

The Influence of Teachers' Mathematics Teaching Beliefs on their Teaching Practices in selected Kindergartens in Nanjing City, China

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ABSTRACT

Teaching belief is the viewpoint that teachers hold and believe in the teaching work, teaching role, curriculum, students, learning and other related factors in the teaching situation and teaching process. The scope covers teachers' teaching practice experience and life experience, and guides teachers thinking and behavior. On the one hand, all course decisions and teaching behaviors of teachers in the teaching process are influenced by their teaching beliefs; on the other hand, beliefs affecting teacher behavior are often hidden and unrecognized. Studying on the teaching beliefs can give teachers the opportunity to reflect on their own implicit beliefs, and teaching beliefs may change accordingly, leading to improvements in teaching practice. Therefore, teaching belief is a very important and valuable field of educational research. This study aims to explore the impact of teaching belief on their classroom teaching practices. The data of this study were collected through questionnaire and interviews. The questionnaires were distributed to 300 teachers from the 14 randomly selected kindergartens in the urban Nanjing District. The findings of this study will inform the design of professional development approaches that will increase child-centered and inquiry-based teaching approaches in early childhood classrooms in the Nanjing city of China.

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1. Introduction

Teachers' belief systems reflect personal theories about the nature of knowledge and knowing that, in turn, influence teachers' curriculum decision making and teaching approaches (Hofer & Pintrich, 1997; Lovat & Smith, 1995; Pajares, 1992). According to Thompson (1984) teachers' beliefs "seemed to be manifestations of unconsciously held views of expressions of verbal commitments to abstract ideas that may be thought of as part of a general ideology of teaching" (p. 112). They represent implicit assumptions about curriculum, schooling, students, teaching and learning, and knowledge and act as cognitive and affective filters through which new knowledge and experience is interpreted and enacted (Artzt & Armour Thomas, 1996; Lovat & Smith, 1995). Existing research on teacher beliefs shows that teachers' teaching beliefs can have a profound impact on their performance and learners' achievements. The direct relationship between learner achievements and teachers' teaching beliefs has also been verified through research and interviews in the past two decades (House, 2006; Koller, 2001; Mason & Scrivani, 2004). Influencing teachers' beliefs, therefore, may be essential to changing teachers' classroom practices.

Professional development approaches in any form should increase inquiry-based teaching of mathematics in classrooms. The National Council of Teachers of Mathematics (NCTM, 1991) 'Standards' stress that mathematics needs to be taught as a dynamic tool for thought, not just as a set of operations to be learned. The NCTM Standards stipulate that students need opportunities to communicate math ideas and solve problems with others, that they should engage in mathematical activities with confidence and enthusiasm, and that teachers should use assessment strategies that focus on understanding rather than on right answers. Teachers are encouraged to value and reward students'

effort and persistence, and to give children some discretion in how they approach mathematical problems and encourage them to use a variety of approaches to mathematics tasks. This approach to mathematics instruction, referred to often as ‘inquiry-oriented’ (or progressive approach in this study), represents fundamental changes in teaching practices, a shift away from the exclusive use of more traditional textbook-based teaching, in which the teacher is in complete control and the students' only goal is to learn operations to get the right answer (Stipek, 2001). Several researchers have suggested that professional development programs designed to help teachers implement inquiry-oriented mathematics instruction are minimally effective, in part because teachers “alter what they learn through their existing beliefs”. Cohen and Ball (1990), for example, observed in their study that teachers assimilated new practices to their more traditional beliefs about mathematics education. In their words, ‘New wine was poured, but only into old bottles’ (p.334; see also Schram & Wilcox, 1988; Skemp, 1978).

