

## Study on Knowledge Engineering Education Technique

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**Abstract.** Some educational practices often ignore the design process when solving problems in professional field. Reference to the concept of knowledge engineering in artificial intelligence, this paper presents a new education method called Knowledge Engineering Education Technique (KEET). It emphasizes the learning process. The technique is one method of obtaining knowledge through the research on the basic issues of knowledge and general answers. The basic content and practice of KEET are discussed in this paper. It may enrich the Education Knowledge Engineering (EKE) and promote the innovation and development of education and improve the quality of personnel training.

### 1. Introduction

Many scholars have emphasized the importance of the learning process in their learning theory, but there are still considerable part of educational practice ignoring the process of Solution and Design in professional field. The problem is particularly prominent in the basic education in China. It's limited by both the education system and the faculty. The problem also exists in higher education. However, most of the educators in higher education have the ability to design the educational task which focuses on the learning process. Therefore, a considerable part of the reason is that we ignore its importance. It's not an easy thing to pay attention to the educational process. The educational task which focuses on the process-oriented learning is usually a complex process system. Its complexity may result in the lack of preset control by educational technology. Thus, it restricts the probability and effectiveness to solve the problem via technology-oriented approach [1]. Aiming at this problem, this paper proposes knowledge engineering education technique. This is a new concept which is fundamentally different from the engineering knowledge in Education Knowledge Engineering (EKE). The detailed explanation will be given in the following section. Using the computer has brought us a lot of convenience. However, it makes us ignore the mastery of problem-solving design. Scientists have been training computers to solve problems. You have to admit that computers are getting smarter. If we look at this phenomenon from a different perspective, the key question becomes what we can learn from the computer. The concept that Allen B. Downey emphasizes is how to think like a computer. Computational thinking can solve many problems. In the field of artificial intelligence, a computer gives a result for a comprehensive problem, which is inseparable from its internal complex solving design process. For computers, the educational significance of the design process to solve problems is also far greater than that of the direct result. The design process can improve the ability of computers to solve problems: Firstly, the exploration of design process makes computers accumulate more basic knowledge; Secondly, the implementation of design processes make computers obtain more knowledge-expression methods; Future more, the experience to achieve the purpose of solving problems makes computers accustomed to building knowledge more effectively. If one copies the design process of computers to solve problems, he will learn something. This is the reason why knowledge engineering education technique is discussed in this paper. In the following discussion, Connotations of KEET are introduced in Section II. It highlights the difference between Knowledge engineering in artificial intelligence, KEET and EKE. Section III deals with the basic contents of KEET including the knowledge selection and the knowledge expression. The feasibility of KEET is

described in Section IV. The characteristics and application range are mainly discussed in this part. The practice of KEET is discussed in Section V. The practice principles are given in this part.

## **2. Connotations of KEET**

### **2.1 Concepts of KEET**

Knowledge engineering disciplines was born in 1977. It follows the principles of artificial intelligence. That is, without expertise of certain depth, to provide solving means for the problem that is difficult to obtain answers [2]. It is based on knowledge acquisition and expression. Knowledge engineering is the research on the basic issues of knowledge and general answers in artificial intelligence [3]. One of the central goals of artificial intelligence research is how to make computers smarter. The accumulation of knowledge and expression makes it possible to achieve computer intelligence. The sure thing is that, if one copied the design process of computer to solve problems, he will learn something. Then, if we educate people the same way as we train computer, the effect should be positive. The method of obtaining knowledge through the research on the basic issues of knowledge and general answers is called KEET in this paper. Knowledge engineering in KEET is fundamentally different with that in Education Knowledge Engineering (EKE). Knowledge engineering in EKE refers to that the application of education knowledge make education operations [4, 5]. Education engineering knowledge allows teachers to acquire teaching knowledge operational and enhance the individual competency for teaching [6]. KEET can be used as an educational content which EKE contains.

