A Study on STEM Teaching Behavior Intention of Preschool Education Students in Chongqing

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Abstract

STEM education in preschool children had attracted increasing attention, and teacher training was the key to promote the development of STEM education in preschool children. Based on the theory of planned behavior, this study conducted a questionnaire survey on preschool education majors in three universities in Chongqing through the STEM teaching intention model of preschool education majors, and analyzed the factors influencing their STEM teaching behaviors and their mutual relationships.

The study findings were as follows:

1. The three variables of attitude, subjective norm and behavioral experience had a positive effect on the subjects' STEM teaching intention.

2. Knowledge had no direct influence on the implementation of STEM teaching intentions.

3. However, by significantly influencing attitudes, subjective norms and perceived behavioral control, STEM education in preschool children exerted indirect influence on pre-service teachers' STEM teaching intention.

Keywords: Preschool Education, STEM Education, Behavioral Intention, Theory of Planned Behavior

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1. Introduction

With the advent of the knowledge-based economy era and the social changes brought about by the fourth Industrial Revolution, the current educational objectives have shifted from emphasizing the mastery of subject knowledge to cultivating the core literacy of students. STEM education, which has been in full swing in recent years, is one of the effective ways to cultivate students' core literacy. STEM education emphasizes the integration of disciplines, allowing students to use the knowledge of various disciplines to solve problems in real situations, and cultivating students' comprehensive qualities such as problem-solving ability, critical thinking and collaboration ability. The development trend of STEM education is gradually expanding, the object scope extends to preschool children, and the influence extends from the United States to the whole world. Research on STEM education began to rise around the world. In China, as far as Chongqing is concerned, departments and schools at all levels have put forward different requirements for the implementation of STEM curriculum, among which STEM teacher training has been elevated to a crucial position. However, there are both challenges and opportunities in STEM teacher training in China. The significance of this study is to provide help for the training of preschool STEM teachers in China by investigating the STEM teaching behavior intention of preschool education students in Chongqing.

2. Literature review

In the field of STEM education, many scholars apply the theory of planned behavior to study STEM teachers' behavioral intentions. McConnell proposed a STEM educational intention model. Social and economic impacts, student truancy rates, and years of work experience all show direct relationships with teacher autonomy.(McConnell,2017) Moore and Burrus experiments show that the theory of planned behavior progressively predicts STEM major and career choices through variables, with attitudes and intentions being the most predictable components.(Moore,2008)Clements and D.H. & Sarama, Jet al. examined the use of STEM instructional intentions by science and elementary preservice teachers in terms of computational thinking skills, gender, grade level, daily computer use, and the Internet.(Clements, D.H. & Sarama, J 2016)

Domestic research on STEM education is still in its infancy, and there are few researches on STEM teachers' behavioral intentions. Fang Xu, Zhang Xinhua and Li Lin investigated the influencing factors of teachers' behavioral intention on STEM online education platform based on the Wise platform of South China Normal University. Social influence and effort expectation are positively correlated with behavioral intention through performance expectation. Based on the theory of planned behavior, Lin and Williams explored the influence of knowledge, values, subjective norms, perceived behavioral control, and attitude on behavioral intention among preservice science teachers in STEM education in Taiwan. Lin K Y, Williams P J 2016

From the above discussion, it can be seen that many scholars have applied the theory of planned behavior to preschool education and STEM teachers' behavioral intentions. Existing studies have also combined the two to study the willingness of preschool teacher candidates to STEM teaching based on the theory of planned behavior. Clarke, R., Shaw-Ridley, M conducted a study to determine the perceptions of pre-school teacher representatives of integrated science, technology, Engineering and Mathematics (STEM) education and their preferences for integrated STEM teaching. Clarke, R., Shaw-Ridley, M 2019 However, in this study, the factors influencing the intention of preschool STEM teachers to teach STEM behavior were not studied, which formed the breakthrough of this study. Based on the theory of planned behavior, this study explored the factors that influence preschool students' STEM teaching behavior intention, which filled the gap of existing research.

