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Research Article

Training College Students Grasp Autonomous Learning Strategies to Promote Them Growth

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Abstract

This article, guided by theories such as educational psychology, explores the issue of promoting local college students' autonomous learning through infiltrating autonomous learning strategies in Advanced Mathematics courses teaching. In theoretical learning and practical summary, the author found that local college students have learning deficiencies such as incorrect learning methods, weak independent thinking and self-learning abilities. In addition, high-quality higher mathematics learning can provides college students with a lot of opportunity for rational thinking, which helps to cultivate the rational thinking and rational spirit of college students who are in a critical period of rational development. Based on the learning deficiencies of local college students and the advantages of higher mathematics learning, this article proposes four teaching strategies to promote the growth of college students. The first teaching strategy is to clarify the learning objectives of higher mathematics and guide college students to learn independently. This strategy aims to overcome the shortcomings of traditional higher mathematics teaching, such as single content and incomplete teaching objectives. This teaching strategy clarifies the four-dimensional teaching objectives of advanced mathematics, including mastering knowledge, exercising thinking, improving self-learning level, and enhancing creativity. The mastery of knowledge should be achieved through knowledge learning, infiltrating educational common sense, enriching students' horizons, enhancing students' courage, appreciation, and self-awareness abilities to achieve the "six consciousness" education. The second teaching strategy is to impart self-learning strategies such as analysis and summarization to promote college students' autonomous learning; The third teaching strategy is to provide opportunities for college students to engage in self-directed learning and exercise, such as giving lectures and providing feedback; The final strategy is to evaluate self-directed learning using a self-directed learning scale to ensure learning effectiveness.

Keywords

College Students, Autonomous Teaching Strategies, Advanced Mathematics

1. Introduction

Autonomous learning refers to the process in which learners consciously determine learning objectives, choose learning methods, monitor learning process, and evaluate learning effects. Autonomous learning implemented in school refers to the learning process in which learners formulate and complete specific learning objectives based on their own conditions and needs, under the macro control of overall teaching objectives and the guidance of teachers. Ye Sheng-tao said: Teaching is

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for no teaching. This means that the fundamental purpose and key of teaching lies in helping students learn how to learn, form independent learning awareness, abilities, and habits, and be able to independently explore and practice, solve problems, and innovate.

In the background of Mass Higher Education, there are many college students in local universities who can solve learning problems, obtain good scores, and graduate smoothly through curriculum methods. However, they often fall into a swamp, with vague ideas, slow reactions, rough reasoning, and many subjective arbitrariness filled with speculation and even superstition when encountering life problems. Why do college students with higher education still behave like this? A very important reason is that their learning methods are not correct, and independent thinking and independent learning ability is not strong. So, how can we help college students improve their self-directed learning ability and enhance their ability to do things and behave? In the freshman year, while mastering knowledge, advanced mathematics teachers may make use of advanced mathematics courses to promote college students to master autonomous learning strategies, improve the quality of thinking and develop autonomous learning habits, and furthermore promote college students to better adapt to study and life [1, 2].

Why should we talk about improving college students' self-directed learning ability through Higher Mathematics teaching? The reason is that Higher Mathematics course plays an important role in the four-year study of college students which help them adapt to college life, exercise their thinking and improve their abilities. On the one hand, students have more confidence in this course, and mastering advanced mathematics courses is beneficial for students to learn other courses. On the other hand, this course provides students with a large number of opportunities for rational thinking, and long-term and high-quality training is conducive to the cultivation of rational thinking and rational spirit of freshman students who are in the critical period of rational development [3-5]. Therefore, schools and teachers can and urgently need to do a good job in the teaching of this course, so as to promote college students to adapt to college life as soon as possible and lay a solid foundation for their future four years of learning.

Therefore, it is important to utilize advanced mathematics classrooms to promote self-directed learning among college students. And there are also many studies in this area [6-9], but most of them are general and not highly operational. There are relatively few studies from a psychological perspective, and there is a lack of research on strategies to systematically promote autonomous learning among college students using higher mathematics classrooms from a metacognitive perspective.

This article, guided by theories such as educational psychology, explores the issue of using higher mathematics courses to infiltrate autonomous learning strategies and promote college students' autonomous learning. It proposes four teaching strategies including "clarifying learning objectives and guiding the direction of autonomous learning" in higher mathematics teaching.

