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Brief on Language Oriented Approach (LOA) of Teaching Programming Skills

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Abstract: The study believes teaching is a communication and exchange process between teachers and students, and the quality of teaching depends on communication qualities, especially whether theories, ideas, and methods are accurately transmitted from teachers to students. In programming course teaching, there are losses of the original meaning of the English textbook after being translated into Chinese. In order to avoid the loss of original meaning, the study uses original English textbook for the software programming teaching. In the language choice for specific documentation and programming descriptions, the study emphasizes the choice of the inventor's language. Based on practice, the study summarized the principle of the Language Oriented Approach of Teaching Programming Skills, and outlined the main points and structure of this approach, concluding the prerequisites for its use. Also, the categories of Language Oriented Approach are mentioned. The study shed light on attributing the use of AI, such as the emerging ChatGPT applications, to the Language Oriented Approach.

Keywords: Language Oriented Approach of teaching; Inventor's Native Language; Programming professional training; The nature of ChatGPT application in teaching

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1. Introduction

Since the beginning of this century, the spread of web technology has set off a new wave of learning IT technology. However, most college students majoring in computer science or software in China could not get on the trace, and had difficulty in learning. the study have heard and witnessed that there are obstacles in China's computer-related or Software-related majors. More than half of them cannot work in their majors after graduation. That situation prompts teachers to find ways to provide effective education.

Some teachers, including me, said that they lacked a thinking mode for computers. In 2006, Jeannette M. Wing, Dean, Department of Computer Science, Carnegie Mellon University, published an article and gave the academic concept of "Computational Thinking" [1], which is now given as a basic course for students majoring in computer science in universities. It became a significant measure to promote the learning effect for students

in computer science and related majors.

Now, at Carnegie Mellon University, the concept of Computational Thinking has been extended to the field of Algorithms and even Mathematics. In their description, "Computational Thinking is the thought processes involved in formulating problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information-processing agent" [2].

Some descriptions seem to steer into the connotation of human thinking. "Computational thinking means creating and making use of different levels of abstraction to understand and solve problems more effectively. Computational thinking means thinking algorithmically and with the ability to apply mathematical concepts such as induction to develop more efficient, fair, and secure solutions" [2].

In MIT, Computational thinking is set up as a basic professional course for Computer Science majors or Software majors. They use the Julia programming language to approach real-world problems in varied areas, applying data analysis and computational and mathematical modeling [3].

In practice, after nearly 20 years of unremitting efforts, although the number of computer and software-related majors has increased significantly, the quality improvement of teaching varies by country and region. In the United States and Nordic countries, Software Programming education is well effective, while in China and other countries slipped into another situation.

These famous American and European universities have made remarkable achievements in the education of Computer Science and Technology and have become the model of computer programming education in the world. It is very different from the quality situation in China. The effect of teaching was little, so that in the past decade or more, the explosive growth of software design training institutions sprang, which directly provoked the government to restrict it. Experts stood up and generally blamed poor management of universities for the problem. At the end of September 2019, China's Ministry of Education announced Opinions on Deepening the Reform of Undergraduate Education and Comprehensively Improving the Quality of Personnel Cultivating. As a result, wave after wave, quality evaluations in universities were presented in recent years.

The stark difference drove some teachers to investigate the reasons for this phenomenon. Normally, an ordinary teacher would attribute this phenomenon to problems with teaching methods, such as identifying four distinct implicit skills for novices [4], using an adaptive learning system of programming tools, etc. [5]

However, the study studies the problem in another way. The study has seen the underlying matters of the facts and thought about the reason for the decline in teaching quality in China. It is due to the inappropriate or even incorrect communication methods in teaching.

2. New hypotheses in pedagogy

For seeking the deep reason of the effect difference, the study had rethought about the natures of learning and teaching. In my study, through an in-depth decomposition of the learning and teaching process, the study studied the formal process of students' learning results and the process of transfer of teachers' knowledge to students, and the study made new recognizes in the nature of learning and teaching. There were hypotheses raised, and their principles can be summarized into five propositions.

