The Application of Educational Ecology Theory in Cultivating Autonomous Learning Ability of Engineering College Students

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Abstract. At present, there are problems about college students that they have no learning objectives, no learning plan, no learning perseverance, no teamwork and so on in their independent study. In this paper, from the perspective of micro educational ecology, according to different educational ecology principles, combined with the reform and practice of the College of Electrical and Automation Engineering of Changshu Institute of Technology, the author made the research and exploration on the establishment of the mechanism of autonomous learning ability of engineering students.

1. Introduction
Since the beginning of the new century, mankind has made a series of major breakthroughs and developments in high-tech fields such as new energy, electronic information, biology and space, and these high-tech technologies have been used in the operation and production of enterprises. More and more jobs require professionals with higher levels of knowledge and skill, but it also means that workers must learn and develop their own potential with greater adaptability, flexibility and subjective initiative to catch up with the development of the times. With the rapid development of knowledge economy, the requirement for the quality of the workers and the spirit of innovation are also getting higher and higher, which requires higher education must pay more attention to college students, especially the engineering students’ self-learning ability training, and effectively improve the engineering students’ self-learning ability and innovative spirit. I work in an engineering secondary school of Changshu Institute of Technology as a teacher, which helps me have a certain understanding about the ideas and measures that Changshu Institute of Technology use to cultivate the engineering students’ ability of autonomous learning.

It is generally believed in our nation that self-learning refers to the study dominated by students themselves, which is opposed to the way of study that dominated by others. This kind of learning method should be centered on learners (relative to teacher-centered). Students should complete self-planning, self-management, self-regulation, self-test, self-feedback and self-evaluation in the whole process according to their different needs [1]. The self-learning ability of college students is a kind of comprehensive self-management ability that college students show in the process of learning activities. This ability helps students to improve the enthusiasm and consciousness of getting knowledge and make students learn to think. Students with this ability have a strong curiosity, they are able to arrange their own learning activities independently, have a strong study spirit, use scientific methods to learn the knowledge actively and dare to question the authority [4].

Educational ecology is a new emerging discipline since the 1960s and 1970s. Education ecology is based on the principles of ecology, especially the ecosystem, ecological balance, co-evolution and other principles and mechanisms to study the various educational phenomena and their causes, and
then mastering the law of education development and revealing the development trend and direction of education [2,3].

The study of the mechanism of self-learning ability of college students is based on the principle of educational ecology, from the perspective of ecological environment and co-evolution. It focuses on the self-learning and ability development of students and bases on the secondary college (or department) micro-field to integrate the curriculum system, course content, classroom teaching methods, experimental teaching center construction, student innovation and practice activities, student extracurricular activities, student evaluation system and teaching management and other resources to explore the establishment of self-learning ability to promote college students to improve and improve the mechanism environment.

2.1 Niche principle and individualized teaching

Niche means that in a community, each individual has a different status and function, associated with the competitive exclusion principle and resource sharing [2,5]. In a secondary school of educational ecological environment, different students also have their own “niche”. The establishment of the mechanism of self-learning ability of college students needs to combine the different state of each student, insist on individual teaching and maintain the fairness of education.

2.2 The law of limiting factor and resource integration

The limiting factor of ecology is the lack of ecological factors, or below the critical line, even more than the limits of biological tolerance factors, if such a limiting factor inhibits the growth of organisms. According to this principle, in the process of cultivating students’ autonomous learning ability, we should pay attention to the objective restriction of analysis of ideas, resources, links and managements, exclude the negative influence from the mechanism and create a good environment to promote self-study.

2.3 The law of tolerance, the most appropriate principle and self-cultivation

The role of ecological factors can be played through three states, they are the smallest, the largest and most appropriate amount. The most appropriate amount is the most suitable degree that the ecological factor is balanced in its quality and amount [2]. During the development process of a creature, it has its own scope and range of adaptation of the surrounding ecological environment and a variety of ecological factors. According to this principle, promotion of the cultivation of autonomous learning ability of college students must be a gradual process and follow the objective cognitive psychology instead of seeking a quick success.

