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Elementary school teachers' attitudes towards interdisciplinary teaching in China: current situations and personal factors

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ABSTRACT

This study analyzed the attitudes of Chinese elementary school teachers towards interdisciplinary teaching and the factors that influence elementary school teachers' attitudes. The research subjects were 325 Chinese elementary school teachers. The questionnaire method was used to survey Chinese first-line elementary school teachers, and then the questionnaire data were analyzed. The results showed that Chinese elementary school teachers' attitudes towards interdisciplinary teaching were generally positive, but attitudes varied according to educational level, school type, and subject taught. In general, teachers with a bachelor's degree, public schools, and those who taught subjects as their primary subject were more positive about interdisciplinary teaching.

1. INTRODUCTION

Interdisciplinary teaching is a way of teaching that intentionally integrates methodologies and language from more than one discipline for examining a central theme, issue, problem, topic, or experience (Baishya, 2014). Unlike a discipline-field oriented understanding of knowledge, interdisciplinarity emphasizes connections rather than distinctions (Meeth, 1978). According to (Crowell & Sam, 1989), isolated knowledge, abilities, objectives, assessments, and assumptions about educational environments are

insufficient for producing new understandings. The human brain processes information in parallel and has an inclination to view things as a totality. At this point, the interdisciplinary approach, which combines different disciplines by providing links between them, creates a sense of wholeness.

The teaching impacts of a new approach are typically determined by the attitudes of the teachers toward it (Durlak, 1998). For example, students' attitudes would be influenced by the attitudes of teachers, whether they were favorable or negative (Denessen et al., 2015). Based on the impact of teachers' attitudes on teaching and learning, we believe that it is beneficial to understand teachers' attitudes toward interdisciplinary teaching. However, there is a paucity of research on how elementary school teachers view interdisciplinary teaching and what factors may predict their attitudes toward interdisciplinary teaching. Therefore, this study focuses on Chinese elementary school teachers' attitudes toward interdisciplinary teaching and learning and the factors that influence them. Specifically, we seek to answer the following research questions:

(1) What are the attitudes of primary school teachers towards interdisciplinary teaching?

(2)What personal factors influence primary school teachers' attitudes towards interdisciplinary teaching?

2 LITERATURE REVIEW AND RESEARCH FRAMEWORK

2.1 Interdisciplinary teaching

Interdisciplinary teaching is a style of teaching that organizes the contents under a common, abstract concept (Lynn, 2008).At this point, the interdisciplinary approach integrates different disciplines by establishing connections between them. Interdisciplinary teaching is characterized by a lack of emphasis on disciplinary boundaries, but on connections. It helps students to develop different competencies and to experience a different sense of motivation and relevance (Lindvig & Ulriksen, 2019).

Interdisciplinary teaching benefits both students and teachers. For students, this approach create links among disciplines, contribute to the development of a better understanding of disciplinary logics, and promote the transfer of knowledge and skills among disciplines (Hardré et al., 2013) .For teachers, interdisciplinary teaching allows teachers to be aware of what is happening in other disciplines and provide opportunities for teachers to increase their knowledge and expertise, especially in disciplines that they do not teach. Interdisciplinary teaching allows teachers to create and understand connections among disciplines (Kate et al., 2019)

2.2 Teachers' attitudes

Because we often use the word "attitude" in our daily lives, almost everyone knows its meaning. However, researchers have different definitions of it. One study characterized attitudes as feelings related to an object or activity, referred to as the affective component, and separated them from beliefs, which fall under the cognitive component (Koballa, 1988). Another study argued that attitudes are a structure of multiple dimensions and subcomponents. Individual assessments of these subcomponents contribute to varying degrees to the understanding of overall attitudes (Ajzen, 2001). In this paper, the word "attitudes" refers to a comprehensive evaluation of an object or activity, including both affective and cognitive aspects. Some researches have classified attitudes into two categories. One of these is a generic attitude, which refers to items or groups in a broad sense (e.g., interdisciplinary). The other is an attitude towards behavior, which describes how one does a particular activity to a target (e.g., interdisciplinary teaching). General mentalities don't typically precisely anticipate explicit ways of behaving, while similar ways of behaving can be predicted well from proportions of mentalities toward ways of behaving (Albarracin et al., 2005). Consequently, this paper estimates attitudes towards explicit ways of behaving.

