Study on Preschool Teachers' Willingness to Accept Intelligent Camera Technology in the Classroom - An Empirical Case Based on Perceived Risk Theory

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Abstract

The use of intelligent information technology to strengthen the supervision of child care has also recently caused some controversy. To promote the smooth implementation of relevant national policies, it is necessary to conduct an in-depth investigation to find out the basic characteristics and influencing factors of preschool teachers' willingness to accept intelligent camera technology in the classroom. For this reason, through a random survey of 505 preschool teachers, this study found the following: (1) teachers showed weak acceptance of intelligent camera technology in the classroom; that is, on the whole, they held a positive acceptance attitude but the degree of acceptance was weak; (2) there were significant differences in acceptance intention among preschool teachers of different ages, but there were no significant differences among gender, teaching age, kindergarten type, job position, and class type; (3) performance expectation, promotion conditions, and social influence have a positive impact on preschool teachers' willingness to accept, while safety risks have a negative impact. Based on this, the study suggests that the primary task is to establish a protection mechanism to resolve the security concerns of intelligent supervision, the second is to realize triple transformation to give full play to the educational value of intelligent supervision, and the last is to strengthen group guidance and pay attention to the main needs of intelligent supervision.

Keywords: Preschool teacher, Intelligent camera technology, UTAUT model, Perceived risk, Willingness to accept

1 Introduction

In recent years, due to the exposure of several incidents of "children abuse by kindergarten teachers," the safety supervision of kindergartens has aroused social concern in China. On March 5, 2018, China's "government work report of the State Council in 2018" clearly pointed out that "the government should use Internet information and other means to strengthen the supervision of the whole process of child care and education, and make parents feel at ease about the safety of their children [1]." In this context, with the rapid development of artificial intelligence technology, in recent years, many kindergartens have installed intelligent cameras to strengthen the safety supervision of children.

However, this measure also caused a certain degree of social controversy. Regarding the installation of smart cameras in the classroom, some social media believe that "parents applaud, but teachers are dissatisfied [2, 20, 23-24]." To promote the smooth implementation of the above-mentioned national policies, it is necessary to ask some questions: are the kindergarten teachers—being its key objects—willing to accept the use of intelligent camera technology in the classroom? What factors affect their willingness to accept? What is the impact? Therefore, based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and Perceived Risk theory, this study designed a survey tool and conducted a random survey on 505 kindergarten teachers. We look forward to providing targeted suggestions for the relevant departments through empirical research.

2 Literature Review

2.1 Kindergarten Teachers' Willingness to Accept Information Technology

Previous researches in China are mainly of two types.

The first is the general survey with the theme of "Kindergarten Teachers' information literacy." In 2007,

some scholars found that kindergarten teachers face the following problems in the use of information technology: lack of confidence, "lack of patience," subjective disapproval, and lack of enthusiasm [3]. However, the situation has improved in recent years. In 2018, some scholars found that as high as 67.4% of kindergarten teachers are willing to use educational technology for teaching [4]. The advantage of the existing general investigation lies in the large sample size, but the deficiency lies in the lack of in-depth discussion on specific influencing factors.

The second is targeted research in the direction of "the shortage of kindergarten teachers using information technology." For example, Liu Xia and her team found that there are kindergarten level barriers and ability barriers for kindergarten teachers to integrate information technology into teaching activities [5]. Li and Chen [6] conducted a survey based on UTAUT, and found that kindergarten teachers' subjective intention to use information technology in teaching is high, but their actual behavior is low. It is quite obvious that most of the targeted studies in the past focused on teaching activities, but lacked the attention to related issues from the perspective of management.

However, through literature search, we find that there are few relevant studies in this field in foreign countries, most of which focus on the willingness of teachers in universities, and primary and secondary schools to accept technology.

