

Research on the Design of Teaching Environment Based on Self-directed Learning Taking the Course of "Management Operations Research" as an Example

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ABSTRACT

The self-directed learning is an important topic in education today, and the ability of students to learn independently is the key to moving towards deep and lifelong learning. In response to the current problems in teaching process of the "management operations research", a teaching environment framework is designed and specific teaching practices are given with the orientation of self-directed learning ability, which would ensure the improvement of students' self-directed learning ability.

Keywords: *Self-directed learning, Teaching environment, Pre-class concepts, Metacognition.*

1. INTRODUCTION

Self-directed learning is an important topic in education field, which attracts attentions from the society. As the reform of higher education continues and the educational resources expand, cultivating students to change their learning styles, advocating self-directed learning from the perspective of precision education and developing students' self-directed learning ability are the keys for learners to move towards deep and lifelong learning.

As the saying goes, good teaching is not as good as good learning. Only by giving full play to the initiative and enthusiasm of students' self-directed learning can students' self-development be achieved, and then can students find joy in the process of self-directed learning and learn actively.

2. SELF-DIRECTED LEARNING

The most representative view on self-directed learning comes from social cognitive theory. Bandura, a representative of the social cognitive school, first put forward the idea of students' self-directed learning from the perspective of the interaction among individuals, behaviour and the

environment. Zimmerman proposes the self-directed learning framework from the perspective of the learning task conditions, and defines self-directed learning in terms of learning motivation, learning methods, learning content, learning time and learning environment, which is widely accepted by academics. The so-called self-directed learning refers to the learning mode in which learners establish suitable learning objectives, make reasonable learning plans, choose scientific learning methods, supervise the learning process, assess the learning effects, and manage the whole learning process according to their own specific conditions [1].

Self-directed learning theory is widely used, for example, some studies explore the construction of an independent cooperative learning model for medical students in local comprehensive universities [2]. Chen Chen effectively developed students' self-directed learning skills by setting up pre-class assignments [3]. Li Xi explored the impact on students' self-directed learning in terms of five elements: screen numbering, timing, teaching content, presentation, and narrator voice [4]. Researchers have defined self-directed learning from the perspective of the school education environment, i.e. self-directed learning is a form of

learning in which students actively participate in the whole learning process under the guidance and leadership of teachers in the school education process.

This paper argues that self-directed learning is about stimulating students' internal motivation to take the initiative. Motivation for self-directed learning essentially stems from the instinct to adapt to the environment. It is the environment that determines students' self-directed learning, and the choice of self-directed learning is simply the student's feedback to the environment. Therefore, the fundamental reason for students to choose self-directed learning is environmental feedback. Other factors, including students' own ability and personality, are only relevant factors, not decisive factors. Students' ability to learn independently is reflected in their motivation to learn independently, their ability to transfer learning, and their metacognitive skills. If the environment demands it, students will try to overcome even if the learning is most difficult and they receive negative feedback. Conversely, if the environment does not require it, students will not bother to do so, even if the learning is easy. Therefore, it is vital to design effective teaching environment that promote students' self-directed learning.

3. TEACHING ENVIRONMENT

There are four design logics for teaching environment [5]. The first is learner-centred environment, that is, it is required to create a learning environment that is learner-centred rather than teacher-centred. The second is knowledge-centred environment, that is, it is suggested to build a knowledge-centred environment, deal with the needs of students seriously, lead them to understand and then transfer knowledge. Therefore, the students would become knowledgeable people. The third is evaluation centre environment. In addition to imparting knowledge and interacting with students, classroom teaching needs to be assessed for its effectiveness. The fourth is community centre environment. The extent to which the learning environment is community-centred is also important for learning. Constructivist theory suggests that the teaching environment is the place where learners can use diverse tools and information resources and collaborate and support each other in the pursuit of learning goals and problem-solving activities [6].

Researchers explored the related literature [7][8] of the positivity and effectiveness of the teaching environment for self-directed learning.

4. PROBLEMS IN LEARNING THE COURSE OF "MANAGEMENT OPERATIONS RESEARCH"

The teaching objective of the "Management Operations Research" is to develop students' ability to solve practical problems, and to build a new system of course teaching supported by the construction of the discipline and the teaching reform of the basic management courses, and based on the combination of operations research and practice, helping students to master how to apply the quantitative method models in management operations research to analyze and study modern business management decision-making problems. The teaching objectives are as follows: to master the basic modeling principles of management operations research, to have the ability to think critically, and to have the ability to solve complex problems. In the existing teaching process, there are many problems.

There is a mismatch between the class schedule and the course content. There are a total of 48 credit hours in the course, and it is required to finish linear planning, multi-objective planning, integer planning, transportation problems, non-linear planning, dynamic planning, network planning, etc. Students are mostly exposed to operations research models for the first time, and there are many contents, which are difficult, so students do not have enough confidence in learning, and the class time is seriously insufficient.

