

# Metacognitive Process in Teaching Reform of Programming under the Background of "Internet +" -- --A Qualitative Research Perspective

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**Abstract**— In order to improve the teaching reform of programming under the background of "Internet +" education, this paper, based on the theoretical framework of metacognition, adopts the qualitative research method, and carries out research from three dimensions: famous teachers, experienced teachers and novice teachers. This paper explores the metacognitive process of college teachers in the teaching reform of "Internet +" education. Through the analysis, it is found that the policy orientation of innovative teaching reform based on "Internet +" is a huge driving force for teachers to start metacognition. The use of "Internet +" education makes traditional teaching and innovative teaching collision sparks, so as to improve students' interest in learning, enhance students' independent learning ability, and promote students' lifelong learning ability.

**Keywords**— "Internet +" Education; Metacognition; Qualitative Research; Autonomous Learning Ability.

## I. PROBLEM FORMULATION

Universities are the bases of talent training, and in the era of "Internet +", the education and teaching activities in universities are undergoing positive and innovative changes. In the traditional network teaching, the classroom is the main channel, so how to realize the revolutionary change from "traditional teaching" to "Internet +" teaching, the key is the revolutionary change of teachers' teaching concept. The key to this shift is a revolutionary change in teachers' perceptions of teaching and learning, from the educated to the learner. On the one hand, teachers cannot keep track of the knowledge of each student and cannot interact with each other in real time; on the other hand, there are many online teaching platforms, so teachers must first familiarise themselves with the various functions of the platforms and design lesson plans that are suitable for online teaching in conjunction with the functions of the platforms. In other words, teachers must first of all be enthusiastic users and learners of the concept of the "Internet+" teaching model in order to become effective promoters of the "Internet+" teaching change. This paper explores the use of qualitative research to answer two questions: How do teachers correctly metacognition the idea and concept of "Internet+" teaching and learning in the learning process? And to what extent do teachers' metacognitive knowledge, experience and monitoring enrich the construction and system of Internet+ teaching and learning?

## II. RESEARCH METHODOLOGY

This thesis focuses on the metacognition of university teachers towards the teaching of "Internet+" programming [1], and uses the means and methods of qualitative research to investigate the metacognitive processes and learning states of teachers, their metacognitive processes and their contribution to the teaching of "Internet+" programming. In this study, we explore the metacognitive processes and learning status of teachers, their metacognitive processes and their contribution to the teaching of Internet+ programming. Based on the theory of

the "interview method" and the theories and methods of textual analysis, a participatory study was conducted over a period of nearly two years with nearly 20 teachers from Anqing Normal University and other programming course in Anhui Province. In the course of the study, it was found that many teachers in Anhui universities still prefer traditional classroom teaching and are not ready to learn about "Internet+" teaching. Therefore, in-depth interviews were conducted with eight university teachers. The specific information is shown in Table I.

TABLE I. Information about the teacher interviewed

Teacher <sup>①</sup>	Gender <sup>②</sup>	Years teaching <sup>③</sup>	Title <sup>④</sup>	Type of teacher <sup>⑤</sup>
A <sup>②</sup>	Male <sup>②</sup>	15 <sup>②</sup>	Associate Professor <sup>②</sup>	Experienced in teaching <sup>③</sup>
B <sup>②</sup>	Male <sup>②</sup>	25 <sup>②</sup>	Associate Professor <sup>②</sup>	Experienced in teaching <sup>③</sup>
C <sup>②</sup>	Male <sup>②</sup>	20 <sup>②</sup>	Professor <sup>②</sup>	Master teacher <sup>②</sup>
D <sup>②</sup>	Male <sup>②</sup>	7 <sup>②</sup>	Instructors <sup>②</sup>	Master teacher <sup>②</sup>
E <sup>②</sup>	Male <sup>②</sup>	3 <sup>②</sup>	Instructors <sup>②</sup>	Novice teacher <sup>②</sup>
F <sup>②</sup>	Female <sup>②</sup>	2.5 <sup>②</sup>	Instructors <sup>②</sup>	Novice teacher <sup>②</sup>
G <sup>②</sup>	Female <sup>②</sup>	15 <sup>②</sup>	Associate Professor <sup>②</sup>	Experienced in teaching <sup>③</sup>
H <sup>②</sup>	Female <sup>②</sup>	16 <sup>②</sup>	Instructors <sup>②</sup>	Experienced in teaching <sup>③</sup>

### A. Metacognitive Knowledge

Since the idea of "Internet+" education was introduced, Anhui Provincial Department of Education has continuously given funding and support to universities to promote teaching reform by giving lectures, declaring quality projects and organising various teaching competitions and subject competitions in the province. In this study, it was found that most of the teachers became involved with "Internet+" education when they applied for foundation projects or participated in teaching competitions. This policy orientation clash with the academic mission, research consciousness and inherent perceptions that university teachers have previously possessed. Unlike ordinary research projects, Internet+ education is an emerging topic for those working in higher education institutions, one that still has to be explored and

researched by university teachers. From the analysis of the interviews, we can see that the teachers have been actively exploring and thinking about how to perceive this new concept from the moment they first started to understand Internet+ education.