2.2 Explore Classroom Camera Phenomenon

According to the data collected by the research team, since 2009, the phenomenon of installing cameras in classrooms has attracted the attention of domestic education circles. On July 28, 2009, China Education Daily published several articles to discuss the phenomenon of teachers' cameras, which received both support and opposition. Most opponents think that installing cameras on teachers shows a kind of disrespect and distrust toward teachers [7]. Specific to the field of early childhood education, studies have pointed out that the existence of cameras not only has a negative impact on the psychology of kindergarten teachers [8], but also constrains their teaching level [9] and reflects the trust crisis of parents on kindergarten teachers [10].

In recent years, the introduction of intelligent camera technology has attracted more and more scholars [25-27]. For example, Jiao [11] pointed out that we should "attach great importance to the privacy, laws, regulations and ethical issues brought about by the camera in the classroom and face recognition technology." Some scholars think that we should at least pay attention to the following issues: students' privacy, education discipline, and freedom [12]. Some other scholars reflect on the phenomenon of classroom camera gaze from a philosophical perspective, pointing out that the camera objectifies the teachers and students, and destroys their integrity and sense of time and space [13, 21-22].

However, we found that most of the relevant foreign studies used the camera technology as the tool carrier of observation research, and ignored the privacy and ethical issues involved in its application.

Based on the above results, this study intends to take an empirical approach to focus on Kindergarten teachers' willingness to accept intelligent camera technology in the classroom. The research involves the application of information technology in early childhood education management, and one of its primary purposes is to explore the ways to "equip appropriate information infrastructure" in the field of early childhood education [14].

3 Theoretical Framework

3.1 UTAUT

Academic research on the UTAUT model is abundant. Venkatesh [15] put forward UTAUT in 2003 by combining the advantages of the original related theories (TPB, TAM, etc.) The model includes four core variables: Performance expectation, effort expectation, social influence, and promotion condition; and four moderating variables: Gender, age, experience, and voluntariness. Previous studies have proved that the model has high explanatory power and can be used as a basic theory in practical research [16].

3.2 Perceived Risk Theory

The theory of perceived risk has a long history. The concept of perceived risk was first proposed in 1960 by Professor Raymond A. Bauer of Harvard University. Perceived risk refers to the risk that people perceive of a certain behavior before the implementation of the behavior. Perceived risks have a negative impact on people's behavior [17]. In 1972, Jacoby and Kaplan divided customer perceived risk into five dimensions: finance, function, safety, psychology, and society [18]. In 1993, Stone and Gronhaung [19] proposed that the total perceived risk can be explained by 88.8% when time risk is added to the above five risks. So far, most of the researches on user perceived risk are based on time, function, security, finance, society, and psychology.

3.3 Research Model

Aiming at specific research problems, this study completed the preliminary research model design by combining the practical application of intelligent camera technology in kindergarten classroom. Figure 1 illustrates the model. The model contains eight independent variables, six demographic variables, and one dependent variable. The specific design considerations of the model are described below.
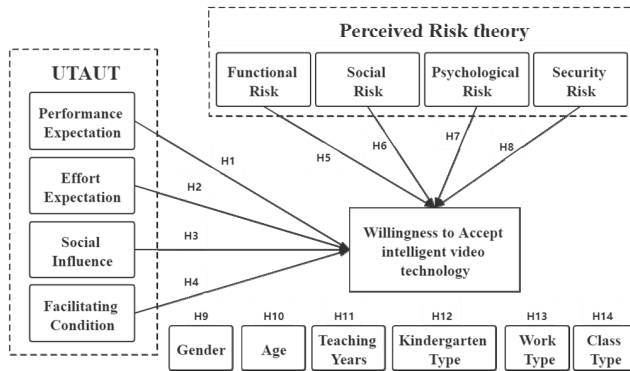
Figure 1. The initial model of influencing factors of teachers' willingness to accept intelligent video technology in classroom

First, regarding the application of UTAUT model variables, the original four core variables of performance expectation, effort expectation, social influence, and promotion conditions were retained; and the two moderators of experience and voluntary were deleted. Second, regarding the application of the perceived risk theory, four main variables of functional risk, social risk, psychological risk, and safety risk were retained; and the two variables of time risk and financial risk were removed.