Specifically, a dimension of attitude toward science teaching (DAS) comprising three dimensions—cognitive beliefs, affective states, and perceived control—was developed and verified by van Aalderen-Smeets et al. (2012). Cognitive beliefs include perceived relevance, perceived difficulty and gender beliefs. Affective states are the positive and negative emotions, including enjoyment and anxiety that teachers experience during the teaching process.

Perceived control refers to teachers' sense of control over their teaching, including self-efficacy and context dependency. The attitude portion of the theoretical framework in this paper was guided by DAS.

2.3 Personal factors that affect teachers' attitudes

The first characteristic is the gender of the teachers, but research on how gender affects teachers' attitudes has shown conflicting results. One study (Andersen; Anderson et al., 1988) found that female teachers reported higher levels of self-efficacy than male teachers. Another study (Eccles, 1994) found the opposite. Besides, other researchers found no differences at all in teacher self-efficacy by gender (Lee et al., 1991).

The second factor is the educational background of the teachers. Prior to 1999, the majority of Chinese elementary teachers were either middle school graduates completing three or five years of preservice training, or they had graduated from teacher college. A four-year undergraduate program in education was launched after 1999. In China nowadays, the majority of elementary school teachers hold bachelor's degrees and have completed four years of preservice training after graduating from high school(孙德芳, 2020). Currently, there are two distinct graduate programs in teacher education: a professional master's program lasting two years, or a three-year academic master's degree. This background may lead to different attitudes because teaching methods vary depending on the educational level (Jarski et al., 1990) . For instance, research has shown that teachers with master's degrees had higher levels of teacher self-efficacy than teachers with bachelor's degrees (Hoover-Dempsey et al., 1987).

The third characteristics relates to a teacher's teaching experiences, including the years of teaching and the subjects they taught. According to a study, there were less significant age-based disparities in teachers' opinions about the usage of geospatial technology (Avdić et al., 2020). However, according to the results of the other study, teachers' self-efficacy rose during their formative years and into their middle careers but fell at the end (Klassen & Chiu, 2010; M, 2010). Moreover, teacher attitudes may be related to their disciplines, as teaching tasks and situations are substantially formed by the nature of the subjects the teacher taught (Chen & Yeung, 2015). One study showed that science teachers scored lower on attitudes toward interdisciplinary teaching and learning and had greater resistance to change than math teachers (Al Salami et al., 2015).

The last characteristic taken into account is teachers' experience in interdisciplinary teaching. A limited number of research (e.g., Powell-Moman and Brown-Schchild 2011a, b; Ross and Bruce 2007) looked into this relationship and found that teachers' self-efficacy rises when they actively engage in high-quality professional development. Furthermore, interdisciplinary teaching is frequently implemented through teamwork. In such circumstances, teachers have the opportunity to observe their colleagues and acquire firsthand experience. Their attitudes may be influenced by other colleagues when they work together.

2.4 Framework

This study focuses on elementary school teachers' attitudes toward interdisciplinary teaching in China and their influence factors. Figure 1 presents the theoretical framework this study. In the dimension of attitude, we used the DAS framework (van Aalderen-Smeets et al., 2011). The framework includes three dimensions: cognitive beliefs, affective states, and perceived control. Moreover, the theoretical framework of influence factors is divided into two groups: personal characteristics and the context of the school. Personal characteristics consist of gender, educational level, teaching experience, training, and professional development.