2. Teaching Strategies

Strategy 1: Clarify learning objectives and lead students' self-directed learning

Doing things requires purposefulness and planning, and the same goes for higher mathematics teaching and learning. Goal setting belongs to the planning strategy in metacognitive learning strategies, which is a very important autonomous learning strategy that plays a role in stimulating motivation and guiding direction in learning. At the beginning of the course of higher mathematics, teachers can arouse students' internal needs and goal pursuit of active learning, point out the direction and focus for students' learning through guide students to establish high learning goals, correct learning perspectives, and clarify the potential hazards of not studying seriously. In addition, in almost every higher mathematics class, teachers not only impart high-quality knowledge, but also propose high learning standards that are not difficult to achieve for students, guiding students to maintain a positive learning attitude. The specific method for setting goals is as follows.

According to the actual situation of college students in local universities, the beginning of higher mathematics courses requires clear learning objectives which include advanced mathematics knowledge mastering, thinking exercising, the level of independent learning improving, and creativity enhancing. The realization of the learning goal of higher mathematics needs to train students' thinking through high-quality knowledge teaching, make them master the scientific thinking method, form three thinking modes, and develop the field between their ears. Three thinking modes include the self-awareness thinking mode of "interests - right and wrong - likes and dislikes", the learning basic thinking mode of "problems (things) - observation and analysis - methods or ideas - practice - summary and reflection -... - problems are safely and completely solved (accurately, clearly, and completely understand things)", and the innovative thinking mode of "discover problems - raisie problems - analyze problems - solve problems". Advanced mathematics knowledge may be forgotten, but the improvement of thinking ability not only contributes to the learning of advanced mathematics, but also contributes to the development of the brain and the learning of other courses, and promotes college students to form rigorous and truth-seeking learning attitude, dialectical materialist world outlook combining theory with practice, optimistic outlook on life, and advocating-truth scientific spirit, humanistic spirit of reflecting on life, critical spirit of rejecting the false and preserving the true, and pioneering and enterprising spirit of innovation. Those will further influence the future problem solving and life of college students [10].

In order to make these learning goals deeply in the minds of college students, advanced mathematics teachers summarized them as a learning slogan that is easy to understand and remember: cold mathematics, hot thinking, perfect practice, happy life. Its meaning refers to utilizing mathematics to stimulate the brain's passionate thinking (The key lies in learning to ask and summarize during learning.), developing a rigorous style in learning, working, and being a person - with few or even no mistakes, and thus leading to a happy life. By using easily understanded and memorized learning slogans, the learning goals can be deeply ingrained in the early stages of higher mathematics learning, inspiring and maintaining the enthusiasm and endogenous motivation of college students in learning.

In addition to the above teaching goals clearly defined at the beginning of higher mathematics, in every higher mathematics class, teachers can not only impart knowledge with high quality, but also turned the above learning objectives based on the knowledge points to the high standard learning objectives of "getting things right at once, understanding at first glance, and understanding at first listen ", so as to meet students' desire for challenge, stimulate students'learning interest and in-depth thinking, develop the habit of summing up and reflecting, and achieve the purpose of mastering knowledge, exercising the brain, mastering independent learning strategies and improving creativity. In addition, by occasionally shouting the learning goal slogan of "cold mathematics, hot thinking, perfect practice, and happy life", teachers can strengthen students' understanding and memory, firm students' direction of effort, and remind students to apply this brain exercise method to daily practice, so that the brain can receive more exercise and achieve results much more quickly. Of course, teachers can also guide students to establish medium to long-term learning goals for each chapter, mid-term, and final period, and promote students to develop good self-directed learning habits such as timely review.

With the effective development and implementation of the above learning objectives strategy in higher maths teaching, college students have a clearer understanding of the learning goals and directions of higher mathematics, master the learning methods by doing higher mathematics questions correctly again and again, improve their self-confidence, have a stronger sense of value and acquisition in higher mathematics learning. Over time, college students have a stronger learning initiative, the consciousness of independent learning, and independent learning ability.