3.4 Hypotheses

The following hypotheses are proposed:

Hypothesis 1 (H1): Performance expectation has a positive impact on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 2 (H2): Effort expectation has a positive impact on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 3 (H3): Social influence has a positive impact on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 4 (H4): Facilitating condition has a positive impact on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 5 (H5): Functional risk will negatively affect kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 6 (H6): Social risk will negatively affect kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 7 (H7): Psychological risk will negatively affect kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 8 (H8): Security risk will negatively affect kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 9 (H9): Gender has a significant influence on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 10 (H10): Age has a significant influence on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 11 (H11): Teaching years has a significant influence on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 12(H12): Kindergarten type has a significant influence on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 13 (H13): Work type has a significant influence on kindergarten teachers' willingness to accept intelligent video technology.

Hypothesis 14 (H14): Class type has a significant influence on kindergarten teachers' willingness to accept intelligent video technology.

4 Methodology

4.1 Participants

In this study, the network questionnaires were randomly distributed by stratified random sampling to the preschool teachers of three different types of kindergartens in Anhui Province to obtain the survey data that meet the requirements. Therefore, the randomly investigated preschool teachers are represented in the national group. Figure 2 presents the specific composition of the sample.

Variable	Types	Number of people	Percentage
Age	20 years old and below	17	3.37%
	21-30 years old	315	62.38%
	31-40 years old	110	21.78%
	41-50 years old	30	5.94%
	51 years old and above	33	6.53%
Length of Teaching	1-5 years	341	67.52%
	6-10 years	70	13.86%
	11-15 years	39	7.72%
	16-20 years	27	5.35%
	more than 21 years	28	5.54%
Gender	male	40	7.92%
	female	465	92.08%
Type of Garden	public kindergarten	183	36.24%
	private kindergarten	286	56.63%
	publicly-built private kindergarten	36	7.13%
Type of Class	baby class	38	7.52%
	bottom class	152	30.10%
	middle class	163	32.28%
	top class	152	30.10%

Figure 2. The specific composition of the sample

4.2 Instrument

The scale designed by the study consists of three parts. First is the basic information (see Figure 2). The second is the core variable part, which sets a total of 13

questions around the four variables of performance expectation, effort expectation, social impact, and promotion conditions of the UTAUT model; and 14 questions around the four variables of functional risk, social risk, psychological risk, and security risk of the perceived risk theory. The third is the dependent variable part, which sets three questions according to the willingness to accept the dependent variable. The questions were asked with a five-point Likert scale.

4.3 Data Collection

The data collection depended on the mainstream questionnaire survey software "Questionnaire Star." From October 1 to December 30, 2019, the author shared the questionnaire link with QQ group and WeChat group, and randomly invited three different types of kindergarten teachers to participate. A total of 637 questionnaires were collected, out of which 132 invalid questionnaires were excluded; thus, a total of 505 valid questionnaires were obtained, and the effective rate of the questionnaire was 79.28%.

4.4 Data Analysis

The data analysis methods employed are described below: SPSS 23.0 is mainly used for descriptive statistics, significant differences, and influencing factors analysis of the collected data. Meanwhile, Cronbach's Alpha and Composite Reliability (CR) methods were used to test the reliability (see Table 2): (1) Cronbach's Alpha values of all variables were higher than 0.90; (2) CR values were all higher than 0.70. The validity of this study was tested by factor analysis and comprehensive validity analysis (as shown in Figure 3): the factor load of each question was greater than 0.7%, and the AVE (extraction of mean variance) value was greater than 0.5. In conclusion, the reliability and validity of the questionnaire are good and meet the requirements of further research.