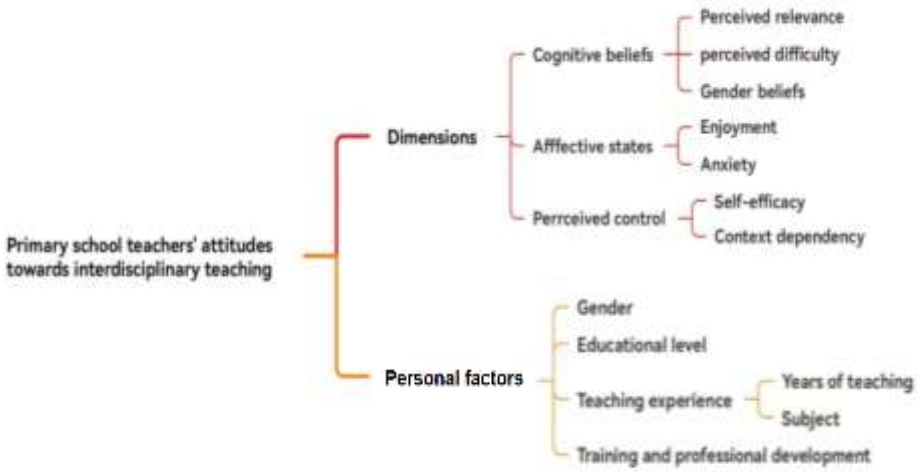

Fig. 1: The figure displays the theoretical framework for elementary school teachers' attitudes toward interdisciplinary teaching in China, including dimensions and factors.

3 METHODOLOGY

3.1 Research design

This study used a quantitative research method to explore the attitudes of elementary school teachers towards interdisciplinary teaching and its influencing factors in China. Then, the results of the study were compared, analyzed and summarized. Overall, this study took elementary school teachers in China as the research subjects, conducted a questionnaire survey, and analyzed the collected quantitative data in order to answer research questions (1) and (2).

3.2 Participants

A total of 325 elementary school teachers in China participated in the survey by answering the online questionnaire through Questionnaire Star. The demographic information of the questionnaire participants, such as gender, level of education, number of years of teaching, type of school, subjects taught, and number of interdisciplinary teaching trainings, is presented in Table 1. 59.1% of the participants was females and the remaining 40.9% was males. Teachers with less than 10 years of teaching experience accounted for 51.4% and more than 20 years of teaching experience accounted for 27.1%. 87.16% of the teachers had a bachelor's degree. Teachers in public schools accounted for 83.7% and in private schools accounted for 16.3%. Subject categories were categorized as humanities-based (including language, English, music, etc.), science-based (including science, mathematics, information technology, etc.), and other. 48% of the teachers taught humanities subjects, while 36.3% taught science subjects. Of these teachers, 62.5% taught only one course and 37.5% taught two or more courses. All of the teachers who participated in this study had received training in interdisciplinary teaching.

Table 1: Demographic information of the participants in the questionnaire.

Personal characteristics		**N**	**%**
Gender	Female	192	59.1
	Male	133	40.9
Educational level	Master degree and above	24	7.4
	Bachelor degree	272	83.7
	Below bachelor degree	29	8.9
Years of teaching	0-5	78	24.0
	6-10	89	27.4
	11-15	54	16.6
	16-20	16	4.9
	20 and above	88	27.1
School type	Public	272	83.7
	Private	53	16.3
Subject taught	Humanities-based	156	48.0
	Science-based	118	36.3
	Else	51	15.7
Number of subject taught	One	203	62.5
	More than one	122	37.5
Training	0 time	0	0.0
	1-2 times	180	55.4
	3-5 times	106	32.6
	5 times above	39	12.0

3.3 Instruments

The questionnaire for this study is divided into two sections. The first section has demographic information about the participants, including gender, level of education, number of years of teaching, type of school, subjects taught, and the number of trainings they had attended on interdisciplinary teaching. The second part is about teachers' attitudes towards interdisciplinary teaching. This section utilizes the DAS framework designed by van Aalderen-Smeets et al. (van Aalderen-Smeets et al., 2011), which includes three dimensions: cognitive beliefs about interdisciplinary teaching, affective states of interdisciplinary teaching, and perceived control of interdisciplinary teaching. On the cognitive beliefs about interdisciplinary teaching dimension, teachers expressed their perceptions of the importance of interdisciplinary teaching in terms of its perceived relevance and difficulty they encountered in teaching. For example, "I had a hard time finding topics for interdisciplinary teaching" and "It is very important to have interdisciplinary teaching in elementary schools." On the affective states of interdisciplinary teaching dimension, teachers' enjoyment and anxiety states were measured. For example, "Interdisciplinary teaching worries me" and "I enjoy interdisciplinary teaching in elementary school". On the perceived control dimension, we obtained information about teachers' self-efficacy context dependency. For example, "I am competent enough to teach interdisciplinary subjects" and "I believe that interdisciplinary teaching can only take place when appropriate materials are provided by the school." A 5-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree" was created to obtain feedback from teachers about interdisciplinary teaching. After deleting the first, third, and fifth questions of the scale, the Cronbach's alpha coefficient for the total scale was 0.879. Satisfactory internal reliabilities were obtained in this study: (a) Cognitive Beliefs about Interdisciplinary Teaching, $\alpha = 0.697$, (b) Affective State of Interdisciplinary Teaching, $\alpha = 0.728$, and (c) Perceived Control of Interdisciplinary Teaching, $\alpha = 0.673$. The reliability of these subscales was acceptable.