It is difficult to track students' learning status. How to grasp the students' learning status from the students' perspective and propose targeted solutions is throughout the semester on this basis. At present, this study mainly uses classroom spot checks, homework checks, classroom tests, 1-to-1 enquiries and other methods to manually record each learning record. However, the records cannot be kept in real time, the information recorded may not be complete, the students may not be fully covered, and it is not possible to make target improvements according to students' individual characteristics.

The evaluation system is relatively homogeneous. Students are currently assessed with the use of two main components: usual performance + final exam result.

In order to be fairer, the researcher has tried the best to consider the diversity of daily performance assessment, but it still cannot cover the whole-process learning assessment of every student.

5. TEACHING ENVIRONMENT DESIGN OF THE COURSE OF "MANAGEMENT OPERATIONS RESEARCH" BASED ON SELF-DIRECTED LEARNING

In the existing teaching environment, students do not take enough initiative in learning and do not

understand the overall optimization idea of management operations research well enough to apply it flexibly in subsequent applications. In view of this, this paper integrates four teaching environments and designs the teaching environment framework for students' self-directed learning ability. With the help of the feedback of teaching environment, the effective teaching of "Management Operations Research" can be realized. The teaching environment framework is as follows. ("Figure 1")

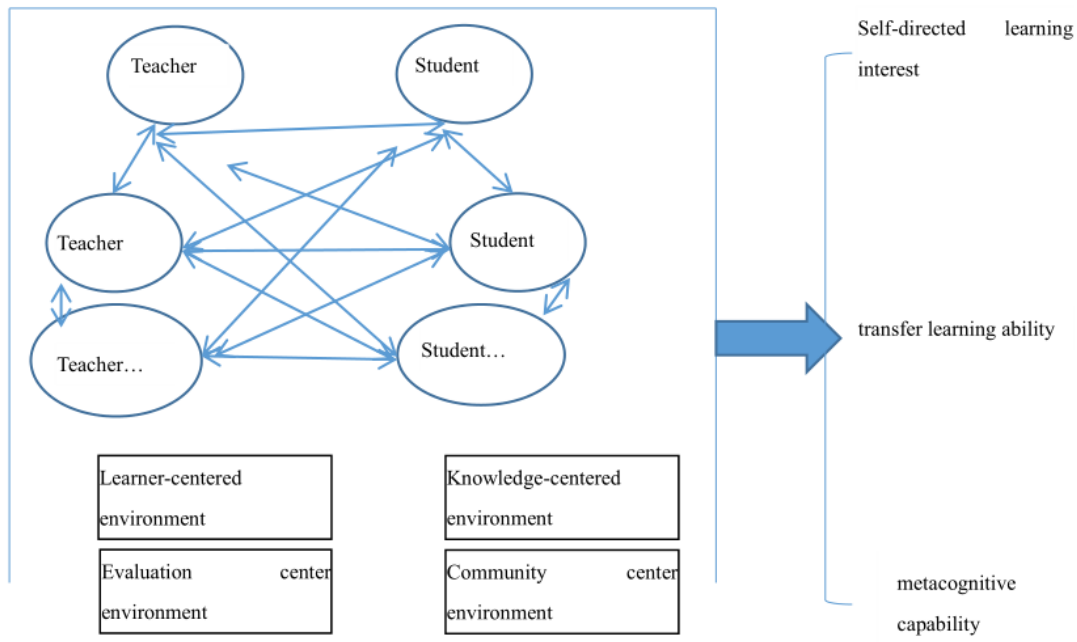


Figure 1 Teaching environment framework.

5.1 Learner-centred Teaching Environment

"Learners must bring knowledge, skills, attitudes, and beliefs to it, and all these things that learners bring receive adequate attention here" [5]. Teachers cannot make one-way outputs. If the interactive teaching is not based on pre-class concept, it is impossible to convey information and knowledge accurately, let alone arouse students' enthusiasm for self-directed learning. Therefore, in the process of teaching,

5.1.1 Recognizing the Differences of Students and the Importance of the Cultural Knowledge for Learning

In addition, it is suggested to change the previous homogeneous teaching method and acknowledge differences in students' knowledge backgrounds, understanding ability and acceptance ability. According to the students' differences, it is necessary to create an individualised teaching environment, design the content difficulty and adopt different teaching requirements for students. The content of "Management Operations Research" is organized around linear programming, including linear programming models (average difficulty), model solving of linear programming (medium difficulty), scenario applications of linear

programming models (medium difficulty), and flexible transfer of linear programming problems (high difficulty), with the corresponding teaching requirements set as being mandatory, as much as possible, and flexible.

5.1.2 Diagnostic Teaching Based on Pre-class Concepts

In order to understand students' differences, students are asked to use their past inherent methods to solve some practical problems before teaching to understand their intuitive views, and new concepts are introduced on this basis. Specific practices are as follows:

Students are required to complete the assigned unit of the textbook on their own before the class, including: video content of the chapter, learning focus and learning difficulties of the chapter, self-made teaching videos of key and difficult points, exercises for each chapter, and reference materials. On this basis, the questions for the chapter are presented.