Strategy 2: Infiltrate independent learning strategies to give college students wings for their independent learning

To do well, one should pay attention to methods, which ensure things done accurately, smoothly, and efficiently. In addition to using planning strategies to guide college students to engage in self-directed learning in higher mathematics, teachers should also incorporate scientific and diverse self-directed learning methods and strategies into teaching, promoting students' better self-directed learning. The methods and strategies that higher mathematics classrooms can provide for students'autonomous learning include strategic knowledge such as questioning, dialectical thinking, observation, analysis, summarization and reflection that local college students generally lack, as well as training methods of three major thinking patterns mentioned earlier.

Higher mathematics teachers can teach students the strategic knowledge about questioning, observation, analysis, summary and reflection through teaching forms, such as knowledge organization, teacher demonstrations, classroom summaries, excellent assignments, question sharing, etc. For example, carefully designing courseware which presents knowledge in a general to special or special to general form, may enable students to understand induction and deduction methods; classroom summary may exercise students' summarizing and summarizing abilities; observing and analyzing problems exercises students' observation and analytical abilities; by doing homework well and correcting it by oneself, recording the time spent on homework, reflecting on homework in a timely manner, and summarizing and reflecting after testing, students can be inspired to have a sense of responsibility in learning, and their thinking integrity and reflective ability can be exercised, etc.

In addition to promoting students to master thinking methods and improve their thinking and self-learning abilities through the above forms, teachers also need to exercise students' three thinking modes through knowledge learning to improve students' efficiency of self-learning.

For example, in order to exercise students' basic learning thinking mode: "when finding problems (facing things), first observe and analysis the problems (things), then find methods or ideas to solve them, next begin to solve the problems (things), last summary and reflect the process... until problems (things) are safely and completely solved (accurately, clearly and completely understand things)", teachers can choose some teaching content to demonstrate this thinking mode, and emphasize that students should generally use this learning thinking mode to explain when teaching math problems for the class.

For example, in order to exercise students' thinking mode of self-awareness:"first analyses the thing' benefit and harm to oneself, then analyses the thing' right and wrong to the social or others, last analyses oneself' likes and dislikes to the thing", teachers can use opportunities such as student lectures or teaching problems to conduct survey questionnaires, analyze their advantages and disadvantages, guide college students to reflect on themselves, and improve their self-awareness ability.

For example, in order to exercise students' innovative thinking mode of discovering, raising, analyzing and solving problems, teachers can select appropriate knowledge, use the discovery method to explain these knowledge, and guide students to understand the discovery and invention of knowledge to improve the innovation awareness and ability of college students.

For example, when learning Green's formula, the teacher can first introduce two examples, then summarize their common characteristics, discover and raise questions, guess possible general conclusions, and finally prove the conclusion.

Teachers can also exercise students' innovative thinking patterns by students submitting reports through group cooperation. These exercises do not need to be limited to knowledge learning, but can be carried out by guiding discussions on things around students. For example, a group in author's class submitted a research report on the washing machine laundry dirt.

By infiltrating independent learning strategies into teaching, clarifying them in the summary, exercising and applying them in various forms, college students' use of self-directed learning strategies is becoming more and more effective, and their enthusiasm for learning is further stimulated, resulting in a significant improvement in their self-directed learning ability.

Strategy 3: Provide practical opportunities for college students to build a platform for self-directed learning.

In addition to guiding students to set clear high learning goals and master scientific learning methods, it is also necessary for math teachers to guide students to integrate theory with practice, so as to make them aware and value the ability to exercise self-directed learning in practice. Therefore, the author provided three opportunities for students to exercise self-directed learning in higher mathematics classrooms: in the early stages of higher mathematics teaching, teachers can encourage students to go up to the podium and be a "little" teacher explaining math problems; during the mid-term of higher mathematics teaching, teachers can arrange for some voluntary students to choose their own topics and go up to the podium and be a "little" teacher explaining new math knowledge; in the later stages of higher mathematics teaching, teachers can choose some learning materials for students to fully self-study, only test and answer questions in class in order to understand the situation of students' self-directed learning, and help students improve their learning methods.