A substantial body of research suggests that teachers' beliefs and values about teaching and learning affect their teaching practices (see reviews by Clark & Peterson, 1986; Fang, 1996; Kagan, 1992; Thompson, 1992). Investigating and if necessary, influencing teachers' beliefs, therefore, may be an essential first step to changing teachers' classroom practices. This study aims how the beliefs that teachers hold impact their classroom instructional practices in selected early childhood teachers in the Nanjing city of China. The goal is to better understand the nature of teachers' beliefs about students' learning and teaching in an early childhood environment. Ultimately, it is hoped that the findings of this study will inform the design of professional development approaches that will increase child-centered and inquiry-based teaching approaches in early childhood classrooms in the Nanjing city of China.

2. Literature Review

The research on the relationship between teachers' teaching beliefs and teaching practices is the most common type of research in all the researches on teaching beliefs, which determine whether teachers teaching beliefs are worthy of attention (Wen, 2006). When teachers teaching beliefs can't affect teaching practice, then teachers teaching beliefs do not need to be studied deeply. Since the 1970s, scholars have gradually attached importance to the relationship between teachers' teaching practice and teacher thinking (Clark & Peterson, 1986), in the study of education, research based on teacher beliefs or teacher thinking has emerged, trying to understand its relationship with teachers' teaching practice or decisions (Richards, & Lockhart, 2000). Teaching belief is an important indicator for studying teaching practice. Teachers' teaching beliefs will not only affect teachers' interpretation of teaching theories and experiences, but also affect teachers' teaching plans, and will also determine teachers' teaching practice (Li, 2002).

As a kind of cognition and concept, teaching belief is the intrinsic basis and foundation of teachers' education, but it does not directly affect students, but affects and acts on students through the intermediary of teaching behavior. So, can teaching practice reflect the teacher's teaching beliefs? What is the relationship between the teaching practice exhibited by the teacher and his existing teaching beliefs? The literature demonstrates a tight interconnectedness between ones' beliefs about teaching and learning and one's instructional practices (Czajka, & McConnell, 2019), much research has been done on the relationship between beliefs and teaching practices (Grouws, 2006). At present, there are two main viewpoints of consistency and difference. Fang (1996) described in his review of research on teacher beliefs and practices two competing theses (consistency versus inconsistency). Douglass and colleagues investigated the relationship between graduate teaching assistants' (GTAs') beliefs and practices and reported that GTAs' beliefs were consistent with their practices, exhibiting traits belonging to two primary categories: mostly teacher-centered and transitional (Douglas et al.,

2016). Other studies, however, reported the opposite finding and identified a misalignment between teaching beliefs and instructional practices (Bennett, & Park, 2011; Mansour, 2013; Dolphin, & Tillotson, 2015; Şen and Sarı, 2018). Fang, believes that the relationship between teachers' teaching beliefs and teaching practices has three main situations through the research of teacher beliefs in the past 30 years: (1) teacher beliefs affect teaching practice; (2) Teacher beliefs and teaching practices interact with each other; (3) Teacher beliefs interact with other external environmental factors to influence teaching practice (Fang, 1996).

In summary, the teachers' teaching beliefs are closely related to teaching practices. Teachers' teaching beliefs are the behind-the-scenes guides of teachers' teaching practices, and teachers teaching beliefs influence teachers teaching practices. Mayer (1987) pointed out that the most basic problem in the research of teacher's teaching belief was the relationship between belief and practice. The influence of belief on teacher's practice often varied with the teaching situation and individual teachers. Therefore, when discussing teachers' teaching beliefs, we should also discuss teachers' teaching practices. By understanding teaching beliefs through explicit behavior, we can find out the influence of teachers' teaching beliefs on their practices, so that we can better improve teaching and have practical significance. This study aims to explore the relationship between kindergarten teachers' mathematics teaching beliefs and teaching practices, enable the teachers to adjust and improve teaching methods in time to improve the effectiveness of kindergarten mathematics classroom teaching.

Research Question

The purpose of this study was to investigate the influence of teacher's mathematics teaching belief on their teaching practices in Chinese kindergartens. Specifically, this study aimed to answer the following research

question:

RQ:What is the relationship between the kindergarten teachers' teaching beliefs and teaching practices?

