A Research Model Construction of Impact of IT Usage on University Faculty's Teaching Self-efficacy

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Abstract: Nowadays, the information technology has been widely used in teaching activities, enabling more and more teachers to improve and facilitate their ways of teaching and communicating. However, how does IT usage exert influence on teaching self-efficacy, especially in university classes, still needs to be further studied. Based on Bandura's self-efficacy theory, and literature review of flipped classroom which is the most representative and latest application scenarios of information technology, we try to identify applicable conceptual dimensions of teaching self-efficacy of university faculty and to construct a research model of influencing mechanism of IT usage on faculty's teaching self-efficacy. Further study directions are suggested at the end of the research.

Keywords: IT usage, teaching self-efficacy, university faculty

1. INTRODUCTION

Since the 1970s and 1980s, with the promotion of information technology (short for "IT") represented by multimedia, computer and Internet, big data, and artificial intelligence, human society has increasingly entered the information age. Nowadays, Information technology has been integrated into every aspect of human life, and has greatly enhanced productivity. The application of information technology in higher education is also general. Information technology has significantly improved the teaching methods of university education, but studies on how IT usage exerts impact on faculty's perceived teaching self-efficacy are still rare.

In China, *Guidelines of the National Program for Medium- and Long-Term Educational Reform and Development (2010-2020)* listed "The acceleration of educational informatization" as one of the primary missions of national education reform in the next decade. Since 2010, from the official (the Ministry of Education) to institutions, the value of information technology has been addressed of many times and great changes have already taken place, such as educational concept, teaching objective, teaching mode, teaching process and media.

Teaching efficacy is defined as teachers' belief that can have a positive effect on students[1]. Teachers' perceptions of teaching efficacy have a positive influence on teaching performance and students' learning achievement[2]. In other words, if a teacher is confident in his/her teaching behavior, he/she will have more enthusiasm and initiative to overcome the difficulties in teaching process.

Nowadays, the application of information technology in education is wildly distributed in numerous education scenarios, including classes in universities. There have been a number of studies discussing the teaching efficacy of primary and secondary school teachers. However, little is known about the teaching efficacy of university faculty. With the help of information technology, which has greatly enriched the teaching methods and communication ways, teachers are enabled to do more for the understanding of students.

In case of higher education field which is much different from primary and secondary education, the learning behaviors of university students in the classroom of universities are more mature and independent. How does university faculty enhance their belief about controlling the classroom, realizing full communication and

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interaction with students and finally improving the teaching effect through the application of information technology still needs to be further studied. The interest of this study lies on first, how does information technology usage enhance the perceived teaching self-efficacy of university faculty; second, the factor structure of faculty's teaching self-efficacy in university classes.

2. CONCEPTUAL FRAMWORK

2.1 Teaching self-efficacy and its construction

Researchers have given many definitions of self-efficacy. Among these definitions, Bandura's definition of self-efficacy is the most classical. In 1977, Bandura introduced the concept of self-efficacy, which refers to the belief that one has the ability to take action (efficacy expectancy) and to gain a certain result (outcome expectancy), which was further divided into two parts, the efficacy expectancy and outcome expectancy[3]. The concept of self-efficacy, since it was put forward, is strongly associated with its application context. Researchers did notice the value of self-efficacy theory in the field of education. In order to match the specific context, many researches were conducted with regard to finding out the exact concept and construction of teacher's perceived self-efficacy.

Contemporary education emphasizes the cultivation of students as active seekers and processors of knowledge and information. In the context of education, in terms of students' growth, teachers' own development and school education's pursuit of effectiveness. Teacher's perceived efficacy is their belief about the ability to exert impact on results of students' motivation and learning. Dembo and Gibson[1] (1984) defined teacher efficacy as "the degree to which teachers think they have the ability to influence students' learning" and they believed that it is composed of two dimensions, general teaching efficacy (GTE) and personal teaching efficacy (PTE). These two dimensions correspond to efficacy expectancy and outcome expectance in Bandura's theory. The former refers to teachers' judgment of the relationship between teaching and learning, in other word, a general view and judgment of the role of educational behavior in the development of students' mind and ability; the latter refers to teacher's own cognition and evaluation of his/her teaching effectiveness. In 1990, Woolfolk and Rosoff indicated that these two dimensions (outcome expectancy and efficacy expectancy) are independently related to teachers' attitude about the class management (strict management vs loose management), students control (student control ideology: intrinsic control vs extrinsic control) and motivational orientation (autonomy vs control)[4]. It means these two dimensions can be studied separately.