2.4 Education rhythm and respect for human physiological rhythm

In the education process, educators and learners are all people and people have a variety of physiological rhythm. Human physiological status and state of brain activity in different periods of have a regular change. It reflects the subjective and objective unity to arrange educational activities according to the normal operation of educational rhythm. According to this principle, when creating an environment of the self-learning ability of college students, we must follow the physiological rhythm to make reasonable arrangements for teaching time and content.

2.5 Social clustering and self-learning team building

The degree of biological clustering affects the dynamics of the group and the conversion of the harmful and beneficial relationship within internal members. The level of grouping will have a direct impact on the activity and effectiveness of the educational community. “Over” and “not enough” are not suitable for the educational community. According to this principle, a college student learning team can be established to promote students’ autonomous learning, and the team’s membership density must be maintained at the Optimum Density, which means following the Allee’s Principle.
3. The Status Quo of Domestic Engineering Students’ Self-learning

3.1 No learning goals

Autonomous learning, as a new way of learning, is different from the traditional high school learning style, which has been widely accepted by college students. For many engineering disciplines, the teachers will arrange some autonomous learning content according to the syllabus and teaching content, in addition to the normal teaching. However, many engineering students are still accustomed to the high school learning style and can not effectively break down their own learning tasks because of laziness and lacking independence and goal, the results lead to less effective.

3.2 No learning plan

College students’ extracurricular time is relatively large, which helps them have higher degree of freedom of self-study. Some of the independent study of engineering students lacks planning, specific learning goals and learning steps. As a result, they spend most of the time blindly following the other students in the class. Some other students learn to follow the crowd and do not develop their own learning plan, which results in low learning efficiency. The overall planning and progress of autonomous learning can not be completed on schedule.

3.3 No learning perseverance

Many college students were misled by the wrong guide of high school stage and believed it relatively easy to study in university and graduate smoothly without hard work. After actually entering the university, they found that the university’s learning is completely different from their imagination. Especially engineering students, they do not only have to study the theoretical knowledge with a lot of pressure, but also have to spend a lot of time completing the practice. This psychological gap is able to cause the mentality of engineering students’ imbalance and low enthusiasm of independent learning, coupled with laziness, which ends up with that engineering can not keep learning by their own perseverance at the step of independent learning and finally affects their academic performance [6].

3.4 No teamwork

Students passed through layers of selection and ultimately stood out by their own efforts at the period of primary and secondary school stage, which makes them lack of teamwork awareness. When it comes to the university stage, a lot of engineering courses (especially the links of practice) need several or even dozens of students to work together to complete. It is so important to deal with the relationship between the individual and the team. Many of the engineering students’ thinking still stay in the stage of primary and secondary school, which makes them lack of teamwork awareness, can not be well integrated into the entire learning team, and ultimately make these people’s independent learning are always free from the team system and the low effectiveness.

4. The Significance of Establishment of the Mechanism of Self-learning Ability Training of Engineering Students

4.1 To provide a new model of cultivating the students’ autonomous learning ability

Today's college students have received too much examination-oriented education and have been involuntary and unfamiliar with self-learning, especially in the study of specialized courses. They are accustomed to indoctrination teaching methods, which makes their learning status and learning result are not ideal. It is hoped that through the top design of the institutional environment to inspire the enthusiasm of all students to carry out autonomous learning, so that each student can choose their own independent learning model.

4.2 Help to cultivate the skills of communication and teamwork of engineering students

The existing teaching mode is that the teacher teaching and students hearing in the classroom.
After school, teachers and students contact very little and their exchange opportunities are limited to
the classroom for just a few tens of minutes. In the mechanism of cultivating students’ autonomous
learning ability, we can design a variety of ways of autonomous learning, such as mutual
recognition of innovation and practice, professional course project-driven learning, professional
course content research study, etc and so on to promote students to communicate with teachers.

4.3 Help to cultivate the practical ability of students and lifelong learning ability

In view of the fact that the majority of college students have the problems of passive study and
lacking practical ability, the mechanism of independent learning ability of engineering students
includes the effective forms of experimentation, integration of theory and practice, which can
greatly stimulate the subjective initiative of students’ self-learning and make them learn to find
problems, analyze problems and solve problems, develop their lifelong learning ability to explore
innovation, advancing with the times and adapt to social developments [7].

