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Research Paper

Teacher Pedagogical Beliefs and Their Role in Teaching Practices and Math Performance among Students

Masoud Kabiri

Corresponding author: Assistant Professor, Research Institute for Education (RIE), Tehran, Iran

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Abstract

Aim: The present study was designed to identify the pedagogical beliefs of teachers and to explore the role of their beliefs in teaching practices and the math performance of their students. Data from 220 math teachers and 5890 students in the eighth grade were analyzed by a secondary analysis of TIMSS 2019. Also, a part of the national items in the Teacher Questionnaire of TIMSS 2019 was selected and seven factors were extracted by Rasch scaling based on two scales, including belief about mathematics and teacher pedagogical beliefs. The scaled scores were analyzed by latent class analysis to classify teacher pedagogical beliefs. The results showed that three dominant beliefs in the teachers were constructivism, direct transfer, and blended, to which 20.5%, 48.5%, and 30.9% of the teachers were classified, respectively. Comparing teaching practices in these groups revealed that less practices were reported in teachers who believed in direct transmit. Constructivist teachers reported the most teaching activities, while blended teachers reported the greatest volume of assessment. Meanwhile, there was no significant difference between the constructivist and traditional teachers in the use of assessment; there was also no difference between the math performance of their students. The results showed that a large part of teachers did not believe in newer pedagogical beliefs. Nevertheless, modifying their beliefs does not improve the students' achievement. Therefore, although teachers' beliefs are useful for learning processes, they are not very effective in improving the students' learning.

***Keywords**: Teacher pedagogical beliefs, teaching practices, math performance, constructivism, direct transmit*

Introduction

Every teacher holds certain beliefs that determine their priorities for teaching and how the students acquire knowledge. It is assumed that teachers' beliefs influence their classroom decisions and behaviors (Buehl and Beck, 2015; Fives et al., 2015).

Much of the literature on the subject focuses on two prototypical beliefs, namely teacher-centered or behaviorist beliefs and learner-centered or constructivist beliefs (Horgan & Gardiner-Hyland, 2019; Berger, et al., 2019). Meanwhile, teachers can hold multiple, potentially-competing beliefs simultaneously, which is entitled blended belief.

Studies on the subject of teachers' beliefs and teaching activities show that teacher self-efficacy, sense of responsibility, pedagogical knowledge, and self-awareness have a moderator role between teachers' beliefs and practices (Buehl and Beck, 2015). Moreover, despite the scarce research on the powerful effects of teachers' beliefs on their students' achievements, these beliefs, which are often communicated nonverbally and unintentionally, are perceived and internalized by the students and have direct consequences for their self-efficacy, efforts, and achievements (Watt and Richardson, 2015). Nonetheless, the idea that the quality of teaching and learning will improve if teachers are supportive of constructivist and student-centered beliefs does not seem to be the case. (Francis, Rapacki & Eker, 2015).

The present study was designed to investigate the classes of pedagogical beliefs toward which Iranian teachers tend more. Identifying the relationship between teachers' pedagogical beliefs and teaching practice as well as the students' achievements is another point of focus in this study.

Methodology

The present study was a secondary analysis of TIMSS 2019 data. The responses given by 220 eighth-grade math teachers as well as 5980 Iranian students were taken as the sample, which were drawn by stratified two-stage cluster sample design.

Three kinds of instruments were analyzed in the present study. First, 12 national items about teacher beliefs on teaching and learning approaches and 34 national items about teacher beliefs on mathematics were examined. The teaching and learning beliefs consisted of two factors: Constructivist and direct transmit approaches to teaching, as adapted from OECD's Teaching and Learning International Survey (TALIS). Moreover, Beliefs on mathematics also contained five factors, math as an inquiry process, math learning via active activities, math as a set of rules and procedures, learning math via following teacher guidelines, and math as fixed abilities. The items are derived from IEA's Teacher Education and Development Study in

Mathematics (TEDS-M). Both these national item sets were embedded in the math teacher questionnaire. Second, self-reported teaching activities were examined, which asked teachers about their teaching practices, expectations from students during teaching, and assessment of students. The items were in the math teacher questionnaire. Third, the math achievement of the students were obtained from a pool of 212 items and calculated.

In order to analyze the data, certain methods were applied. Rasch scaling was applied to create the teacher scales. Then, latent class analysis was used to classify the teachers into several pedagogical beliefs. Winsteps was used to develop the scales and MPLUS was utilized to classify the teachers. Additionally, IDB Analyzer was used to apply the teacher sampling weights, create Jackknife standard errors, and analyze plausible values.

Results

The scaled scores of seven factors were taken as variables of the latent class analysis to classify the teachers into pedagogical beliefs. The comparison of 2-class and 3-class models based on the model fit criteria (AIC, BIC, and entropy), percentage of sample in each class, and substantial implication of the classes showed that the 3-class model was the better one. Therefore, three groups of teachers were recognized based on their pedagogy beliefs: Direct transmission, constructivism, and blended. Each of these groups accounted for 20.5, 48.5, and 30.9 percent of the sample, respectively.

Teacher responses in the teaching practice scales were explored to compare them with respect to the three above classes. The results revealed that constructivist teachers reported the most teaching activities, followed by the blended teachers in the second step. With regard to expectations from the students during teaching, the direct transmit teachers reported significantly less scaled scores than the other two classes, but the difference between the constructivist and blended teachers was not significant. Finally, blended teachers reported the greatest amount of assessment of the students, whereas, there was no significant difference between the constructivist and direct transmit teachers.

The last part of the study relates to students' achievement in these classes of teachers. The results are presented in Table 1.

Table 1. Comparing eighth-grade students' achievements based on their teachers' pedagogical beliefs

	Direct transmit beliefs	**Constructivist beliefs**	**Blended beliefs**
Average of achievement	439	455	436
Standard error	8.17	6.23	8.17
Difference with direct	-	16 (1.4)	3 (0.24)

transmit (t values)	
Difference with direct constructivist (t values)	19 (1.8)

Based on Table 1, although the students of the constructivist teachers showed better math achievement than others, their dominance was not significant. Therefore, there is no evidence to assume that students educated by teachers with different pedagogical beliefs show any different performances.

Discussion and conclusion

The remarkable percentage of blended teachers suggests that these teachers have not chosen their strict pedagogical beliefs yet. In this case, simultaneous statements of constructivism and direct transmit are admissible; however, their teaching practices were reported higher than the other groups, probably revealing that their doubtful conditions did not prevent them from being active teachers.

One out of every five students is educated by a teacher with traditional beliefs. To change the direct transmit beliefs into constructivism, some tools have been applied. Aside from educating teachers in universities, some other resources have contributed to modified beliefs, including personal experiences of the teachers, teachers' knowledge of their courses, and teachers' observation of successful experiences with new teaching approaches based on constructivism.

The lack of significant differences in the students' achievement between the three classes of teachers' beliefs suggests the complexity of comparing achievement by teaching practices. Achievement is a combination of several variables, with teaching practices being one of them. Besides, based on literature, achievement is not deeply affected by constructivist activities due to their time-consuming nature.

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