Since self-efficacy is a highly contextualized construct[5], self-efficacy theory holds that the best predictors of behavior in specific situations are individuals' self-perceptions within those situations[6]. So, we need to propose a proper definition and construction of faculty's teaching self-efficacy in context of higher education. In analogy to Woolfolk and Rosoff's research, we do a similar analysis. In university's class, the class management tend to be looser than its counterpart in primary and secondary school. University faculty tend to pay more attention at students' ability of effectively acquiring knowledge rather than knowledge itself. Ashton and Webb (1986) defined teaching efficacy as personal beliefs about capabilities to help students learn[7]. According to Bandura's theory, faculty's teaching self-efficacy, in higher education context, can be defined as belief that one has ability to effectively instruct and teach students and enable them to gain the ability to proactively acquire necessary knowledge that they need to solve issues. Certainly, it includes two dimensions: general teaching efficacy (GTE), which refers to the belief about effective instructing and knowledge imparting activities; personal teaching efficacy (PTE), which refers to the belief about the direct causal relationship between those activities and students' ability enhancement and sense of gain in learning. Technically, in this research we put higher priority to PTE, because it is closer to Bandura's original and essential meaning of efficacy, which is one's belief about the ability of taking action.

2.2 The determinants of self-efficacy in general

According to Bandura's self-efficacy theory, the perceived self-efficacy mainly comes from four main sources, (1) Direct feedback of one's own behavior, (2) Watching and analyzing others' behavior outcomes (Modeling) , (3) Social persuasion, (4) Emotional and psychological states[8]. We can also call them antecedents of self-efficacy. The contention can be drawn from the Attribution theory, that the perceived sense of self-efficacy derives from attribution of external and internal causes[9]. External causes include the attribution, complexity, or environmental factors of tasks of missions, as well as other person's behavior outcomes; internal causes include the motivation, ability, performance strategies, as well as one's physical and mental condition and so on. External factors often affect self-efficacy indirectly through internal factors.

2.2.1 External causes

The main source of external factors is the task itself. External factors exert an indirect influence on self-efficacy through cognitive processing, and individuals form sense of self-efficacy by evaluating and judging the attributions and complexity of the task. That is to say, external factors can only affect self-efficacy through cognitive processing. First, the attributions of a task are confirmed to be important. In the workplace context, one' s judgement about if he/she could complete a certain task depends on the task independence (other coworkers' involvement in order to complete the job) and resources needed. The second factor is the task complexity, which refers to the number of processes, steps, components and uncertainties of the task. Thirdly, the environment pertains to the task is also important. For example, when an individual works in a noisy or dangerous environment, his or her mental state will change greatly compared with that in a quiet and safe environment, which will significantly reduce the individual's perception of self-efficacy.

In the meantime, watching and analyzing other person's behavior outcomes can also affect one' s efficacy judgement. As is known that, "People partly judge their capabilities in comparison with others"[10]. One can model the construction of self-efficacy through the information of other people' s success of failure when they do the similar tasks. Besides, experiences from other people can also partly determine one's ability to overcome boredom, anxiety, distraction, as well as one's duration of persistence in face of difficulties. By observing others, one can gain information about the time and effort required to accomplish similar tasks.

Last but not least, social persuasions may also exert influence on one's efficacy judgement. Different from their direct experience of one's own or experience gained by observing others, social persuasion lacks the restoration of the actual situation of certain tasks, and individuals cannot form self-efficacy completely just by being persuaded. It is noted that, the personal status, prestige and professionalism of the persuader have a decisive influence on the effectiveness of social persuasion. When faced in difficulties, encouragement from person with high authority will greatly increase one's effort and persistence[11]. In the meanwhile, the ways of verbal persuasive feedback also play an important role. Compared with other types of encouragement, the positive evaluation of one's ability is more conducive to the improvement of self-efficacy, especially in the early stage of the formation of individual ability. Moreover, frequent feedback can increase the accuracy of self-efficacy as well as motivation[9].