Before the lesson, the teacher compiles all the students' questions to generate a problem set for the chapter, collates the problem set and analyses the students' difficulties in learning the chapter and the differences with the teacher's expectations, which serves as a basis for the teacher's classroom teaching arrangements.

5.1.3 Emphasis on Students' Expression

Expression is the most direct means to reflect students, and teachers can find out what each student can know, understand and do.

The question-driven teaching is adopted, so as to encourage students' active expression.

Firstly, questions are set around the key points of the lesson, students are asked to respond and explanations are based on their answers. The question-driven method can be used to focus on students' concerns, highlight the key difficulties of the knowledge system and enhance students' confidence in learning.

Secondly, students can answer the questions in a variety of forms. According to the student groups, each group would obtain the opportunity to answer, and race to be the first to answer a question, so that students who are fully prepared before class have more opportunities to score.

Thirdly, students can also take the initiative to ask questions before class, and the teacher can explain them or other students can help to answer them to liven up the classroom atmosphere.

Through question-driven teaching, an environment for students' expression is created and data can be collected on the whole learning process, forming a personalised data framework and creating an accurate learning programme for each student.

5.2 Knowledge-centred Environment

"Knowledge-centred environment emphasizes figuring out meaning. By means of making sense of new information and clarifying unclear knowledge, it is suggested to help students improve metacognition." [5] Only by understanding the principles can students better solve problems. Without understanding the principles, students simply learn how to operate, and the methods will be diminished and gradually lost in the process of transmission, and eventually nothing at all. The most important aspect of the course is that the students eventually acquire knowledge, and the main approaches are as follows.

5.2.1 Constructing a Mind Map of the Course

Students must have an initial framework understanding of the subject system by collecting a variety of literature, analyzing the disciplinary development of operations research and understanding its status from a philosophical perspective. On this basis, a mind map of the course is constructed so that students have a sense of what they are about to accomplish, such as "this is an interesting subject", "I can do it well", "I will become an expert in this field in the future".

5.2.2 Course Content Is Consistent with Course Objectives

Transferability is the ultimate goal of developing students' self-directed learning. The mastery of curriculum knowledge determines the transfer competence, including transfer in concepts, subjects, school years and schools. The course is taught using a staggered progression of chapters to advance the curriculum, i.e. completing a teaching of chapter and then returning to the previous chapter for review, so as to continuously train students' comprehension and retention skills;

exercises are explained and occasional unit tests are given to allow students sufficient time to study the course.

5.3 Evaluation Centre Environment

The ability to perceive one's own cognition is metacognitive skill, which helps students to plan and organize their learning better and independently, and enhance transferability effectively. An effective way to determine metacognitive ability is evaluation. There are two methods of evaluation, including formative evaluation (using evaluation as a source of feedback to improve teaching and learning) and summative evaluation (primarily measuring what students have learned at the end of the learning activity).

Course evaluation covers the whole process of learning, including the pre-course, in-course and post-course stages.

In pre-course phase, students can take course video learning. Students can record the key points of theoretical knowledge in each chapter after completing the video study of the textbook on their own, so that they can take these questions in the offline classroom and get twice the result with half the effort. Students can take the initiative to answer questions in class or be sampled to answer them, which helps teachers to examine students' self-learning. At the same time, stage self-evaluation questions are set online, objective questions occupy the main body, each student completes them online independently within a set time frame, and the platform scores them automatically. And then, students' mastery of the key concepts and knowledge points of the corresponding stage can be tested.

In-class stage, questions in class are set. Each response is recorded and scored, including the score of groups and individuals. Second, questions for the in-class test are set. Each student is required to complete and teachers mark the test during class. Then, students' mastery of the knowledge points can be understood, so as to avoid individual students being lazy. This part is automatically marked and recorded using the MOOCs app. In addition, the evaluation of assignments is set. Each student is given a mark for the work they have done.

In post-course phase, post-course practical exercises are set. Through online discussion, teachers comment and mark for each group. Lab report (in the form of a short essay) should be

finished by a team. The team can make free choice of topic, modelling solution, final defence and submission of paper. Then, students' ability to apply their knowledge of operations research in practice can be tested. Finally, according final test, teachers can measure what students have actually learned in this semester.

5.4 Community Centre Environment

Classroom teaching cannot be confined to the classroom, and the community can be a combination of class, school, family, community and society. Therefore, during the teaching process, it is necessary to pay attention to the influence of the general environment on students' motivation for self-directed learning, and make full use of the Internet to integrate into various communities, such as building a class QQ group to create an active learning atmosphere in the class, encouraging students to use their knowledge of operations research to participate in various projects within and outside the school, paying attention to social hotspots and new developments in the discipline of operations research, and actively making contribution in any way.

6. CONCLUSION

Students' self-directed learning ability has always been the focus and difficulty of cultivation in universities. With the integration of four traditional teaching environments, this paper designs a teaching environment framework for the course of "Management Operations Research", and further explores student differentiation strategies, course content organization, teaching tools, and course teaching evaluation in the teaching environment. Students are motivated to learn on their own through feedback from the environment.

AUTHORS' CONTRIBUTIONS

This paper is independently completed by Li Wang.

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