Teacher A: I have been working as a teaching secretary in the college and I have a better grasp of the teaching reform trends put forward by the Ministry of Education and the university, which are the main way I learn. I have declared a MOOC course in programming.

Teacher B: I have been teaching programming, which is a course closely related to computing, and I personally prefer traditional teaching, especially in the laboratory classes of programming, where the teacher guides the students' experiments on site so that they can learn more efficiently. I also checked the school documents in time to know that I had to keep up with the trend of the time and prepare for "Internet+" teaching.

Teacher H: "Internet+" education should be practical, not just a slogan, not just a few experienced teachers taking part in teaching competitions to win prizes. Schools can carry out observation and teaching or invite experts and scholars to introduce some of their experience.

Teacher C: In recent years, the provincial education department and the school have given some financial support to the quality project. It is obvious that the school supports "Internet+" education and pays close attention to quality. This is a kind of orientation of the school, following the wind vane of teaching reform of the Ministry of Education and leading teachers to be stronger step by step.

Teacher D: I have gained a deeper understanding of "Internet+" education by leading students in competitions such as "Internet+" and "Big Data". I have been able to use the competitions to promote teaching and learning, and I have learnt the importance of "Internet+" education. I am also project driven in doing "Internet+", and the support from the university and the Department of Education for project funding is of great importance. I myself have declared a provincial boutique course in programming.

Teacher G: Communication is very important and must be done. It is important in order to communicate with experts and scholars, and to communicate with famous enterprises, in order to improve oneself on the one hand, and to understand the market demand on the other, so as to provide high-level talents for society.

The teachers interviewed clearly wanted to see good examples of successful Internet+ education and to have more relevant exchanges between them. In addition to still needing adequate financial support for their future learning, they also have a deeper desire for a community of learning. A common feature of their meta-cognitive knowledge remains that constructing relationships with peers is a powerful way to perceive "Internet+" education.

### *B. Metacognitive Experience*

Flavel also makes it clear in his metacognitive theory that there is a very important factor in achieving our cognitive goals, and that is our metacognitive experience. Metacognitive

experience refers to the cognitive experience and human emotional experience that accompany human cognitive activity. Various emotional experiences in metacognitive experience (e.g. confusion, frustration) can both guide cognitives in revising their goals and may also directly influence changes in their metacognitive knowledge. This study found that programming teachers' initial period of understanding and perception of Internet+ classroom teaching was accompanied by a negative mindset of confusion, bewilderment, and even rejection [2].

Teacher B: At the beginning, I did not be too so familiar with the concept of "Internet+" education. Students listened below, teachers talked in class, and teacher-student interaction was good.

Teacher G: My understanding of "Internet+" education was that we should abandon the traditional classroom teaching mode and use online teaching, especially for engineering subjects like us, who need to do experiments in the laboratory, which is very uncomfortable.

Teacher E: I am an engineering teacher, and I was particularly confused when I was writing and declaring the quality project. The core of our programming course is to do experiments, and how to conduct experiments in the mode of "Internet+" education.

However, during the interviews, almost all the teachers interviewed said that their views on "Internet+" education were becoming clearer as independent learning progressed. They understand that "Internet+" education is not about abandoning traditional classroom teaching, but about using the advanced technology of the Internet to enrich traditional classroom teaching, and that communication between teachers and students is not limited to the classroom. Especially during the epidemic, the development of "Internet+" education made it possible for our teaching to proceed in an orderly manner. Accordingly, various teachers' meta-cognitive feelings towards "Internet+" education have also changed.

Teacher G: I've been working hard on this whole "Internet+" education thing for a while now, and it's not that you need a whole high profile project or win a good course competition. The most important point is to use our Internet as a tool in the classroom to improve the quality of teaching and learning, to develop students' autonomy and to increase their interest in learning. I have designed my own random roll call system, where students' pictures and corresponding student numbers are placed in the system, and when I ask students questions in class, I turn on a scroll bar and randomly select students to answer the questions. With the introduction of this random roll call system, there has been a significant increase in student attendance. It has improved classroom management, made the classroom more lively and interesting, and increased student-teacher interaction, which I think is a manifestation of "Internet+" education.