2.2.2 Internal causes

The internal causes of self-efficacy establishment include one's knowledge and skills, physical and emotional states, personality, performance strategies, as well as one's efforts spent. Like other influencing factors, they also need to be processed by individual cognition before exerting influence. First of all, the influence of individual knowledge and ability on self-efficacy is obvious. Having richer knowledge and corresponding ability on certain tasks makes individuals have strong confidence in completing more similar tasks, thus inspiring higher task-oriented self-efficacy. In order to maintain a high level of knowledge and ability-oriented self-efficacy, individuals need to constantly update their knowledge bank and improve their

abilities through constant exercise and practice. It has been confirmed that people with Type A personality, compared with Type B personalities, are more aggressive when it comes to tasks and difficulties, it is partly because type A people are more confident with his/her ability and more optimistic about the outcome of actions. In a relatively long time, knowledge, abilities, and personalities are relatively stable causes compared with performance strategies, physical and emotional states, and efforts spent.

Physical and emotional states can also exert influence on self-efficacy in specific situations. People feel confident at doing things when they are in good physical condition[12]. In the meantime, self-efficacy is influenced by individual's mood too. As mood is an unstable and variable cause in the process of self-efficacy establishment, the mechanism may be more complicated. Generally, in a cheerful mood, individuals tend to take the task more easily, which helps to improve their self-confidence. When in sad or even depressed mood, people tend to have negative opinion of themselves and thus reduce sense of efficacy. It is also worth noting that there is often an interaction mechanism between emotional state and self-efficacy. When one's self-efficacy increases or decreases, his/her emotional state will also change accordingly. High level of self-efficacy is conducive to the formation of an optimistic and happy mood, while low efficiency will often push individuals into low mood, or even depression.

2.3 IT usage in university teaching

After 20 years of construction, remarkable achievements have been achieved in higher education informatization infrastructure. With the network bandwidth and coverage widen, equipment and technology updated constantly, digital education resources are more and more abundant and available to university students and teachers. As the cost of acquisition of these resources continues to decrease, the atmosphere of "learn anytime, learn everywhere " is forming in students communities. Correspondingly, the idea of teaching anywhere, anytime is also spreading among teachers. Information technology has played an important role in modern development of higher education. In 2016, Kevin Carey even predicted the end of college and the coming rise of universities of everywhere[13].

Informatization of college teaching began with the widespread use of massive open online courses (short for "MOOC"). With the rapid development of MOOCs, High-quality educational resources are no longer the privilege of a few social elites. Many world-known universities have set up their platform of online courses, among them have formed platform leagues such as edX and Coursera. In China, Tsinghua university, Peking University, Fudan university and other universities have joined these international leagues，including almost all of the 985 colleges and universities. MOOCs are only the primary form of Information technology's application in university teaching. After nearly 10 years of development, MOOCs have experienced fast technology upgrade and form of innovation. However, many challenges yet being ahead. Although MOOCs make college classes more and more accessible, they still cannot completely replace classroom teaching in that the lack of effective teaching effectiveness feedback mechanism, lack of course learning certification, low user engagement and low sustainability. Actually, MOOC is nothing more than a replay of college classroom teaching on the Internet, where a teacher may be faced with thousands of students behind computer screens. Invariably they are still listening passively and without any forms of interaction.

In order to improve these shortcomings, making information technology better serve university teaching, the flipped classroom rises in response to the proper time and conditions. The so called "flipped classroom" is a new type of teaching mode in the information environment, in which course teachers provide learning resources in the form of teaching video, students watch and learn teaching video and other learning resources before class, and students complete their homework with teachers, answering, collaborative inquiry, interactive communication and other mutual activities proceeding together in classroom[14]. Flipped classroom overturns the traditional teaching model of "teachers teaching + students doing homework". The process of internalizing

knowledge is proceeded after class in traditional teaching, whereas the counterpart of flipped classroom is proceeded just in class. As is known that digestion and assimilation of knowledge is far more important than teaching itself, the method of flipped classroom bring more improving possibilities to modern university teaching.