4.4 Help to improve ability of running school of the secondary school teaching units

Higher school students are distributed in the secondary teaching units that belong to school, and
this level of the environment will have a direct impact on the personnel training. It is precisely from
the perspective of micro-education ecology to start the top design so that it can promote the
secondary teaching units to integrate resources better, to create a systematic self-learning to
cultivate the micro-education environment, target to carry out relevant research and practice, which
help all students benefit. Many of the practical contents will be of great practical value to the reform
of classroom teaching and the change of students’ learning styles, which is of great significance for
colleges and universities to assure teaching quality from the grassroots level.

5. Self-learning Ability Training Practice of Engineering Students in Changshu Institute of
Technology

Based on the different principles of micro education ecology, this college has carried out a series
of relevant measures to cultivate the cultivation of college students’ autonomy ability in the
academy range, which is based on the students’ training program of Electrical and Automation
Engineering School of Changshu Institute of Technology.

5.1 To promote students to carry out independent research by the recognition of innovative
training results credit

Relying on college students innovation laboratory, advanced automation technology joint
demonstration training center, advanced measurement and control technology joint training center,
focusing the resident students of the three platforms as the target group, we carried out the credits
recognition of innovative training results to promote the students to carry out the reform practice of
curriculum assessment, that is, resident students of the three platforms, in accordance with their
own training program requirements to carry out independent learning training to meet the
requirements of the pre-assessment requirements, then the credits of the corresponding course can
be obtained by mutual recognition of the course credits.

During the year of implementation of recognition of innovative training results credits, nearly 40
students submitted their own curriculum works. This is a proof to its positive role in enhancing
students’ autonomous learning and promoting students’ innovative research. It enables students to
meet the requirements of basic professional courses through a variety of experimental training and
innovative training platforms by their ingenuity and creativity.

5.2 To promote students to take the initiative to explore the type of learning courses by the
assessment of project-driven form

Carrying out the reform of curriculum assessment methods for some very practical professional
compulsory courses. That is, according to the principles of educational ecology to extract some
students and let they use a variety of open experimental platforms, in accordance with the
requirements of the relevant tasks, through self-learning to complete a certain number of project
design, and pass through the task in the laboratory to finish the course examinations [8].
Correspondingly, the course examination has increased the proportion of the assessment of the
operation and used the approach of “written test + practice”, and changed the original written
examination papers in the design questions and integrated design questions into operational
questions. The examination is held in the laboratory in batches to further improve the student’s
operational and engineering design capabilities.

The result of the reform attempt is that the students who have participated in the reform practice
have achieved good results. This proves that the project-driven form allows students to carry out
active exploratory learning in the course of completing the project design, which can effectively
cultivate students’ autonomous learning ability, and ultimately enable students to master the relevant
professional knowledge of the course and professional practice skills.

5.3 To guide students to pay attention to procedural learning by the assessment of content
segmentation

In order to mobilize students’ enthusiasm and initiative in learning, we should strengthen the
students’ usual learning and avoid the pre-test revising and break the examination status of “single
paper test results”. The college has carried out the content segmentation examination to guide
students to pay attention to the reform of the examination method of learning process, that is, to
change the traditional single written examination method into a phased examination, in order to
promote students to learn the knowledge of each stage, so as to improve the effectiveness of
classroom teaching. College finally selected three professional compulsory courses for reform, each
course assessment is divided into three stages and each stage can be made a specific stage division
based on the continuity of the course chapters and other needs respectively. The final form of each
stage of the three courses is the same as the final examinations of other courses, and the final score
of the examination takes the average of the three stages of the examination.

The teaching effect is very obvious after a semester of the reform of the implementation, under
the condition that the type of questions, amount of questions and the difficulty of the examination
are relatively increased, the overall performance of the students that participated in the reform has
been significantly improved compared to the past. Teachers that participated in the reform reflected
that in the implementation of the content of the sub-paragraph assessment reform, since the
completion of each stage after the completion of the task has an examination, so that students are
usually in a state of tension, which prompts them to strengthen the attention to process learning, and
learning initiative also increased accordingly, the classroom discipline has also been significantly
improved and achieved the effect of combination of classroom teaching and extracurricular
self-learning.

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