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Knowledge Learning in University Mathematics

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Abstract: The paper, in view of the situation that the knowledge of university mathematics is complicated yet trivial , puts forward to establish connections of knowledge in the same course, between different courses and even different disciplines by applying advanced information technology for the sustainable development of knowledge learning and the improvement of student's mathematics quality.

Keywords: information technology; knowledge Learning; connection; sustainable development; mathematics quality.

1. Introduction

It is essential for students in universities of science & technology to study mathematics well, especially for the students majoring in mathematics, computers, communications technology, etc. However, most students feel headache about the new situation that studying mathematics in universities is no longer as it used to be when only simple algebra and geometry needed to be learnt. In fact, they are faced with a rather vast and complex mathematical system, in which there are many curricula including calculus, complex analysis, Fourier integral transform, linear algebra, abstract algebra, analytic geometry, ordinary differential equation, partial differential equation, probability theory and statistics, discrete mathematics and numerical calculation. Moreover, there are a lot of knowledge that need to be understood and grasped only in a simple course. Thus, a question is posed for teachers: how to handle all kinds of knowledge rationally and effectively to enable students understand them more easily, and ultimately to achieve the aim of retaining knowledge sustainable?

There is no doubt that the use of advanced information technology is a good way, by which a clear and systematic connection can be established between knowledge that students have learnt or will learn. And with the maturity of technical means and students' familiarity with them, this new teaching method will play an increasingly important role in the future.

2. Knowledge Learning in A Single Course

The principle of mathematics learning association in psychology states that learning should be in a unified system containing related concepts and principles. This is also consistent with the overall principles of systems science[1].

It is not a new idea to make knowledge in a single course unified as a whole. Nowadays, almost all teaching uphold such a principle and teachers are active practitioners in class[2]. The concept of limit, for example, is throughout learning of the calculus, making continuity, derivative, integral, series and other knowledge points a string. In such a unified framework, connection and distinction between different knowledge are analyzed so as to expand and deepen concepts. A chain is formed from the first-order derivative to the higher order derivatives and from the derivatives of functions of one variable to the partial derivatives of functions of variables. For students, knowledge, instead of being trivial, becomes sustainable. Furthermore, it gets easier for students to understand the nature of knowledge, to clarify fundamental relationship between knowledge, and to remember, imitate, suspect and create.

Thus, a learning software can be designed in a single course, upholding the principle of studying knowledge from easy to difficult and making many a little a mickle without a blind pursuit of integrity and complexity. The software should be designed easy to operate. The concrete knowledge points are arranged in accordance with the order of the initial learning with the order unfixed. In fact, the learning software is characterized by the interconnection of konwledge, adding complementary knowledge which may be studied later. There can be more flexibility in design by using human-computer interaction model, that is to say, the software should appropriately guide students so that they can enhance the sense of participation in the information exchange process with the computers.

3. Knowledge Learning in Different Mathematics Courses

If what has been mentioned above is a horizontal comparison, here is a vertical investigation. All the learning process of mathematics courses is continuous in universities, rather than being isolated. Therefore, a relatively higher demand is made for teachers .They should not only be familiar with the knowledge they are teaching, but also be familiar with those related in preceding and following courses. A bridge can be built between different mathematics courses through lots of knowledge points.

For students, the matrix concept is learnt first in the linear algebra course, which focuses on explaining some basic properties and applications of the matrix. If students think that learning can also stop there about the matrix with the completion of the course, they're totally wrong. In fact, the matrix appears in many other courses with the learning going further. For example, a Boolean matrix is studied in the abstract algebra which is from so-called Boolean algebra[3]. And this Boolean matrix is used as a research tool for graph theory in discrete mathematics later, called the graph matrix[4]. In fuzzy mathematics, it is called relationship matrix and generalized to form the fuzzy relationship matrix in the sense of fuzzy mathematics[5]. The same knowledge point applied in different courses, of course, focuses on different aspects. It makes students to master the knowledge more comprehensively and flexibly.

Mastery of knowledge, which is definitely not the ultimate goal of learning, is not only to learn basic contents, but to learn how to use them. The same knowledge point is described in different forms in different courses with a variety of practical examples given in class, which inspire students with more comprehensive understanding of the knowledge point and stimulate their interests in learning. For example, a optimal tree in the cluster analysis of fuzzy mathematics and in graph theory is associated with the shortest path problem in a weighted graph. Transport problems in real life can also be abstracted as the shortest path problem in operations research. There are many such practical examples. But the fact is that the teaching time is limited in classes so that teachers can not fully show them to students. Due to this, the use of information technology tools is certainly a good assistant out of class. In the designed software, the difference and connection between knowledge points in related course and the application in many practical problems can be linked into many small subjects to be illustrated conveniently to the students without face-to-face instruction. Of course, the design can combine multiple technologies, such as PPT presentations, animation design, web simulation, simple games, exchanging groups to reduce students' irritability and raise their interests.

4. Knowledge Learning in Different Disciplines

It is easier to understand the connection of knowledge in different courses in the same discipline. While, is there a gulf between different disciplines? The answer is of course no. In fact, modern cross-linkages between disciplines have become a hot spot, not just in the traditional fields like science and technology, economics and management, but even in so-called soft sciences, to name only a few, humanities and social sciences. The signal denoising in communication sciences is consistent with the uniform continuity in calculus, commodities production and sales are arranged by the use of operations research in the economic management and statistics methods are used in humanities and social sciences. All these can be showed to students as backgrounds of relevant knowledge or application examples, which can greatly attract students' attention and cause their curiosity and inquiry by actual simulation operation of learning software in class.

Knowledge learning can not be scripted, otherwise, it will be isolated, discontinuous and boring. As a rusult, students will employ rigid rather than creative ways of thinking to understand things. It may be a powerful refute to the question on the value of mathematics learning by associating the basic knowledge point with the problems that students can never link to what they are learning by the use of information technology.

The separated subject teaching in education is an inevitable result of knowledge explosion. Under such circumstances, it is unrealistic and unreasonable to require students to master total knowledge in all fields. Anyway, it is equally bad to let knowledge more and more trivial. The good teaching ideas coupled with advanced information technology can help students to master knowledge from points to surface , and then to build their own intellectual framework. Ultimately, the overall qualities of students will be improved, which is the primary prupose to learn knowledge.

5. Conclusions

High-tech is ultimately mathematical techniques with the rapid development of information science. The main purpose of mathematics learning for students is to cultivate their mathematical qualities which stands for a mathematical way of thinking, refers to a consciousness to deal with problems initiatively by the use of mathematical knowledge, consisting of the logical thinking, the intuition from the reality to abstract mathematical problems, the abstracting power to form mathematical concepts, the ability to use mathematical languages and the practices to construct mathematical models. The quality-oriented education in mathematics is a process, in which knowledge learning plays a fundamental role. One can not carry out a creative work if he is not able to under-

stand clearly the knowledge he needs. Of course, it doesn't mean that mathematical qualities can be fully cultivated as long as to learn knowledge well. However, it can be considered a process of improving mathematical qualities to learn knowledge with a connective and sustainable attitude. At the same time, the application of information technologies in knowledge learning accelerates the process. It's improper to deliberate knowledge learning and cultivating capacity separately. In fact, learning knowledge can develop abilities and qualities, and the improvement of qualities makes learning knowledge easier in turn.

It's always a problem for teachers how to make mathematical knowledge learning solid and interesting but not lacking of application and preciseness? Many educators have tried a lot of means out to solve this problem in teaching methods and contents. It is a nature thought to achieve the goal through basic knowledge learning thoroughly with advanced information technologies.

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