First, teaching is a process of knowledge transfer from intellectuals to seekers and listeners. And Learning is a process of communication seekers do with intellectuals such as prophets, inventors, teachers, and other knowledge holders. Second, students' learning effects depend on the communication effects. Third, the main tool for communication between students and teachers is language, so language is the main tool for learning

and teaching. Other teaching tools should be based on language (rarely, a tool of linguistic nature). Fourth, there are two categories of language in learning and teaching, one is the language of communication between people and the other is the language of communication between people and computing machines. When we here say learning communication, both human communication and human-machine communication should be involved. Fifth, thinking is a kind of self-communication, and the teacher's language reasoning is a process of thinking [7].

Based on these propositions, roughly, the study reclassified teaching methods into two broad categories: teaching methods without computer languages and teaching methods with computer languages. Today, computers are widely used. The usage of computers in teaching mainly involves participating in the teaching process with computer languages to enhance teaching efficiency. To identify these two kinds of teaching more accurately, we must first figure out the teaching method without computer languages.

The study studied the pedagogy, which is teaching without computer languages. From the perspective of the teaching process, teaching is communication and exchange between teachers and students. The contents of communication are theories, ideas, opinions and methods. The quality of communication depends on whether these theories, ideas, and methods are accurately transmitted from teachers to students. If they are, the knowledge has been caught by the students; If not, the students will enter a situation where they can't learn [7].

In fact, when students talk to teachers for learning, it partly used the teachers as mediation that students communicate with thinkers, masters, inventors, engineers and so on. For example, learning the principles of Python is process of communications of students with the Python inventors, Guido van Rossum. At least it should be a communication with a Python expert. In these communications students gain the learning achievements.

The study firmly believe that the teaching effect depends on the communication effect between teachers and students, and the communication content is the explanation of computer science knowledge and software products. Moreover, the learning effect depends on the degree and depth of communications between teachers and students, as well as the cognitive level of scientific knowledge and product standard [7].

In the course of communications, language is the first and most important tool. We humans communicate by language. Communicating by language is the main way for students to acquire knowledge. There are many languages available for use. The correct choice of language plays a crucial role in the teaching process. For the reason that most computer technology originated from English speakers, and in practice, the knowledge has been translated into students' native which leading to inaccurate and a lack of precision. For Chinese, there are language barriers to learning IT technology with translation. Probably, the same is true for people from many other non-English countries. Almost all IT originated in Europe and the United States, where English is used. Linguistically, English and Chinese are completely different languages; one is a combined order language, and the other is a pictographic language. So the study proposed using the inventor's native language as the communication language. In Computer Science and Technology, most inventors come from America, England, and Nordic countries, so the study chose the relevant editions of the textbook in order to stay consistent with the thinking of those inventors. This is key to gaining knowledge of computers and software, both for students and teachers [8].

Behind different languages, there are different modes of thinking. When the same content is expressed in different languages, the content is decomposed under different thinking modes. So the results of decomposition may not be the same. There is a loss of intended meaning in the translation process. However, in modern technology teaching, we are used to translating the original to the local language as teaching material. This is, in another way, to decode the original. The result may be a completely different statement from the original one. This throws the learner into a cloud of confused and obscure words. This causes the learner to miss the point of

what they should get [8].

The work of programming and sending instructions to a computer is complex. Even if in combined ordered language countries, developers in non-English speaking countries need two language processes to work with a computer: first to convert the native language to English; second to feed the English-based programming language to the machine for execution. In the first process, due to the functional defects of translation itself, the semantics may be distorted or some original meaning will be lost, which reduces the accuracy and efficiency of communication between developers and computers. Those cause programmers to appear imbecile or incompetent, both in knowledge acquisition and programming practice. To prevent those from happening, in education for Computer Science and Technology majors and the related majors, there is a great need for native English teaching materials, textbooks, and a great need for English speaking [7].

3. The principles of the Language-oriented Approach

In reality, because software technology is an invention in English-speaking countries, other countries use translated texts as teaching materials. Due to the evolution of translation methods, there are many cases where the original meanings are lost or even distorted after translation. the study will give you a few examples in the field of software engineering in China. The improper translation of technical terms such as bit, database, frame, virtual machine, firmware, etc., leaves many students confused from the beginning of their studies. Without a later careful identification of these words in their original language, there is a high probability that these students will never get the hang although having accessed into the software programming industry, or never get into it at all [8]. Assuming that AI is now used to implement education, because the basic work of translation has gone wrong, AI applications will not be very helpful to students, and it is an attention that the cost of AI development is very large.