3. Research Methods and Material

3.1 Research Methodology

This study mainly explores the influencing factors and mechanisms of STEM teaching behavioral intention of preschool education majors. this study is suitable to adopt a quantitative research-based method to analyze the relationship between the influencing factors and the influencing path of preschool students' STEM teaching behavior intention. At the same time, the behavioral intention of STEM teaching is also affected by the differences of social and objective conditions, and there are specific differences

among individuals. Therefore, the research of influencing factors needs to collect sample data through qualitative research methods such as interviews and observations. Therefore, questionnaires and interviews were used in this study to investigate the influencing factors and mechanisms of STEM teaching behavioral intention among preschool education majors.

3.2 Population and sample size

In this study, students majoring in preschool education in Chongqing were selected as the research object, and three undergraduate programs of preschool education were set up in this area Selected 211 universities, one municipal key university and one private university respectively, the online questionnaire was distributed to the pre-school education major students of these schools by means of teachers' recommendation, counselors' forwarding and classmates' pushing, and the data were collected by filling in the questionnaire voluntarily. Finally, A total of 600 questionnaires were issued 476 valid questionnaires were collected, and the age of the data sources covered all grades from freshman to doctor . The ratio of male to female students and educational background was basically consistent with the actual situation of students majoring in preschool education in Chongqing. This study randomly selected from southwest university, chongqing normal university, chongqing normal university college of humanities and science and technology the three schools in the school undergraduate and graduate students 40 people, after asking, 37 people agree to accept the interview, ultimately 37 effective interview results, including southwest university graduate student 4, 20 undergraduates, chongqing normal university undergraduates 3 people, among them, Among them, 10 undergraduates from Chongqing Humanities College. The author conducted face-to-face interviews with 37 interviewees who left their contact information in the questionnaire

3.3 Data collection

3.3.1 Design, measurement and distribution of questionnaires

According to the theory of planned behavior, combined with the cultivation direction of Chinese students' core literacy, and modified with reference to Qian Jingrui's

questionnaire, the "Chongqing Preschool Education Students' STEM Teaching Behavior Intention Questionnaire" was formed.

The first part was the basic information questionnaire, which mainly investigated the basic information of the subjects. The second part was the STEM teaching behavior intention questionnaire, which was divided into six dimensions: STEM related knowledge, STEM teaching behavior experience, attitude towards STEM teaching, subjective norm of STEM teaching, STEM teaching perceived behavior control, and STEM teaching behavior intention. A total of 27 questions were asked using 5-level Likert scale. Subjects agreed or agreed with 27 sentences ranging from "strongly agree"/strongly agree "to" strongly disagree"/"strongly disagree".

After determining the preliminary items of the questionnaire, invite experts in related fields for small-scale exchanges. Then, some students of preschool education major were contacted to conduct a small scale questionnaire survey. After completing the above work, modify the questionnaire and confirm the final version.

3.3.2 Design and implementation of interview outline

The variables included STEM related knowledge, STEM teaching behavior experience, attitude toward STEM teaching, subjective norms of STEM teaching, STEM teaching perceived behavior control, STEM teaching behavior intention and suggestions for

STEM teaching training in colleges and universities. The purpose of this study is to supplement and explain the results of the questionnaire.

3.4 Data analysis

3.4.1 Quantitative data analysis methods

The analysis process using quantitative data in this study was as follows:

(1) Descriptive statistics of the sample, including mean, standard deviation, median and distribution pattern.

(2) To test the measurement model, confirmatory factor analysis was performed on the samples, including reliability analysis, factor loading coefficient analysis, aggregate

validity and discriminant validity, and then the model structure was modified according to the degree of fit of the model.

3.4.2 Qualitative data analysis

In this study, interview data were coded according to Strauss's three-level coding method. The NVivo software was used to extract the concepts of 37 valid interview records from the interview data, and the three-level codes were obtained by hierarchical induction and ranking. According to the three-level codes, the interview results were further analyzed.