5 Results

5.1 Descriptive Analysis

Using the descriptive statistics of the data analyzed by the SPSS software, the basic situation of preschool teachers' willingness to accept intelligent camera technology in the classroom is shown in Table 1. On the whole, preschool teachers' average willingness to accept was 3.34 > 3.0; specifically, only 16.71% (84) of the preschool teachers indicated that they were unwilling (including 33 is "very disagree" and 51 is "disagree"). The proportion of preschool classrooms accepted by preschool teachers with no opinion or consent (including 185 who chose no opinion, 181 who agreed, and 55 who very much agreed) accounted for 83.29%. This shows that preschool teachers are willing

Variable	Number of items	Factor loading	Cronbach's alpha	AVE	CR
Performance expectation	3	0.885-0.920	0.930	0.8144	0.9294
Effort expectation	3	0.857-0.925	0.913	0.789	0.9181
Social impact	3	0.925-0.941	0.954	0.8699	0.9525
Promotion condition	4	0.789-0.926	0.916	0.7253	0.9131
Functional risk	4	0.764-0.894	0.904	0.7027	0.904
Social risk	3	0.890-0.956	0.950	0.8502	0.9445
Psychological risk	3	0.872-0.923	0.938	0.8147	0.9295
Security risk	4	0.817-0.925	0.938	0.7908	0.9378
Willingness to accept	3	0.783-0.820	0.959	0.5907	0.7429

Figure 3. Reliability and validity test results

to accept intelligent camera technology in the classroom, but the degree of acceptance is weak; in terms of quantity, the number of preschool teachers who are willing to accept intelligent camera technology in the classroom is more than that of the unwilling.

The descriptive result of the willingness to accept based on demographic variables is provided below. In terms of gender, the willingness to accept is higher in the male groups (3.48) than in the female groups (3.33). In terms of age, the group over 51 years old has the strongest willingness to accept (3.78), followed by the group under 20 years old (3.67), group aged 41-50 (3.42), group aged 21-30 (3.30), and group aged 31-40 (3.27), which is the weakest. In terms of teaching age, the two groups with the strongest willingness to accept are 16-20 years and more than 21 years, with an average of 3.56, followed by 1-5 years (3.36), 11-15 years (3.26), and 6-10 years (3.17), which is the lowest. Based on the type of kindergarten, private kindergarten teachers (3.40) have the strongest willingness, followed by public kindergartens (3.30). The willingness to accept is the weakest in public and private kindergartens (3.18). From the point of view of work, the willingness of nursing teachers is the strongest (3.43), followed by the assigned class teachers (3.37), and the weakest is that of the main class teachers (3.32). From the class, small class teachers have the strongest willingness to accept (3.46), followed by large class teachers (3.42), middle-class teachers (3.37), and the weakest are the small class teachers (3.21).

5.2 Analysis of the Impact of Demographic Variables on Acceptance Willingness of Teachers

The data test results show that the survey data are not approximately normal distribution. Therefore, the data of this study are not suitable to use independent

Table 1. Descriptive statistics

Variable	Type	N	Mean	S.D.
Gender	Male	40	3.48	.942
	Female	465	3.33	.984
Age	Under 20 years old	17	3.67	.890
	21-30 years old	315	3.30	1.050
	31-40 years old	110	3.27	.885
	41-50 years old	30	3.42	.763
	Over 51 years old	33	3.78	.654
Teaching years	1-5 years	341	3.36	1.023
	6-10 years	70	3.17	.946
	11-15 years	39	3.26	.880
	16-20 years	27	3.56	.852
	Over 21 years	28	3.56	.709
Type of kindergartens	Public kindergartens	183	3.30	1.063
	Private kindergartens	286	3.40	.892
	Public and private kindergartens	36	3.18	1.189
Job positions	The main class teachers	281	3.32	.998
	The class allocation teachers	195	3.37	1.009
	The conservation teachers	29	3.43	.526
Type of classes	Little-class	38	3.46	.947
	Small-class	152	3.21	.958
	Middle-class	163	3.37	.958
	Large-class	152	3.42	1.028
	Total	505	3.34	.980

sample T-test and one-way ANOVA, but suitable to use relevant nonparametric test methods. The specific test method selection and analysis results are described below.