In the early stages of higher mathematics teaching, due to the difficulty of learning limit theory and the facts that students are still in the adaptation stage to university learning, although students' learning enthusiasm is quite high, but most students still have a passive learning method with a high dependence on teachers, low questioning awareness and ability, and weak ability to analyze and solve problems, and are still in the stage of stimulating self-learning awareness. At this stage, the main goal is to guide students to clarify their self-learning goals--to try to do simple questions correctly at once, to find ways to solve difficult problems, and to make students aware of the necessity, importance. And through necessary teaching organization, math teachers make students aware of the necessity, importance, and feasibility of doing simple exercises correctly at once. For example, when teaching a new lesson, math teachers assign slightly lower difficulty questions and ask students to do on the podium. Before students explain math problem on the podium, math teachers remind students to firstly observe, analyze, and think the questions in their brains"Can I do it? is each step clear? do I have any questions? how much is the chance of getting it right first time?" and to get it right first time. Through those, students can exercise their abilities in questioning, observing, analyzing, summarizing, and self-awareness.

At mid semester, with the enhancement of students' awareness and ability of self-directed learning, as well as the improvement of their enthusiasm for participating in the classroom, teachers can arrange voluntary students to choose a question from the textbook before the new class, learn independently first, and then explain it on the podium according to the learning thinking mode. This focuses on exercising individual students' self-learning ability and learning thinking patterns, discovering excellent problem-solving masters from whom other students can learn.

In the later stages of higher mathematics teaching, teachers can choose some learning materials for students to fully self-study, only test and answer questions in class in order to understand the situation of students' self-directed learning, and help students improve their learning methods. This approach focuses on exercising the self-learning ability of all students in the class.

Through the above exercises, students' self-awareness, thinking methods, thinking patterns, and self-learning abilities have all been exercised well.

Strategy 4: Conducting learning assessments to ensure good learning outcomes

In order to make self-directed learning more targeted, clear, and effective, it is also necessary to use learning assessments. This type of assessment includes regular assessment, final assessment, self-directed assessment, self-directed learning scale, and innovation scale assessment. Regular and final assessment aims at assessing students' mastery of mathematical knowledge. Self assessment of self-directed learning level is relatively simple. At the beginning of the school year, teachers provide a classification of learning levels in class. Autonomous learning is divided into passive learning, low-level autonomous learning, and high-level autonomous learning based on the questioning, memory, and understanding during learning, as well as the depth of problem-solving. Autonomous learning without questioning is not truly autonomous learning, but passive learning. Autonomous learning that only remembers and understands factual information is low-level autonomous learning while the learning that focuses on and deeply thinks about issues such as "how knowledge is created, how problems are solved, and how evidence is collected" is high-level autonomous learning. Students independently determine whether they belong to passive learning, low-level self-directed learning, or high-level self-directed learning. The purpose of this assessment is to stimulate students' awareness of questioning and emphasize the use and application of questioning strategies, promote their transition from passive learning to independent thinking and self-directed learning, and prepare them for better adaptation to college learning.

The assessment of self-directed learning scale refers to the use of the self-directed learning scale compiled by Zhu Zude and Zhang Wei to assess the use of learning strategies among college students [11]. This scale includes the Learning Motivation Scale and the Learning Strategy Scale. We mainly use the Learning Strategy Scale which consists of 64 questions. The Learning Strategy Scale measures students' ability in learning methods, seeking help, planning, summarizing, evaluating, and managing learning, etc.

The innovation scale evaluation refers to evaluating college students' critical thinking situation measured by College Student Critical Thinking Scale compiled by Hou Yubo et al. The innovation scale includes two dimensions and seven sub dimensions of innovative spirit. The two dimensions are the subject dimension and the object dimension (environmental dimension), and the seven sub dimensions are: flexibility and adaptability, innovation and uniqueness, criticalness, reflection, teacher support, university curriculum, and peer influence. Among them, the first four sub dimensions belong to the subject dimension, and the last three dimensions belong to the object dimension. The higher the total score of the questionnaire, the stronger the investigated students' innovative spirit.

Both self-directed learning scale assessments and innovation scale ones are conducted in the form of questionnaires at the beginning and end of the course. On the one hand, the survey results serve for better teaching based on the learning situation. On the other hand, by comparing the results of two self-directed learning surveys, we can understand the changes of students'ability in applied learning strategy and critical thinking, and provide more accurate guidance to promote students' creative development.