4. Results and Discussion

4.1 Descriptive Statistics below

The Research Statistics Computer package was used to process data for the questionnaire items. the mean value ranged from 2.21 to 4.39, and the standard deviation ranged from 0.496 to 1.479, indicating that the respondents' responses to most questions were between neutral and supportive, and the distribution was not concentrated. When the sample size is large, the test results of normal distribution of data will be more sensitive, which is easy to lead to data bias. The absolute values of skewness and kurtosis of this sample are less than 1, indicating that the data of this sample are basically normally distributed.

4.2 Confirmatory factor analysis

Table 1 Coding classification of positive attitudes towards STEM teaching

Positive attitudes towards STEM teaching	Number of mentions
Set the stage for your child's future	9
Enrich your children's knowledge	5
Develop your child's abilities	5
Stimulate your child's interest in learning	4
Develop your child's mind	2

Table 2 Code breakdown for wait-and-see attitudes toward STEM teaching

Adopt a wait-and-see attitude toward STEM teaching	Number of mentions
He thinks STEM education still has a lot of room to grow	8
Think STEM education is trending	5

Table 3 Implementation of STEM teaching coding classification table based on subjective factors

STEM teaching is carried out based on subjective factors	Number of mentions
Meet your child's developmental needs	9
The concept of self-education	8
Teaching content needs	4
Give yourself an edge	1

Table 4 Classification Table of implementing STEM teaching coding Objective factors

STEM teaching should be carried out according to objective factors	Number of mentions
The philosophy and requirements of the park	8
Your social environment	6

Table 5 Code classification table with strong perceptual and behavioral control ability

Strong control over perceived behavior	Number of mentions
Think you're capable but don't practice it	6
STEM teaching has been successfully implemented	1

Table 6 Perceived behavioral control ability weak code classification

Weak perceptual behavioral control ability	Number of mentions
Lack of knowledge about STEM	8
Lack of STEM education knowledge	7
Lack of STEM-related experience	3.

Table 7 STEM teaching intention strong coding classification table

The intention to implement STEM teaching was very strong	Number of mentions
90% - 100%.	5
80% - 90%.	10
70% - 80%.	7
60% - 70%.	2

Table 8 List of properly implemented STEM teaching norms

The willingness to implement STEM teaching is not strong	Number of mentions
< 50%	4
50% - 60%.	5

Table 9 Added Practice Opportunity Code category table

practice	Number of mentions
Increase opportunities for kindergarten internships	14
Teach through the valve stem	3.

4.3 Discussion of coding results

The results showed that the STEM teaching behavior intention of preschool education students in Chongqing was mainly related to their attitude, subjective norm and perceived behavioral control of STEM teaching, and the mastery of STEM knowledge would affect their attitude, subjective norm and perceived behavioral control of STEM teaching. The degree of STEM teaching behavior experience has an impact on STEM teaching attitude and STEM teaching subjective norm.

The results of this study are different from the research of Lin and William (S 2016) on STEM teaching behavior intention of preservice science teachers in Taiwan. The results showed that the STEM teaching behavior intention of preservice science teachers in Taiwan was mainly related to their values, perceived behavioral control and subjective norms. However, it was not related to STEM teaching knowledge or attitude.

This difference may be due to the need for preservice science teachers in Taiwan to actively evaluate the effectiveness of STEM teaching and to obtain and control the teaching resources needed to implement STEM programs. Currently, preschool STEM teachers in Chongqing do not need to be evaluated before implementing STEM teaching. In addition, a study conducted by Moore et al. (2019) on students in Iowa City, USA, revealed that attitude is a particularly strong predictor of STEM intention. In this study, although degree and intention were the strongest predictors of STEM major and STEM career choice, subjective norms and perceived behavioral control were not predictive of STEM choice.Of these, perceived behavioral control was not predictive of STEM choice, which is consistent with the results of this study. In this study, the effect of perceived behavioral control on STEM teaching behavioral intention was very weak. From the above studies in different countries and regions, it can be seen that the differences in research objects and social backgrounds will lead to the differences in research results. Therefore, it can be inferred that due to the different research objects and backgrounds, the factors affecting teachers' STEM teaching behavior intention will vary to different degrees.