With the help of information technology, flipped classroom has been strengthened in many aspects. First, teachers can select learning materials (such as videos, PPTs or courseware) for students from a curriculum bank with relevant knowledge points. These teaching contents are well produced, most of which are from famous teachers or famous educational institutions[15]. Compared to teaching in class in person, these learning materials can maintain higher stability ensuring the quality of teaching. A complex knowledge point can be divided into many short teaching video sessions of 10-20 minutes and be pushed to students in a relatively rational logic. Before class, using online or offline media players, students can pause and playback the teaching content even for many times, which is conducive to students' thinking in learning and the improvement of independent learning ability. Students do not have to be nervous, worried about the omission of knowledge, so the learning atmosphere can be relatively relaxing. Secondly, flipped classroom is committed to building a comprehensive and interactive online learning platform. In this platform, students not only can learn online courses, they can even directly ask questions to teachers or other students online without waiting for the next time of offline class, and share their learning experiences. The efficiency of interaction and communication has been significantly improved. Thirdly, the curriculum management system can be embedded into this platform, and teachers can make use of this management system to keep track of students' learning progress, homework scores and knowledge shortfalls at any time[14]. This means that teachers are enabled to receive feedback data which is intelligent, in real time and from multiple dimensions.

In flipped classroom, teachers devote most of their energy to students' knowledge assimilation, instead of imparting knowledge. Information technology has greatly facilitated this process in many ways, such as providing high quality learning materials, improving mutual communications, and delivering real-time information.

3.   RESEARCH MODEL CONSTRUCTION

Flipped classroom has many new features, the goal-oriented teaching method of which has greatly improved the traditional teaching mode. Therefore, it is of great practical significance to study the influence of flipped classroom method on teachers' teaching self-efficacy in the context of IT usage. According to the classical self-efficacy theory, various information sources that affect self-efficacy need to be cognitively processed by individuals to form a sense of self-efficacy for a particular task. The influencing mechanism of all the external or internal causes on university teachers' self-efficacy in the context of flipped classroom teaching is studied in the next. We will discuss the impact of flipped classroom on college teaching respectively.

3.1 Attributions and complexity

According to Bandura's theory, the attributions and complexity of university teaching exert certain influence on teacher's self-efficacy. As flipped classroom is the latest application scenario of information technology in teaching, its influence on traditional university teaching is a lot. First, one of the most important features of university teaching is the emphasis on independent learning. One of the most important goals of university teaching is to enable students to complete their learning tasks as independently as possible. Flipped classroom, by pushing well-made teaching video and courseware, provides students with a convenient opportunity for independent learning. Secondly, with the application of information technology, the interdependence of teaching activities is greatly changed, in that, teachers can be freed from the onerous activities of teaching preparation and lesson planning, and it is more flexible in the time and space for course

preparation. In traditional teaching, teachers are constrained by time and space in lesson preparation. For example, teachers need to prepare lessons one or two days before class. It is easy to forget if the preparation is too early, and it is too hasty if the preparation is too late. In flipped classroom method, the lesson preparation time is relatively flexible, well-made course bank has enough learning materials, teachers only need to prepare themselves with open mind and systematic knowledge reserve about what is going to be discussed in class. Thirdly, flipped classroom equipped with information hardware and software can be regarded as an innovative and systematic teaching solution. this makes the teaching process much simpler and more focused. Teachers no longer have to spend much of their effort on explaining knowledge points, instead, they can devote more energy to helping students understand and apply knowledge.

The core of flipped classroom is to use information technology to change the basic logic of teaching process, thus changing the attributions and complexity of teaching activities. By analyzing and perceiving these changes, teachers rebuild their perception of teaching activities, in other words, they rebuild their belief that they can successfully complete teaching activities (efficacy expectation). On the other hand, Many successful cases of flipped classroom can also enhance teachers' confidence that the information-based teaching method will successfully improve teaching quality.

Based on the above-mentioned improvement of the attributions and complexity of teaching activities in flipped classroom, we put forward the first hypothesis:

H1: The improved attributions and complexity of teaching process by IT usage have a positive effect on teachers' belief that they can successfully complete teaching activities (efficacy expectation).

H2: The improved attributions and complexity of teaching process by IT usage have a positive effect on teachers' belief that IT based teaching method will successfully enhance the teaching efficiency (outcome expectation).