### **2.2 Connotations of KEET**

KEET emphasizes that educatees should develop the habit to choose knowledge and obtain knowledge expression like a computer. The purpose to develop the habit is that educatees will become more intelligent through training. Although without expertise of certain depth, they can provide solving means for the problem to a certain degree and try to acquire new knowledge and build new knowledge system. When the educators teach basic knowledge for solving problems, they should focus on teaching the methods of knowledge construction and expression and make the educatees obtain knowledge as much as possible. Once educatees participate in the education given by KEET, the educator's main job is to guide educatees to select and express knowledge according to the pre-set methods. It's important to note that educatees' behavior should be fully guided rather than unduly restricted. In view of educational essence, KEET shows features of activity, life, creativity and integration. In view of educational subject, the educational process is educatee-centered and mobilizing the educatees' enthusiasm and initiative. In view of educational purpose, KEET promotes educatees' self-realization about knowledge selection and expression.

## **3. Fundamental contents of KEET**

We should learn from computer how to solve problems at an appropriate level. Obviously, it does not make sense to learn at the level how the transistor works. The problem-solving process by computer can be summarized as knowledge selection and knowledge process at the level of operating knowledge. For KEET, to learn from computer at this level is appropriate. Thus, the Fundamental contents of KEET can be divided into knowledge selection and knowledge process.

### **3.1 Knowledge selection**

Similar to the elements of knowledge engineering in artificial intelligence, the fundamental contents of KEET also include the selection and expression of knowledge. Reference to the logic about knowledge selection in computer, this section focuses on the steps and principle of the knowledge selection in KEET. Faced with a huge amount of knowledge in the knowledge base, the ability to select knowledge becomes more important. For different educated individuals or groups, educational tasks are different. Does an educational task require professional knowledge or common knowledge? If general knowledge is required, what is it? The first matter of knowledge selection is to determine what kind of knowledge is involved. Obviously, language teaching and mathematics

teaching contain different categories of knowledge. After knowing what kind of knowledge is involved, the next consideration is how much knowledge we need. Because one of the key concerns for KEET is knowledge accumulation, knowledge amount should be overestimated. Of course, the amount is generally not from "one" to "infinity." The explanation will be given in the next paragraph. To some extent, knowledge amount affects the ability of educators to design educational tasks and that of educatees to solve problems. The overestimated amount of knowledge can help educators and educatees distribute knowledge resources reasonably and predict the progress.

### **3.2 Knowledge expression**

For KEET, most of the learning processes are to collect and process knowledge for solving problems. Whether problems in an educational task can be easily executed and copied or become a failed attempt depends not only on what kind and how much knowledge educatees reserve, but also on how educatees gather and build knowledge. That is the content of this paragraph to be discussed. In the introduction, this paper has explained why problem solving process is more important than the direct result. One of the reasons is that the experience to achieve the purpose of solving problems makes solvers accustomed to building knowledge more effectively. Stating the required knowledge in the professional field is obviously different from memorizing formulas superficially. The piece of knowledge which is difficult to provide information sources is hardly to be applied to a number of unanticipated changes. Therefore, knowledge expression is based on extracting the required knowledge from the knowledge base reversibly. The knowledge which is not required will increase the difficulty of solving problems. That's why the knowledge amount should not be infinite. Problem solving relies on knowledge expression: some procedural knowledge is expressed by one or more procedural collections; some factual knowledge is expressed by using certain methods in some way. Some educational tasks may be designed to be complex. The present knowledge reserves are not enough for him to do the solving design successfully, which requires the expansion of knowledge expression given by one or more groups. After they collect information, analyze countermeasure and discuss what they know and how they work, they complete the expansion of knowledge expression in collaboration. In fact, this process of cooperation is the education process for the individual. There are a lot of computer knowledge representation methods, including Predicate logic expression, frame expression, semantic web expression, object-oriented expression, state space expression, etc. Whether it is declarative knowledge expression or procedural knowledge expression, the computer knowledge expressions give us some inspiration: some knowledge expression methods focus on the knowledge structure; some focus on the connection between different knowledge; others are in line with the human logical thinking; still others may even express uncertain knowledge. By using KEET, the process of computer knowledge expression can be copied selectively to train students to master different knowledge expressions.