3. Methodology

Research Design

This study adopted a mixed-method non-experimental survey design. This study is a descriptive study in that it does not involve any form of experimentation to test causality between independent and dependent variables in the study.

Samples

The sample involved in this study is 300 kindergarten teachers from selected 8 public kindergartens and 6 private kindergartens. All these 300 kindergarten teachers were requested to complete a Questionnaire in this study. The sample contains a sub-sample for interview which is 5 teachers from one public kindergarten and 5 teachers from one private kindergarten. The two kindergartens were randomly selected from the sample of kindergartens. The 10 teachers were divided into Group A and Group B in two focus interview groups. Teachers from Group A were referred to as Respondents GA1(Group A1), GA2, GA3, GA4 and GA5. In same way, teachers from Group B were referred to as Respondents GB1(Group B1), GB2, GB3, GB4 and GB5.

The questionnaire was distributed to these 300 teachers and the researcher obtained a 100% response rate. After data cleaning, a total of 275 responses were found to be suitable for further analysis, effective rate of 91.6%.

Instrument

This study adopted the mixed-methods approach comprised both quantitative and qualitative components. Two research instruments were used in the study to collect data, one is a 70-item survey questionnaire and the other a set of semi-structured interview questions. The survey questionnaire used in this study comprised three sections A, B and C. Section A of the instrument requested respondents to provide demographic information about themselves and their families. The main section of the instrument was section B, a 40-item beliefs survey questionnaire which investigated the overall kindergarten teachers' mathematics teaching beliefs and was obtained from the review of literature (Platas, 2008). Section C of the questionnaire comprised 30-items which explored teaching related practices of early childhood teachers and was extracted and combined from two Chinese studies.

Reliability and Validity

Cronbach's alpha coefficients SPSS version 22 was used to check the reliability of the questionnaire in this study. The Cronbach's alpha was found to be 0.91 which is accepted as it is exceeding the ideal ratio of the reliability test (Pallant, 2010). On the other hand, Validity and Reliability of interview in this study was established by expert opinion of a panel of experts at SEGi University and pilot study. The instruments were found to be highly reliable and valid by conducting pilot study and using the viewpoints of a panel of experts.

Data Collection

The data collection of this study is carried out in three steps, the first step is to conduct a pilot study to check the reliability and construct validity of the

instruments and test the data collection proceed; The second step is to conduct actual study, first, data collection via questionnaire which is 300 teachers from selected kindergartens were requested to complete the questionnaire; The third step is data collection via interview which is Semi-Structured interviews with teachers in selected two Kindergartens by Focus Group Interview.

Data Analysis

Quantitative data were collected in this study. The data were analyzed using Statistical Package for the Social Science (SPSS) version 22.0. The correlation test was carried out to establish the correlation among independent and dependent variables in the study.

The qualitative data collected during interview will be transcribed and the text will be analyzed for themes. these themes will be related to the data obtained from the quantitative analysis to further supplement the qualitative data.

4. Results

The research question in this study investigated the relationship between kindergarten teachers' teaching beliefs and teaching practices. This was investigated using Pearson product-moment correlation coefficient where the score for r showed the strength of the relationship whilst the p value showed the level of significance. Table 1 below displayed the results of the correlation analysis between the teachers' overall mathematics teaching beliefs and teaching practices.

As shown in the above Table 1, the overall correlation coefficient between teaching belief and teaching practice was $r=.511$, passing the 5% significance

test, $p < 0.01$, reaching a significant level of 0.01, which show that there is a significant positive correlation between overall mathematics teaching belief with teaching practice and indicated that teachers' overall mathematics teaching beliefs have a positive effect on teaching practices.

