, the level of complexity of the knowledge structure represented by A④ is higher than that of A①.From a psychological perspective, interest is linked to knowledge and emotions. As students deepen their understanding of the learning content, their interest in learning will become stronger, thus achieving a new and higher level of optimal experience.

3.2 Clarifying Goals

This theory suggests that the reason why optimal experiences can lead to complete engagement is due to the clarity of activity goals. The goals can be explicit or implicit, but these activities have their own set of rules, and participants need to be clear about what steps are correct and what kind of performance is excellent. In the teaching of applied undergraduate mathematics courses in private universities, teachers should set clear and diversified teaching goals, including multiple dimensions such as knowledge and skills, process and methods, emotional attitudes and values, and should be inclusive to make teaching goals and students' own goals have a certain point of integration, so that students can experience the consistency between the teaching goals and their own developmental goals, internalize their learning goals, and stimulate their internal motivation to learn.

Taking the function limit in Advanced Mathematics as an example, students find it easy to understand the geometric and qualitative descriptions of function limits after learning about sequence limits. However, they may encounter difficulties in understanding and mastering the precise definition(definition“$\varepsilon - X$” 、 “$\varepsilon - \delta$”) of function limits, particularly in the case of the two main categories and six specific situations("$x \to \infty$" ("$x \to +\infty$"、"$x \to -\infty$") and "$x \to x_0$" ("$x \to x_0^+$"、"$x \to x_0^-$")). Therefore, in teaching design, it is necessary to consider students' majors and real-life experiences and use practical problems from their daily lives as the starting point. For instance, for students majoring in finance and economics, a question could be designed to calculate the principal and interest on a deposit to spark their interest and motivation to learn about function limits. Then, the concept of function limits can be introduced, starting from the intuitive understanding of the graph and moving towards the qualitative definition in words. Finally, returning to the initial deposit question, students are encouraged to think about a solution, experience the pleasure of applying mathematical knowledge to solve practical problems, and build their confidence in learning mathematics.

3.3 Complete Focus

The theory of optimal experience proposes that the key to experiencing "flow" is to concentrate attention, which means to be fully engaged in an activity and reach a state of forgetfulness of self. Studies have found a significant positive correlation between concentration and time management skills: students with weaker focus, such as those who rely heavily on their phones, have their attention spread out by their phones, leading to a decrease in their time management and monitoring abilities, which in turn reduces their sense of time efficacy; whereas students with higher concentration have a higher sense of time efficacy.

In the teaching of Advanced Mathematics, the subject's inherent characteristics of abstractness, logical rigor, and strong theoretical basis can make it dull for many students. It can be difficult for students to remain fully focused during a fifty-minute class where a teacher continuously delivers new knowledge. Maintaining focus requires effort and willpower from students, especially those who lack interest in mathematics, so deliberate training is necessary in the beginning. For example, the teachers can carefully plan their teaching activities, dividing knowledge points into smaller segments of 15-20 minutes and inserting some mathematical anecdotes (such as stories about great mathematicians like Euler, Hilbert's 23 problems, etc.) between them. This rhythmically captures students' attention and keeps their focus on important knowledge points.

In conclusion, the core tenets of the theory of optimal experience have a high degree of relevance to the key points in the teaching of Advanced Mathematics. Applying the theory of optimal experience to the teaching of Advanced Mathematics is feasible and can help solve the main issues in the teaching of Advanced Mathematics in private applied undergraduate universities.

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