3.2 Ways of feedback

A typical feature of flipped classroom is to use information technology to improve ways of feedback. With the help of information technology, flipped classroom teaching mode can greatly improve the formation of feedback mechanism. Firstly, flipped classrooms provide far more ways of feedback than traditional classroom. With the help of curriculum management system, teachers can easily acquire feedbacks from students' online comment, online communication, as well as students scores from various tests or assignments. Secondly, teachers can get first-hand information about students' learning effects by sharing learning tips and answering questions in real time online. Thirdly, teachers can check the teaching materials they have made in the system at any time, and think over the whole process of their teaching, especially the method of communicating with students so as to further improve the teaching efficiency of flipped classroom. Finally, teachers can also learn from other teachers' flipped classroom teaching method for indirect experience, because through the platform which has other similar professional courses, or even sample and classical courses, teachers can easily study, observe and appreciate the advantages of these courses online, so as to improve their own courses. This is also one of the effective ways to obtain indirect feedback by means of informatization.

According to Bandura's self-efficacy theory, accurate and abundant feedback is conducive to the formation of individual's self-efficacy[8]. As information technology has enabled teachers to acquire feedback efficiently, and to gain lots of ways to improve their teaching skills, teachers may have more confidence in teaching well. Combined with the factors that influence the formation of self-efficacy discussed above, we assume:

H3: The accurate and abundant feedback provided by IT usage have a positive effect on teachers' belief that they can successfully complete teaching activities (efficacy expectation).

H4: The accurate and abundant feedback provided by IT usage have a positive effect on teachers' belief that IT based teaching method will successfully enhance the teaching efficiency (outcome expectation).

3.3 Model construction

Based on the discussion above, we build the research model as follows:
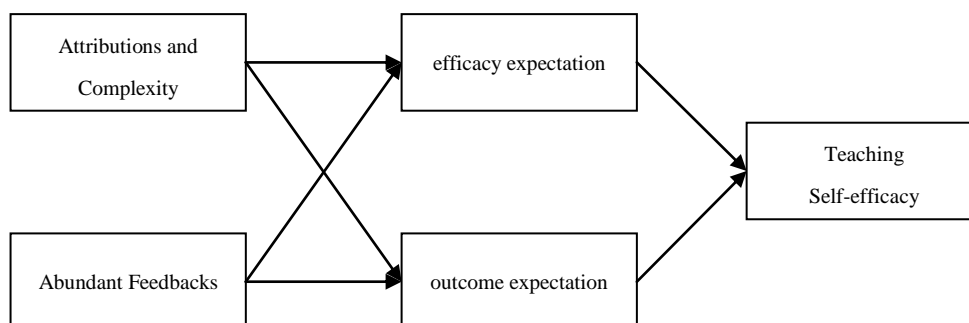

Figure 1.   The research model of university teachers' teaching self-efficacy

4.   CONCLUSION AND IMPLICATIONS

In higher education context, teaching efficacy is still a construct worth studying. With the wide application of information technology, the ways of teaching in universities are undergoing great changes. Recently, the most typical example of IT application in university teaching activities is the flipped classroom teaching method. According to Bandura's self-efficacy theory, we try to find out the exact factors that IT usage exert influence on teachers' self-efficacy in university classroom. Through reasoning and analysis, based on the classical self-efficacy theory, this study systematically analyzes the impact of IT application in university teaching activities, and constructs a research model to describe the impact mechanism. Flipped classroom has brought revolutionary changes to college teaching. On one hand, flipped classroom has profoundly changed the attributions and complexity of teaching activities, which can to some extent enhance the self-efficacy level of teachers in university classroom teach. On the other hand, flipped classroom has greatly enriched the feedback forms and feedback channels of teaching effects, making teachers better understand their own teaching process, students' learning status, and learning results. This research model constructs the influencing factors and mechanism of teachers' teaching self-efficacy in the context of university. It not only inherits the influence factors of Bandura's classical theory on the formation of individual self-efficacy, but also combines the reasoning and deductions in the background of IT usage in the practice of university teaching. The construction of this research model shed light on the research of the self-efficacy of university teachers. It also provides the research paradigm for reference for further study. Further empirical study needs to be conducted to test the effectiveness of this model.

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