3.4 Data analysis

We processed and analyzed the quantitative data using the online data analysis platform SPSSPRO (https: //www.spsspro.com). Independent samples T-tests and ANOVA were used to compare attitudes toward interdisciplinary teaching among various populations.

4 FINDINGS

4.1 What are the attitudes of primary school teachers towards interdisciplinary teaching?

The differences in Chinese primary school teachers' attitudes toward interdisciplinary teaching are summarized in Table 2. Chinese primary school teachers who taught different subjects (F = 6.632, p = 0.000) and had different educational levels showed significantly differences toward interdisciplinary teaching (F = 17.304, p = 0.000). In contrast, teachers with a bachelor's degree and those teaching mathematics were more positive. In addition, teachers with different types of schools had different overall attitude scores (t = 3.658, p = 0.001). Teachers in public schools held more positive attitudes than teachers in private schools. However, there were no significant differences in overall attitude scores among teachers who differed by gender (t = -0.450, p = 0.653), years of teaching (F = 1.457, p = 0.215), and number of subjects taught (F = 2.915, p = 0.921).

Table 2 The differences in Chinese primary school teachers' attitudes toward interdisciplinary teaching

Variable		M	SD	t/F	P
Gender	Female	3.34	0.50	-0.450	0.653
	Male	3.31	0.58		
Educational level	Master degree and above	2.87	0.69	17.304	0.000**
	Bachelor degree	3.40	0.47		
	Below bachelor degree	3.03	0.71		
Years of teaching	0-5	3.33	0.54	1.457	0.215
	6-10	3.32	0.52		
	11-15	3.44	0.47		
	16-20	3.46	0.59		
	20 and above	3.24	0.57		
Subject taught	Chinese	3.45	0.34	6.632	0.000**
	Maths	3.52	0.42		
	English	3.23	0.73		
	Science	2.89	0.81		
	Morality and Rule of Law	2.56	0.44		
	Music	3.04	0.61		
	The fine arts	3.16	0.66		
	Physical culture	3.39	0.43		
	Labor skills	3.10	0.58		
	Information technology	3.02	0.59		
Number of subject taught	One	3.33	0.59	2.915	0.921
	More than one	3.33	0.50		
School type	Public	3.38	0.51	3.658	0.001**
	Private	3.06	0.60		

4.2 What personal factors influence primary school teachers' attitudes towards interdisciplinary teaching?

Tables 3, 4, and 5 summarize the differences in Chinese elementary school teachers' attitudes toward interdisciplinary teaching on three dimensions: cognitive beliefs, affective states, and perceived control. This also explains the factors influencing Chinese elementary school teachers to engage in interdisciplinarity. First, there were significant differences in Chinese elementary school teachers' attitudes toward interdisciplinary teaching and learning across educational levels (p = 0.000) and across disciplines (p = 0.000) on all three different dimensions. In addition, there were significant differences in the dimensions of affective state (p = 0.001) and perceived control (p = 0.000) by school type. Finally, on the cognitive beliefs dimension, there was a difference in teachers' attitudes toward interdisciplinary teaching and learning across different years of teaching (p=0.041). In conclusion, the factors affecting Chinese elementary school teachers' attitudes toward interdisciplinary teaching include educational level, subject, school type, and teaching age.