Teacher D: I came to the school in 2014 and since I arrived, I feel that the school attaches great importance to teaching and learning, especially "Internet+" education. Every year the school organises teaching competitions such as "Flipped Classroom", "Online Teaching" and "Young Teachers Teaching". For myself, after receiving these vanes from the

school, I started the work of setting up the virtual lab, not thinking that I would use it at first, as students were doing their experiments in the lab. During the epidemic, the students were taught via the internet and the virtual lab I built came in handy to take on the experimental teaching of programming.

Teacher F: I think "Internet+" education is not only for teachers, but also for students. The teachers in our teaching and research department have led students to develop the "Programming Knowledge Base" APP, which allows students to discuss the knowledge that is difficult to understand after class. This allows students and teachers to communicate with each other beyond the classroom. In addition, we have also developed a practical programming competition platform to provide a stage for students who are interested in programming and have the ability to progress to the next level.

It is clear from the responses to the above interviews that teachers have become more broad-minded and open-minded as their metacognition has deepened. Their understanding of "Internet+" education is no longer confused, no longer literal but a genuine use of the Internet as a tool in education.

### *C. Metacognitive Monitoring of Cognition*

Metacognitive monitoring is broadly defined as the process of actively monitoring and appropriately regulating the cognitive activities of individuals throughout the process of their own awareness and activities as cognitive objects. In the process of cognition, it evaluates people's cognitive activities according to their cognitive goals, identifies their cognitive biases and adjusts their strategies in a timely manner.

From the interviews, it is clear that teachers' reflections have personality characteristics, but they all share the same metacognitive monitoring strategy of learning from teaching, learning from teaching, reflecting after teaching, going beyond their former selves and creating knowledge.

Teacher F: After such a pilot of the reform, I realised that I might normally have blind spots in my teaching and I would have reflections. I deeply feel that in our professional development, while teaching our students basic professional knowledge, we also need to teach them according to their abilities and how to make full use of the Internet as a tool to enable students to learn at any time, so that our students have the ability to learn for life. This is the most important thing. I reflect on how to use the internet to design good lesson plans, motivate students and increase their interest in learning.

Teacher G: With this topic of the Quality Project, I will pay more attention to "Internet+" education. When designing classroom teaching, I will take into account the situation of my class and design a teaching plan that is suitable for my class.

Teacher B: The teacher is a leader, the teacher has to use the internet to combine with traditional teaching and design lesson plans, (the process), firstly to improve my business skills, then I also pay more attention to the latest technological advances.

In addition, the research also revealed that teachers with a strong sense of self-monitoring were assigning interesting 'Internet+' fun assignments. We all had our own opinions, but teachers were positive about the importance of Internet+ education.

### III. CONCLUSION

The core of "Internet+" education is innovative education and teaching. The research participants have explored and integrated the content of Internet+ education and enriched their classroom teaching through their own learning, practical exercises and reflections [4]. The above analysis shows that teachers' perceptions of values are different and unique, but they all attach great importance and attention to Internet+ education under the promotion of policies [3].

In the process of constructing "Internet+" education in China, the teachers' understanding and acceptance of "Internet+" education is crucial, which directly affects whether "Internet+" education can achieve its innovative educational goals. "This has a direct impact on whether the goal of innovative education under Internet+ education can really be achieved. A teacher's metacognition, in turn, directly affects the level of a teacher's cognitive ability. The eight teachers formed a common metacognitive pathway. In the process, the teachers are growing and becoming disseminators and creators of new knowledge. In our research and practice, teachers are expected to internalise all of the advanced educational theories and ideas and sublimate them into their own educational and teaching philosophies. To enable students to engage in active exploration and innovation in the classroom. While promoting the healthy growth of students, the teachers' own comprehensive quality can be improved as well.

### IV. SUMMARY

The shortcomings and outlook of this study are mainly focused on the following aspects. Firstly, the subjects of the in-depth interviews were all teachers who teach programming or have declared programming projects, and teachers of other subjects were not involved, although each course has its own characteristics, many knowledge can be shared under the wave of "Internet+". Secondly, the types of teachers selected were master teachers, experienced teachers and novice teachers, but no in-depth interviews were conducted with students, another subject in the classroom, which should be covered in future research. Again, this study only involved teachers from Anhui province, and no interviews were conducted with teachers from other provinces. Through this study, in the process of exploring and practising the metacognition of teachers' subjects, we found that "Internet+" education will become an important topic in the training of university teachers in the future.

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