Someone may contradict me by using AI technology to optimize translation functions. To answer you, optimizing technology to achieve desirable results is not something that can be done overnight. And it comes at a huge cost. Using language is a uniquely human ability, and it's quite complex. Compared with human use, it is at a simple level that uses linguistic concepts to reason and deduce, and there are many factors that ChatGPT cannot calculate when it comes to communication. It cannot lend itself to rigorous levels of communication and scientific reasoning.

So, we have to turn back to human language stage for solutions. We switch to use the human brain to solve the problem of efficiency in education. We make efforts to allows students to effectively learn foreign techniques which are expressed in non-native languages but in original language. We let students grasp it accurately in the context of the original language.

However, the approach is special for programming teaching. To make the problem clear, we like to give advice specific to the practical level. Here is a detailed explanation of the rules of this method. The main nodes of this approach can be expressed as follows:

(1) Programming teaching is a communication process between teachers and students, and students gain knowledge in the communication process.

(2) The tool of communication is language, and in order to avoid communication ambiguity, the inventor's original language is advocated to use.

(3) Choose the original documents of software developers and hardware inventors as teaching materials.

(4) This approach is specifically designed for situations where the native language of the learner is different from the native language of the software inventor or the language of the human-computer dialogue.

(5) This approach can be used as an alternative to ChatGPT application in teaching, for ChatGPT does not take into account the language gap and does not have the desired effect.

Compared with the curriculum system design, the language-oriented approach focuses on the basic work of teaching, makes use of the important role of language in communication, and implements teaching that is conducive to students' learning efficiency. This method should be the basis of many teaching methods.

4. Categories of Language Oriented approach

As for the language in this issue, the study promises that the language described here includes two categories of language. One is human language, the other is programming language. The former is a natural communication tool; The latter is used to instruct the computer to work sequentially. Thus, software is formed, serving as an intermediary for communication between teachers and students. With the advent of the AI era, many experts realized that ChatGPT can be applied to education as the main technology. There is a rush surge in the number of recommendations to use ChatGPT for programming education. ChatGPT is a software implemented with a programming language, so it is also the result of applying the Language Oriented approach. the study regards ChatGPT educational application as a branch of Language Oriented approach with AI in it, whereas what the study practices as a traditional Language Oriented approach does not have AI.

In fact, the application of ChatGPT in teaching practice is rooted in the Language-Oriented Approach. It represents a specific use case in contexts where no language gap exists. Therefore, the use of ChatGPT in education can be divided into two categories: applications without a language gap (i.e., within a single language) and applications with a language gap. However, this study argues that using ChatGPT for cross-language education is not an ideal approach. For instance, when Chinese is taught using technological content developed in English, there is inevitably a loss of efficiency. In such cases, ChatGPT still relies on translation from the source language into the target language, and semantic loss can occur, similar to traditional translation without AI.

5. Application expansion and deepening of Language Oriented approach

The study have carried this method out as a teaching reform, practicing this method for seven years. With practice, this method has been proven to have better learning efficiency for students whose programming instruction language is not their native language [6].

Using the Language-oriented teaching materials in instruction practice, can benefit several aspects, such as the students, the teachers and the employer enterprises. More significantly, the teaching effects of instruction reform as a whole has a leap progress in Pedagogy. It greatly improves the quality of the teaching practice unit for professional course.

According to the study's preliminary judgment, there are three application fields of this approach: practical education, international education, and lifelong education. In practical education, especially in vocational education, the use of foreign technology requires reading the usage documents and technical instructions in foreign languages, as well as the interactive text in the human-computer interaction interface is all native language of the inventor. The use of original languages has the effect of timeliness and accuracy for accurately mastering the technology. In the process of software coding, LOA-trained personnel can easily deal with the prompt in the machine monitor, where human-computer dialogues open help a lot.

In international education, by going abroad to the native country of the technology invention, students can learn foreign technology more conveniently and accurately to master the technology, which itself is an LOA. Of

course, without going abroad the implementation of LOA teaching locally can save the high cost of shortening the space distance is a better thing but performs learning foreign programming technology in own country.