Table 3 Differences in attitudes on the cognitive belief dimension

Variable		M	SD	t/F	P
Gender	Male	3.13	0.43	-1.238	0.217
	Female	3.19	0.39		
Educational level	Master degree and above	2.87	0.49	8.122	0.000**
	Bachelor degree	3.20	0.38		
	Below bachelor degree	3.08	0.52		
Years of teaching	0-5	3.18	0.44	2.518	0.041*
	6-10	3.17	0.39		
	11-15	3.22	0.35		
	16-20	3.36	0.46		
	20 and above	3.07	0.40		
Subject taught	Chinese	3.23	0.31	3.688	0.000**
	Maths	3.25	0.37		
	English	3.21	0.65		
	Science	2.86	0.47		
	Morality and Rule of Law	2.74	0.39		
	Music	3.07	0.49		
	The fine arts	3.32	0.45		
	Physical culture	3.39	0.27		
	Labor skills	2.98	0.41		
	Information technology	2.95	0.38		
Number of subject taught	One	3.13	0.45	-1.015	0.311
	More than one	3.18	0.38		
School type	Public	3.18	0.40	1.774	0.077
	Private	3.07	0.43		

Table 4 Differences in attitudes on the affective states dimension

Variable		M	SD	t/F	P
Gender	Male	3.45	0.85	0.226	0.821
	Female	3.43	0.74		
Educational level	Master degree and above	2.87	1.00	13.033	0.000**
	Bachelor degree	3.53	0.70		
	Below bachelor degree	3.03	1.00		
Years of teaching	0-5	3.42	0.79	0.695	0.596
	6-10	3.41	0.77		
	11-15	3.60	0.68		
	16-20	3.48	0.79		
	20 and above	3.38	0.85		
Subject taught	Chinese	3.57	0.59	4.766	0.000**
	Maths	3.70	0.64		
	English	3.20	0.96		
	Science	3.03	1.08		
	Morality and Rule of Law	2.40	0.72		
	Music	2.97	0.95		
	The fine arts	3.14	0.99		
	Physical culture	3.32	0.85		
	Labor skills	3.28	0.72		
	Information technology	3.14	0.84		
Number of subject taught	One	3.46	0.83	0.296	0.767
	More than one	3.43	0.76		
School type	Public	3.52	0.85	3.593	0.001**
	Private	3.43	0.74		

Table 5 Differences in attitudes on the perceived control dimension

Variable		M	SD	t/F	P
Gender	Male	3.44	0.82	-0.444	0.657
	Female	3.48	0.72		
Educational level	Master degree and above	2.88	0.89	18.071	0.000**
	Bachelor degree	3.57	0.68		
	Below bachelor degree	2.95	0.96		
Years of teaching	0-5	3.47	0.76	1.213	0.305
	6-10	3.46	0.71		
	11-15	3.61	0.64		
	16-20	3.58	0.87		
	20 and above	3.34	0.85		
Subject taught	Chinese	3.65	0.53	6.750	0.000**
	Maths	3.72	0.57		
	English	3.31	0.83		
	Science	2.77	1.23		
	Morality and Rule of Law	2.48	0.65		
	Music	3.10	0.61		
	The fine arts	3.18	0.98		
	Physical culture	3.57	0.52		
	Labor skills	3.08	1.00		
	Information technology	3.00	0.92		
Number of subject taught	One	3.48	0.80	0.238	0.812
	More than one	3.45	0.74		
School type	Public	3.54	0.73	4.177	0.000**
	Private	3.07	0.82		

5 DISCUSSION

The purpose of this study was to explore Chinese elementary school teachers' attitudes toward interdisciplinary teaching and to explore the personal factors that influence their attitudes. To this end, a questionnaire survey was used to conduct a quantitative study of Chinese elementary school teachers' attitudes toward interdisciplinary teaching and the factors influencing them. The research questions leading to the findings of this study are discussed in the following sections.

5.1 What are the attitudes of primary school teachers towards interdisciplinary teaching?

Research question one investigated teachers' attitudes towards interdisciplinary teaching in different contexts. The findings showed that Chinese elementary school teachers had relatively positive attitudes toward interdisciplinary teaching and that attitudes varied by education level, subject taught, and school type. However, there were no significant differences between genders, years of teaching experience or number of subjects taught.