Table 1

Pearson Product-moment Correlations between Teachers' Overall Mathematics Teaching Beliefs and Teaching Practice

		AA	LGMK	PG	CL	OTB	TP
Age-appropriateness	Pearson Correlation	1	.295**	.732**	.535**	.873**	.491**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
Locus of Generation of Mathematical Knowledge	Pearson Correlation	.295**	1	.324**	.253**	.546**	.085
	Sig. (2-tailed)	.000		.000	.000	.000	.162
Primary Goal	Pearson Correlation	.732**	.324**	1	.450**	.828**	.394**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
Confidence Level in Providing Mathematics Instruction	Pearson Correlation	.535**	.253**	.450**	1	.769**	.499**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
Overall Teaching Belief	Pearson Correlation	.873**	.546**	.828**	.769**	1	.511**
	Sig. (2-tailed)	.000	.000	.000	.000		.000

Teaching Practice	Pearson						
	Correlation	.491**	.085	.394**	.499**	.511**	1
	Sig. (2-tailed)	.000	.162	.000	.000	.000	

** . Correlation is significant at the 0.01 level (2-tailed).

The researcher interviewed the teachers about the relevance of teaching beliefs and teaching practices. The interview question was “Do you think mathematics teaching beliefs that teacher have play a big role in the classroom teaching process? What are the main indicators?” The teachers agreed that mathematics teaching belief played a very important role in the process of mathematics teaching. Some specific views of teachers are as follows.

The first teacher of Group A (GA1) proposed:

“I think mathematics teaching belief plays a very important role in the process of mathematics teaching, because belief is directly related to our way of teaching mathematics. If I don't have correct beliefs, for example, in my belief, if mathematics teaching is not based on games, then my words and behaviors in the process of mathematics teaching may be biased towards primary school rather than the teaching methods acceptable to preschool children...”

The third teacher in Group A (GA3) stated:

“Teaching belief plays a big role in my teaching process. First, if my personal belief ignores the importance of mathematics, then I will weaken mathematics in the proportion of curriculum arrangements; Secondly, if I can't grasp the development characteristics of children of all ages, then the mathematics goals I have set and the mathematics teaching content I choose will be unsuitable for

children...”

The first teacher of Group B (GB1) explained the role of teaching belief in teaching practice in combination with her own changes in mathematics teaching:

“... At the beginning of my work, when I gave children a math class, I mainly focused on teaching mathematics knowledge directly to my children while children mainly listened to me, because my understanding at that time was that the teacher was the leader in the classroom; After working for a long time, I slowly realized that the child is the subject of mathematics activities. In my current mathematics teaching, I inspired children to think more and let the children find problems and solve problems in operation. I think the change in my behavior comes from the change in my teaching belief...”

The second teacher in Group B (GB2) stressed:

“I believe that teaching belief plays a very important role in teaching practice. For example, in my belief, I think mathematics is very important, then I infiltrated mathematics in all aspects of children day life in kindergarten. Such as let the children record how many glasses of water, they drank today...”

The results in Table 1 also showed that the overall mathematics teaching beliefs of the teachers were basically consistent with their teaching practices, indicating that teachers' teaching beliefs can basically be implemented in teaching practice. This conclusion was also reflected in the interview results of the researcher.

The first teacher in Group A (GA1) stated:

“I feel that I practice teaching in accordance with my teaching beliefs in mathematics teaching...”

The first teacher of Group B (GB1) expressed her opinion:

“I dare not say that my teaching behavior is carried out completely according to the teaching belief, but I will try my best to implement my teaching belief in the teaching process...Unless subject to material conditions, such as when placing mathematical materials, some are not available, have to be replaced or abandoned, or can't provide a set of materials for each child and so on. In the above circumstances, my teaching behavior may have some discrepancies with teaching beliefs, as long as the basic concepts related to children's mathematics learning, I think it is relatively easy to implement, for example, pay attention to the application of children's mathematical experience in life...”

The fourth teacher in Group B (GB4) stressed that:

“In the absence of special circumstances, I will definitely follow my teaching beliefs to perform my teaching behavior, but if I encounter some large-scale activities organized by kindergarten, such as the Children's Day performance, because the task is heavy and the time is tight, then I may simplify the process of mathematics activities, shorten the teaching time and so on. In similar special circumstances, the teaching behavior will have some deviation from the teaching belief. . .”