To investigate whether there is a significant difference between male and female preschool teachers' willingness to accept, the data of male and female samples are tested by Mann-Whitney U test of two independent samples of male and female. For example, Table 2 shows that there is no significant difference in acceptance willingness between male and female preschool teachers ($\alpha = 0.05$).

Table 2. Results of differences in acceptance willingness of male and female teachers

	Acceptance willingness
Mann-Whitney U	8898.000
Wilcoxon W	117243.000
Z	-0.464
Sig. (2-tailed)	0.643

To investigate whether there are differences in acceptance willingness among teachers of different age, teaching age, kindergarten type, job position, and class type, the data are tested by Kruskal-Wallis with several independent samples. In Table 3, there are significant differences in acceptance willingness among preschool teachers of different ages. There was no significant difference in acceptance willingness among preschool teachers with different teaching age, garden type, job position, and class type.

Table 3. Results of teachers' willingness to accept

	Chi-Square	df	Sig. (2-tailed)
Age	11.172	4	.025*
Teaching years	5.706	4	.222
Type of kindergartens	0.846	2	.655
Job positions	0.282	2	.868
Type of classes	6.025	3	.110

*$p < 0.05$.

In summary, Hypothesis 10 is supported and Hypotheses 9, 11, 12, 13, and 14 are not.

5.3 Regression Analysis of the Influence of Core Variables on Kindergarten Teachers' Willingness to Accept

Considering the data characteristics in this study (the main independent variable and dependent variable data are non-numerical classified variables), it is suitable to adopt the optimal scale regression analysis and use the nonlinear transformation to find the best regression equation. The results are described below.

First, the significance of the regression equation was judged by ANOVA. Figure 4 showed that the significance of regression equation is established.

	Sum of Squares	df	Mean Square	F	Sig.
Regression	291.850	20	14.592	33.135	0.000
Residual	213.150	484	.440		
Summary	505.000	504			

Figure 4. Regression equation variance analysis results

Secondly, through the regression coefficient, we judge the main independent variables and the direction of influence on the willingness of kindergarten teachers to accept the dependent variables, and then get the final regression equation. In Figure 5, the Sig. value of performance expectation, social influence, and promotion conditions are 0.000, and the Sig. value of safety risk is 0.026, which are all less than 0.05, indicating that these four independent variables have a significant impact on the willingness to accept the dependent variable; The Sig. values of other independent variables are all greater than 0.05. Relatively speaking, they cannot explain the willingness to accept the dependent variable well. According to the positive and negative results of Beta value in Figure 5, we can see that performance expectation, social impact, and promotion conditions have a positive impact on the willingness to accept the dependent variable while security risk has a negative impact. At the same time, according to the importance coefficient Importance in Figure 5, we can see that social influence is the most important in the regression equation, followed by promotion conditions, performance expectations, and finally security risks. Relatively speaking, other variables are of low importance and can be ignored.

	Beta	Bootstrap(1000) Estimate of Std. Error	df	F	Sig.	Importance
		Standardized Coefficients				
Performance expectations	.189	.059	3	10.273	.000	.206
Effort expectations	.077	.052	3	2.192	.088	.053
Social influence	.363	.066	3	30.426	.000	.445
Promote conditions	.209	.061	4	11.795	.000	.222
Function risk	-.018	.073	2	.061	.941	.003
Social risk	.052	.082	2	.406	.667	-.011
Psychological risk	-.053	.096	1	.308	.579	.024
Security risk	-.119	.062	2	3.672	.026	.057

Figure 5. Regression equation variance analysis results

According to the above data analysis results, the regression equation finally obtained in the study is as follows:

Acceptance willingness = 0.189 performance expectation + 0.363 social influence + 0.209 promotion conditions – 0.119 security risk.

In summary, hypotheses 1, 3, 4, and 8 are valid. hypotheses 2, 5, 6, and 7 are not valid.