3. Teaching Effectiveness

After effectively implementing the above teaching strategies, some students taught by the author have achieved self-learning and they could complete their homework before class, the awareness and level of questioning have also been improved, especially with a significant improvement in independent thinking and critical thinking awareness and ability. The more direct effect is that after the reform, the average marks and passing rate for the final examination has improved. The shortcomings of this study lie in the fact that during the reform, Individual students with weak self-discipline lacked discipline sometime, and had less improvement in self-directed learning. This is an issue that needs to be continuously improved in the future.

4. The Conclusion

The essence of education is to develop students' intelligence, the breakthrough of which is to cultivate their thinking qualities, and the foundation of all thinking qualities is the depth of thinking. Therefore, the key to cultivating college students' thinking quality lies in promoting them deep thinking through learning, generating and mastering learning strategies, especially metacognitive autonomous learning strategies, including planning strategies. Educator Lin Chongde pointed out that "cultivating thinking quality is the breakthrough for developing intelligence." [12-15] Professor Liu Dianzhi from Suzhou University said, "For individuals, in order to innovate, they must first be someone who can learn and efficiently apply learning strategies, and generate their own strategies. So, for students studying in school, mastering knowledge is just the means, and learning to learn, mastering learning strategies, and generating their own learning strategies is the goal." Therefore, every higher mathematics teacher has a responsibility and obligation regard cultivating students' self-directed learning as an important teaching goal. In practical teaching, the concept of emphasizing knowledge transmission over strategy guidance should be transformed, and the teaching method of emphasizing declarative knowledge and ignoring procedural knowledge, especially strategic knowledge teaching, should be changed. Continuous innovation should be made to promote college students to better master self-directed learning strategies and carry out self-directed learning, to achieve the goal of learning, become high-quality talents, and better serve society.

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Author Contributions

Wu Hongye is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Pang Weiguo: Several advances in research on autonomous learning abroad since the 1990s [J]. Psychology Dynamics, 2000: 12-16.

[2] Xie Changkui. The emblem of college students: a trained mind_ reflections on the cultivation of thinking quality among chinese adolescents [J]. Contemporary Youth Research, 2002: 6-14.

[3] Wu Hongye. Constructing the training mode of systematic thinking and realizing the educational values of higher mathematics [J]. Higher Education Research 2022; 7(6): 199-202.

[4] Jiang Yingchun. Exploration and practice of autonomous learning teaching mode of advanced mathematics in the 'Internet plus' Era [J]. University Education, 2018, 9: 92-94.

[5] Zhao Yanhui, Tang Zuoming. Cultivation of students' autonomous learning ability in higher mathematics teaching under the flipped cassroom mode [J]. Mathematics Learning and Research, 2016(7): 18.

[6] Li Hongxia. Autonomous learning in advanced mathematics and its related strategy rearch [D]. 2015, 3: 11-13.

[7] Yan Guanqun. The application of autonomous learning in higher mathematics teaching [J]. Friends of Mathematics [J], 2018(8): 57-58.

[8] Liu Yi, Zhao Juming A survey on the current situation of critical thinking tendencies among college students -- Taking a local comprehensive university as an example [J]. Higher Engineering Cheng Education Research, 2010(1): 81-85.

[9] Song Jue. The value orientation and implementation path of modern university system in china [J]. Research on Educational Development, September 2008, 64-67.

[10] Zhu Zude, Wang Jingqiong, Zhang Wei, et al. Development of a scale for self-directed learning among college students [J]. Psychological Development and Education, 2005 (3): 60-65.

[11] Hou Yubo, Li Qiangqiang, Li Hao. Construction of critical thinkingstructure and scale development for chinese people [J]. Journal of Peking University (Natural Science) Version: 2022, 2 (58): 383-390.

[12] Lin Chongde. Cultivating thinking quality is a breakthrough for developing intelligence [J]. Journal of the National School of Education Administration, 2005, 09: 21-32.

[13] Zhong Qiquan. Learn to Ask: An approach to cultivate multiple thinking abilities [J]. Journal of Comparative Education, 2020, (3): 3-10.

[14] Dong Qi. The correlation and experimental research on the nature of the relationship between metacognition and thinking quality [J]. Journal of Beijing Normal University (social sciences), 1990, 5: 51-58.

[15] Wang Ling, Fang Ping, Guo Dejun. The nature, structure, and evaluation methods of metacognition [J]. Journal of Developments in Psychology, 1999: 6-11.