As shown in Table 1 above, the correlation coefficient between the *Age-appropriateness* level and the teaching practice was $r=0.491$, $p<0.01$, indicating a significant positive moderate level correlation between the two variables. Similarly, the correlation coefficients of *Primary Classroom Goals* level, and *teacher's confidence in Mathematics instruction* level and teaching practices were $r=.394$, $r=.499$, $p<0.01$, respectively, showing that these two sub-scales and teaching practice were all significantly positively correlated. It can also be seen from the results that the correlation coefficient between the *Locus of Generation of Mathematical knowledge* level and the teaching practice was $r=.085$, $p=.162$, indicating that the two did not have significant correlation.

From the analysis of the correlation between the various factors of teaching belief and teaching practices, it was found that the teaching beliefs sub-scales at *Age-appropriateness*, *Primary Classroom Goals* and *Confidence Level in Providing Mathematics instruction* have a significant positive correlation with teaching practice. However, there was no significant correlation between the teaching belief factor of *Locus of Generation of Mathematical knowledge* and the teaching practice. In the interview, individual teachers also mentioned that there were similar phenomena in their teaching practice.

The second teacher of Group A(GA2) stated:

"I know that mathematics teaching for preschool children is suitable for teaching with gamification teaching methods. In teaching practice, such teaching beliefs should be incorporated into it, but in actual teaching, sometimes there are some teaching tendencies of primary school. The tendency is that I speak a lot, so that the chances of the child actively thinking and operating autonomously are relatively small. It may be because I am more anxious in the teaching process, eager to let the children master the relevant

mathematical knowledge...”

The fourth teacher of the A group (GA4) mentioned that there is a certain contradiction between the teaching beliefs and the teaching practice. Sometimes, the teaching beliefs are more ideal, but the teaching practice is more realistic. For example, in the case of a relatively low proportion of teachers and children, teachers can fully lead children to explore and discover. But in reality, we have a large number of children in a class, and the time for a math activity is limited. If rely solely on the means of the game to teach, there will be situations where the child's game has not been finished yet, but the time has ended. In this case, I want to ensure that the children can learn some mathematics key knowledge in a limited time, then I can only finish it quickly, and there is a certain contradiction between this and the correct teaching belief.

5. Discussion and Conclusion

Teachers' beliefs regarding teaching and learning are among the most important factors shaping the teacher's classroom practices (Fang, 1996; Kagan, & Smith, K. E., 1988; Pajares, 1992). Much research has been done on the relationship between beliefs and teaching practices (Grouws, 2006). At present, there are two main viewpoints of consistency and difference. Fang (1996) described in his review of research on teacher beliefs and practices two competing theses (consistency versus inconsistency). The findings in this study were consistent with the view of consistency. Many studies have shown that teachers' teaching beliefs affect their teaching behavior and were the most effective indicators for predicting teachers' teaching behavior and teaching effectiveness (Richards, & Lockhart, 2000). In addition, nearly all extant studies that have examined associations between teachers' beliefs about mathematics and mathematics teaching and their classroom practices are

based on qualitative case studies of one or a few teachers (Thompson, 1992). These case studies suggested some congruence between beliefs and practices. Although many studies on teachers' beliefs suggest that there was a relationship, causality is difficult to explain. Some studies strongly suggested teachers' beliefs influenced instructional behaviour, while in other cases it appeared that instructional practices influenced teachers' beliefs (Buzeika, 1996; McGalliard, 1983).

The results obtained from this study found that teachers' overall Mathematics teaching beliefs had a positive effect on teaching practice, which indicated that teachers' teaching beliefs can influence their practices in mathematics teaching and the mathematics teaching beliefs of the teachers were basically consistent with the teaching practices. The teachers who participated in the interview agreed that mathematics teaching belief plays a very important role in the process of mathematics teaching, namely, it recognized the correlation between teaching beliefs and teaching practices, which was consistent with the above analysis results.

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