6 Conclusion

6.1 Teachers Show the Weak Acceptance of Intelligent Camera Technology in the Classroom

The study found that preschool teachers showed a "weak acceptance" of intelligent camera technology in the classroom. Here, "weak acceptance" expresses two meanings. First, on the whole, preschool teachers hold an approved and positive attitude toward intelligent camera technology in the classroom (the average value of willingness to accept is more than 3 points), which is not only an exciting and encouraging result but also reflects, to a certain extent, the one-sidedness of the public opinion mentioned in the introduction. Specifically, more than 30% of the groups expressed no opinions (36.57%), and nearly 50% of the groups indicated that they were willing to accept it (46.72%). Second, in terms of degree, although preschool teachers tend to accept, the degree of acceptance is weak. Specifically, less than 20% (16.71%) of the group made it clear that they were not willing to accept the technology.

The study has confirmed that functional risk, social risk, and psychological risk have no significant influence on preschool teachers' acceptance willingness. Through statistical analysis, the influence degree of other variables on preschool teachers' acceptance willingness is obtained. It can be obtained by analyzing the specific values of teachers' acceptance willingness; the teachers who explicitly reject teachers are most affected by safety risk factors and least affected by social factors. In the group of teachers who expressed no opinion, social factors had the greatest influence and effort expectation had the

least. In the group of clearly accepted teachers, social factors had the largest influence and safety risk factors had the least.

6.2 Significant Differences in the Acceptance Intention of Teachers of Different Ages

The study found that among the demographic variables surveyed, there were significant differences in the acceptance intention of kindergarten teachers of different ages. The variables of gender, teaching age, type of garden, position, class, and so on did not have a significant impact on the acceptance intention of kindergarten teachers. Moreover, there were significant differences in the acceptance intention of kindergarten teachers aged 31-40 years and over 51 years.

The findings are different from the existing ones. Studies have shown that there are no significant differences in the intention and behavior of kindergarten teachers of different ages in the use of information technology teaching. As mentioned earlier, this study mainly belongs to the acceptance intention of information technology by kindergarten teachers in the management application. The differences between the two studies reveal that it is necessary to continue exploring the differences in the willingness of kindergarten teachers to accept information technology under different application scenarios in the future.

6.3 Performance Expectations, Social impact, and Promotion Conditions Have a Positive Impact on the Acceptance Intention of Teachers

The UTAUT model is verified in this part of the study. Among the four main variables of its model design, performance expectation, social influence, and promotion conditions have a positive influence on the acceptance intention of kindergarten teachers, while the expectation of effort has not exerted a significant influence on the acceptance intention of kindergarten teachers. The effect of the expectation of effort is different from previous studies. Statistics show that the explicit disagreement with the statements "the use of intelligent camera technology and its related support software is easy to master," "the practical process of intelligent camera technology and its related support software is very simple," and "Video materials and related information recorded by intelligent camera technology are easy to understand" of kindergarten teachers are only about 10%. It can be argued that nearly 90% of the kindergarten teachers think that intelligent camera technology in the classroom has the characteristic of ease of use.

6.4 Security Risks Have a Negative Impact on the Acceptance Intention of Teachers

The study found that security risks had a significant impact on the acceptance intention of kindergarten teachers, while functional risks, social risks, and psychological risks had no significant effects. As mentioned earlier, the important purpose of a large number of kindergartens installing intelligent camera technology in the classroom is to ensure the safety of young children. However, this study is a reminder of the new security concerns that this security precaution may cause.

This security concern is primarily about privacy disclosure. The results of this study show that if intelligent camera technology is used in the class, close to or more than 50% of the explicit consent answers four sub-questions, "Fear of revealing my personal privacy," "fear of revealing the privacy of young children," "Fear of revealing the privacy of the classwork," and "Fear of using recorded video materials for improper use by others." Among them, kindergarten teachers are most worried about "revealing the privacy of young children" (54.26%), followed by "recording video materials improperly used by others" (53.17%), and "Fear of revealing my personal privacy" (51.68%); 49.50% of the kindergarten teachers worried about "revealing the privacy of classwork."

Acknowledgments

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