## **4. Feasibility of KEET**

As can be seen from the essence, subject, purpose and contents of KEET, it emphasizes systematic design of the learning process. However, can we achieve the teaching process design the same way as a computer solving problems? It's possible to repeat computer problem-solving process because we cannot deny most of the work done by computer experts. The educational instructiveness of the problem solving process like a computer has been emphasized in the foregoing. Therefore, knowledge engineering education technology is feasible. Someone would say all you emphasize is to let the program experts participate in education or we think like a computer scientist directly. This perception is wrong: a program expert may not design the educational task according to this education technology and most educators cannot reach the high level that a program specialist stays at in his own field. In fact, education experts and computer experts have their own professional advantage in the application of knowledge engineering technology. Fortunately, knowledge engineering educational technology focuses on the understanding of this Educational philosophy. For most educators, they do not need much profound computer knowledge. The salient feature of KEET is flexibility in use. This

is determined by the characteristics of knowledge engineering. Diversified knowledge processing and scientific knowledge propagation dissemination is one of the main characteristics of Knowledge Engineering [1]. KEET should be in line with this characteristic. On the one hand, the flexibility of KEET in use is reflected in the flexible and diverse educational mission design. By designing knowledge selection and knowledge expression appropriately, educators can make the education task become either intuitive and simple or abstract and complex. A rational design can not only focus on the learning process, but also take Individual cultural differences into account. Therefore, KEET can be applied to different levels of education. Diversified knowledge processing and scientific knowledge dissemination determines the flexibility of education task design. Knowledge Engineering Education Act educational mission design. KEET can bring a different learning environment to educatees, which may stimulate enthusiasm, improve efficiency and enhance creativity. On the other hand, the flexibility of KEET in use is reflected in the performance of its openness. KEET accepts other educational technology migration and can be transplanted to other educational technology. The computer thinking is emphasized in KEET. In this case, KEET can be integrated into a variety of educational technology. Educators can creatively transform other educational technology and achieve the objective given by KEET.

## **5. Practice of KEET**

Connotation and basic content of KEET determine its practice principles: we must grasp the core idea of KEET when diverse methods are proposed to complete the education task. In educational practice, task design is more demanding for educators. Educators are devoted to designing various expression methods for a specific educational task on the basis of proficiency. They also need to determine the type and amount of knowledge and evaluate the expression method. A good task design should guide educatees to study the ins and outs of the question. Naturally, the implementation of educational practice becomes the process where educatees select knowledge from knowledge base and express knowledge by imitating computers. In a sense, a causal relationship exists between the problem-solving process and the completion of the education task. Although the process is part of the education task, it is so important that it can be regarded as an independent part. The decomposition and further decomposition of the tasks in the practice enrich the knowledge selection and expression. Some of the problems encountered that arise in the process will become new beginnings to the acquisition and expression of knowledge. During the practice process, one may take a variety of strategies such as target guiding strategy, structure optimization strategy, cooperative learning strategy, dynamic generation strategy, etc. For target guiding strategy, the problem-solving processes are carried out under the condition when learning target is emphasized. It is similar to increasing feedback nodes for computer control. For structure optimization strategy, we pay more attention to knowledge selection and knowledge expression, which is similar to computer-objective optimization. For cooperative learning strategy, a comprehensive problem is assigned to the team, which is similar to Computer multi-position control. For dynamic generation strategy, the solving design is open. Even the teaching task design itself is open. It's similar to open-loop control. The core idea of KEET can also be integrated into other educational technology in practice. We can simulate computer to analyze the knowledge selection and knowledge expression in the case-teaching technology [6]. We also can simulate computer to express knowledge and achieve solving optimization in the project-teaching technology [8]. In summary, educators will benefit from the explicit principles of KEET and its diverse methods in their education practice.

## **6. Conclusion**

Knowledge engineering has had a profound impact on the innovation and development of education technology. Reference to the concept of Knowledge engineering in artificial intelligence fields, this paper presents KEET and the basic content and practice of KEET are discussed. It may enrich the Education Knowledge Engineering and promote the innovation and development of

education and improve the quality of personnel training. Since the new technology has just been proposed by our group, more work need to be done in the follow-up study as to deeper theoretical study and practical exploration. For example, at the level of knowledge selection and expression, the frame representation, the pattern recognition, the neural networks are likely to become the essence of KEET, which is worth doing more research on. The integration of KEET and other education techniques is another interesting topic for further discussion. It's still a long way to explore specific educational mission designs for educatees of different levels in different scientific fields. Educators need to constantly explore and work together in teaching process.

## 7. References

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