In terms of educational level, elementary school teachers with undergraduate degrees had the most positive attitudes toward interdisciplinary teaching, while elementary school teachers with graduate degrees were the least motivated. This is the opposite of what we had expected at the beginning. We believe that there are several reasons for this situation: firstly, many Chinese elementary school teachers have graduated with an undergraduate degree in primary education. Undergraduate primary education studies are more integrated, that is, every subject is learned. Interdisciplinary teaching highlights the characteristics of integration, which fits with the characteristics of the

teaching ability of elementary school teachers of all subjects. Second, there is an increasing number of students who are interprofessionals in China. These students who cross the examination to education have not learned professional knowledge systematically. This also leads to their low motivation for interdisciplinary teaching.

About the type of school, teachers in public elementary school are more motivated to interdisciplinary teaching. This is understandable. Unlike the elite education practiced in private schools in developed Western countries, public schools in China are the majority, and the best teachers and principals are concentrated in public schools, not private schools (华伟, 2016). This is because China has a large population and is still in the primary stage of socialism, with many poor people, few resources, and large class sizes. Public primary and secondary schools are still unable to meet the enrollment needs of all children, especially in rural and backward areas. Therefore, the government often adopts a policy of encouraging the establishment of private primary and secondary schools or a laissez-faire policy to make up for the shortage of public schools. As a result, most of the students in China who attend private elementary school do so because they are unable to enroll in public elementary school.

Teachers who teach the main subject have a more positive attitude than those who teach the secondary subject. This is because main subject teachers have more instructional time, providing them with the time to teach across disciplines. Meanwhile, teachers who taught maths were the most motivated because this subject usually guides students to solve problems in real-life situations. For example, to increase students' interest in and understanding of mathematics, teachers often encourage students to connect mathematics to their experiences in the real world(Quintero, 2004), ask questions, and solve mathematical problems through group discussions(Bevan & Capraro, 2021). Contrary to our predictions, teachers who taught science were the least motivated by attitudes toward interdisciplinary teaching as well as the number of subjects taught was not related to teachers' attitudes toward interdisciplinary teaching. We initially expected teachers who taught more than two subjects to have more positive attitudes because the use of interdisciplinary teaching requires combining knowledge and methods from different subjects. In addition, the low motivation of science teachers may be related to the reality that science education is not emphasized in Chinese elementary school and the amount of science class time is low.

5.2 What personal factors influence primary school teachers' attitudes towards interdisciplinary teaching?

Research question two was to explore the factors that influence Chinese elementary school teachers' attitudes toward interdisciplinary teaching. The results of the analysis of variance found that the level of education, type of school, differences in the subjects taught, and training all had an impact on teachers' attitudes toward interdisciplinary teaching. It is not the case that the higher the education level, the more positive teachers' attitudes towards interdisciplinary teaching. Our study found that teachers with a bachelor's degree were the most positive about interdisciplinary teaching. Also, the nature of the school affects teachers' attitudes toward interdisciplinary teaching, with teachers in public schools being more positive. In addition, the subject matter taught is also an influential factor. Main subject teachers in elementary school are more motivated towards interdisciplinary teaching, especially in math. This is because the main subject teachers have more adequate time for interdisciplinary teaching. Appleton and Kindt (1999) found that in the absence of sufficient instructional time, teachers lacked confidence and were less likely to put extra effort. Finally, training also has an effect on teachers' attitudes toward interdisciplinary teaching, a finding that is consistent with previous research.

6 Limitations

We recognize that our study has some limitations. In the first place, what we did was a cross-sectional study and we could only gather information about the present moment. This approach has no causal inference and cannot explain change. Another limitation is in the area of factors influencing teachers' attitudes toward

interdisciplinary teaching. The study showed that personal characteristics were important factors influencing teachers' attitudes. However, other factors were also found to influence their attitudes. For example, students' lack of motivation to learn decreases teachers' enthusiasm to teach (Kelani & Gado, 2018). More factors could be considered in future studies to provide a more comprehensive explanation of changes in teachers' attitudes. Finally, only questionnaires were administered to elementary school teachers, and more in-depth interviews were not conducted. The questionnaire was only a self-assessment by the respondents, which did not allow for an in-depth understanding of what the respondents really thought. The follow-up study will combine quantitative data with qualitative research.

Ethics declarations

Conflict of interest

The authors have not disclosed any competing interests.

Data availability

The data generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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