In lifelong education, local students can first learn the language of the technical country as a foreign language, so that they can learn the frontier science and technology of the advanced technology country for a lifetime. Usage of LOA can avoid the losses of original meaning caused by translation which result in interruption of the education process.

However, all these are limited to technical education. As for social science, the main unit of society is the group, which easily takes interests as the center, and researchers will inevitably be in a certain group. They will inevitably explore problems from their interests. Countries with different languages are prone to form different concepts and theories, which have low requirements for uniqueness, logic, and consistency. It is not as strictly consistent and logical as natural science and technology. So I'm not advocating Language Oriented Approach to social science teaching. However, this method should be extended to the fields of natural science and technology education, so to better promote the rapid development of science and technology around the world.

Nowadays, with rapid technological progress and great improvement of AI technology, the discussion of applying AI technology to teaching has sprung up. the study suggest that the application and development of AI in teaching should be built based on this approach. The basis of AI technology is character computing, which began in the 1950s and 1960s and reached its peak in the 1970s. It has proved many mathematical theorems of world-class difficulty. The underlying logic of character computing is linguistic reasoning, so AI is essentially the result of linguistic reasoning using computer technology. Today, there are many AI educational applications, although a few are not for communication functions (or nodes), but the application of AI in learning and teaching is bound to replace the brain's thinking function. People think in language. So most of the AI educational applications belong to LOA, once their functions are focused on thinking.

Next, you might want to continue optimizing AI algorithms in translation software. But no matter how optimized, at the node of understanding and communicating, machine algorithms are still less accurate and secure than the human brain. We have to admit the limitations of AI, and leave some jobs to be done by human brains, which is more cost-effective. There is a trade-off between using AI and continuing to use the human brain, and there should be a balance point, exceeding which we would be better off not using AI. The trade-off between using and not using AI is a difficult thing. There is no cheap way to measure precisely, and only a rough estimate can be given here. The figure is complex for research and development but promising, and this paper does some basic mentions for it, leaving room to the more skilled to develop later.

6. Conclusion

Teachers can improve the teaching quality by designing a curriculum system, such as adding Computational Thinking courses, or we can improve the teaching quality by using Language-Oriented Approach. Evaluating my experiences and practices, the latter is more effective.

Today, many teachers use ChatGPT, an AI tool, for lesson preparation. This is a manifestation of applying the language function of ChatGPT. ChatGPT works with linguistic reasoning, it transfers human language reasoning into software reasoning. Meanwhile, Language-Oriented Approach focuses on linguistic communication, which is foundation of the reasoning. So, the language-oriented approach should be the basis for ChatGPT development. There are two kinds of Language-Oriented Approach. One is based on teachers' mental labor, which is not use AI, and we can call it traditional LOA; Another is based on Large language model

AI, having applications such as DeepSeek, ChatGPT, and we can call it LLM LOA.

There are two categories of ChatGPT education application, the first is the ChatGPT application without language gap, the second is the ChatGPT application with language gap. For the ChatGPT application without language gap, the study have practiced and mentioned as above. For the ChatGPT application without language gap, we have seen just as what ChatGPT has already done.

The main measures in Language-Oriented Approach include: Selecting textbook from all language version, and choosing one suitable, English is always; preparing problem sets in chosen language; executing Bilingual or chosen language teaching; giving lessons in inventor's native language; demonstrating occupational operating environment in experimental scenes, etc.

There are prerequisites for the use of this approach. This approach is recommended if the following three conditions are met:

(1) The language used is not the language that resides in language-teaching. It is engineering teaching, not language teaching.

(2) The language of the technology inventor is quite different from the native language of the students.

(3) The language will be used in the course of employing the technology.

However, limited by time and energy, the theoretical system on the Language Oriented Approach of Teaching has not been developed. Leave it to interested colleagues. It must be promising. The issue of how to implement translation without loss of the intended meaning of the original language text has not been addressed. More themes need to be explored, such as the detailed extension of the use of this approach, etc. And the proposal in this paper is limited to technical education; whether the approach can be used in social science education is not discussed.

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