Differences in cultural background is planned behavior theory in the development of an important discovery, as the change of social norms and normative beliefs to assess the social impact, normative beliefs are the main factors influencing the subjective norms, social norms and normative beliefs should not only consider the individual behavior, but also personal survival and rely on social networks, This explains why studies in different cultures have different results. The theory of planned behavior suggests that the basis of social influence is collectivist culture. Under the cultural background of socialism with Chinese characteristics, the cultural background of Chinese teachers is deeply influenced by collectivism culture. Teachers will be influenced by various members and factors of the education community, such as Ministry of Education officials, school administrators, other teachers, parents and the public, when advancing STEM teaching. Taiwan scholar Huang (2012) pointed out that the emphasis on entrance examination has played a key role in many educational reforms in Taiwan. Therefore, it is reasonable to believe that in the field of preschool education in China, the reform of college entrance examination and the reform of "primary school" education will inevitably have a significant impact on

STEM teaching students in preschool education in Chongqing.As in the interview, many respondents were worried that the implementation of STEM teaching was against the policy of “de-primary school”, which weakened their willingness to implement STEM teaching. The interview content of the research subjects provided further explanations and explanations for quantitative data analysis. Although many freshmen and sophomores do not have enough knowledge of STEM teaching and believe that they do not have the confidence and ability to carry out STEM teaching activities at present, many respondents expressed their willingness to try STEM teaching in their future work due to the high social awareness of STEM education and the increasing social attention to STEM education. This results in low perceived behavioral control and high behavioral intention, which leads to a weak influence of perceived behavioral control on STEM teaching behavioral intention in the overall research results. In addition, STEM education in China is still in its infancy, and STEM teaching in preschool education has not been carried out on a large scale. Therefore, it is difficult for preschool education majors in Chongqing universities to obtain STEM-related theoretical knowledge and practical opportunities, resulting in a lack of STEM teaching behavior experience. It is precisely because of these cognitive deficiencies that STEM teaching behavior experience is not related to STEM teaching perceived behavior control in the results of this study.

5. Conclusions suggestions and recommendations

5.1 Summary of research results

STEM teaching behavior experience affects STEM perceived behavior control, STEM teaching subjective norms, and STEM teaching behavior intention; STEM teaching attitude affects STEM teaching behavior intention; STEM teaching subjective norms affect STEM teaching behavior intention; Perceived behavioral control of STEM teaching has an impact on STEM teaching behavioral intention.

5.2 Conclusion

The following are the conclusions of the two research questions:

Research Question 1: What are the factors that influence the behavioral intention of preschool education students to teach STEM?

The influencing factors of STEM teaching behavior intention of preschool education students include STEM related knowledge, STEM teaching behavior experience, STEM teaching attitude, STEM teaching subjective norm, and STEM teaching perceived behavior control.

Research question 2: How do these factors affect the STEM teaching behavior intention of preschool education students?

Rich STEM-related knowledge and rich STEM teaching behavior experience can help preschool education students improve their positive attitude toward STEM teaching and strengthen subjective norms for implementing STEM teaching. In addition, expanding their STEM-related knowledge can also improve their perceived behavioral control in implementing STEM teaching. Positive STEM teaching attitude, strong subjective norms of STEM teaching and perceived behavioral control of STEM teaching can enhance the behavioral intention to implement STEM teaching. STEM teaching activities of preschool children not only lay an important foundation for the development of children's own core literacy, but also play an advanced role in China's educational reform. An important guarantee for the implementation of STEM teaching for children is STEM teacher training. In order to make STEM teaching widely carried out in kindergartens, it is very important to train preschool education students in Chongqing. Through the conclusion of this study, we can understand the factors that affect the STEM teaching behavior willingness of preschool education students in Chongqing, so as to provide "suitable medicine" for the formation of STEM curriculum system of preschool education in colleges and universities, and put forward constructive suggestions.

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