International Journal of Environmental & Science Education, 2007, 2 (2), 54 – 59
ISSN 1306-3065

Analyzing Some Iranian- High School Teachers' Beliefs on Mathematics, Mathematics Learning and Mathematics Teaching

[1]Ahmad Shahvarani and [12]Behnaz Savizi
[1]Azad Islamic University, Science and Research branch, Iran. [2]E-mail: bsavizi@yahoo.com

Abstract: This study focuses on some Iranian high school mathematics teachers' beliefs about the nature of mathematics, its teaching and learning within two theoretical frameworks, Absolutist Traditional Beliefs and Constructivist Non-Traditional Beliefs. Almost 100 of high school mathematics teachers in district 1 of education department of Tehran filled the questionnaires which were about their traditional and non- traditional beliefs. The results showed the teachers have stronger agreement with traditional beliefs than with non-traditional beliefs about the nature of mathematics, students' learning and mathematics curriculum. Some conflicting and mixed views were also observed in teachers which can mean the incomplete process of new reform movements among the mathematics teachers. On the other hand, relation between different variables shows that teachers' beliefs about the nature of mathematics, mathematics curriculum, students, students' learning and their own teaching, may affect one another.
Key words: Teachers' Beliefs, Traditional Beliefs, Non- Traditional Beliefs, Iranian Teachers

INTRODUCTION

Beliefs might be defined as one's personal views, conceptions and theories (Thompson, 1992).

The importance of the construct lies in findings that teachers' behavior is primarily determined by their belief system rather than by their own knowledge. Experience and prior knowledge are also important, but beliefs act as the "driving forces" in shaping the structure and content of their practices in the classroom It has been established that teachers' beliefs about mathematics, teaching and learning have a significant influence on their instructional practices (Golafshani and Ross; 2006). As Hersh (1986) put it, "one's conceptions of what mathematics is affects one's conceptions of how it should be presented".(Hersh, 1986). Also, teachers' beliefs about students' ability and learning greatly influence their instructional practices (Nathan and Koedinger, 2000). Another important aspect in the research on teachers' beliefs is that one must accept the central role of teachers in changing or reforming mathematics education (Cooney and Wilson, 2002). The implementation of reform ideas and of attempts at changing instructional practice in an administrative way will not work unless teachers are aware of and believe in the reform movement in mathematics education.

It has been reported that in order to implement the reform objectives and changes in mathematics instruction, teachers must possess beliefs about mathematics, learning, and teaching that significantly differ from the current school mathematics traditions (Battista, 1994). It is important to determine the whole direction of the teachers' views, and to reveal which components of teachers' beliefs about the nature of mathematics, students learning and mathematics teaching influence one another.

Theoretical Framework

Teachers' Beliefs about the nature of mathematics

This study examined some Iranian high school mathematics teachers' beliefs about the nature of mathematics, its teaching and learning, students and mathematics curriculum within two theoretical frameworks, Absolutist Traditional Beliefs and Constructivist Non-Traditional Beliefs.

Teachers with traditional or absolutist conception of mathematics describe the mathematics subject as a vast collection of fixed and infallible concepts and skills (Romberg, 1992).

Traditional beliefs about the nature of mathematics have been represented by terms like "objectivity of mathematics", "universality and certainty of mathematical rules and facts" and "mathematics, the science of Elite" in this study.

The belief about the "objectivity of mathematics" may associate to one aspect of the belief about students' learning or teachers' teaching like "teaching through word explanation", and the belief about the "certainty of mathematics" may associate to the other aspect of mentioned beliefs like the "dependency of students' social progress to their mathematics knowledge".

An alternative to traditional view is constructivist conception about mathematics which emphasizes the practice of mathematics and the reconstruction of mathematical knowledge. Teachers holding the constructivist view of mathematics take the subject as a man-made universe to describe their observations of the world.

Teachers' Beliefs about Teaching and Learning Mathematics

"Word explanations" and focusing on "drills" might be supposed as two aspects of traditional ways of mathematics teaching in the classroom.

This mode of mathematics teaching is the "Content-centered with an emphasis on performance that emphasizes student performance and mastery of mathematical rules and procedures" (Kuhs and Ball, 1986). This view of teaching is closely tied with the role of the teacher as a transmitter of the knowledge, explaining the content, and the students do drill and practice using the prescribed procedures and it could follow from teachers' traditional absolutist view of mathematics.(Golafshani and Ross; 2006)

The traditional beliefs about "students' learning" which is identified by the term "TRDLRN", mostly deal with these two aspects.

The "TRDTCH" questions in this study do not assess teachers' beliefs about teaching but directly ask them to indicate if they use "problem solving approach" for teaching mathematics or use "word explanation" before dealing with related problems to the lesson.

On the other hand, the modern trend of teaching and learning mathematics might have the same meaning as problem solving approach among Iranian teachers and educators.

In addition to the beliefs that teachers hold about students' learning, they have some general beliefs about the students which might be driven from the society or teachers' work experience, like teachers' beliefs about students' fear of mathematics or their ability to apply acquired knowledge of mathematics in their real lives. This kind of beliefs have been introduced by the term "BAS" (belief about the student) in this study.

The teachers' beliefs about mathematics curriculum are also important. The common idea in Iran is that mathematics curriculum should be in complete conformity with international communities of education or developed countries' mathematics curriculum. This idea is supposed to be a traditional belief because the recent reforms in mathematics education have declared there is no good curriculum independent of culture.

In modern trends, social, cultural and political situations, besides to what mathematician produce, extremely influence mathematics education and its curriculum. So the curriculum which is useful in country "A" could be useless in country "B" and vice versa. Teachers' traditional beliefs about curriculum may limit their creativity and their field of work and scarify individual and cultural differences for the sake of so called "international standards".

METHODOLOGY

The subjects were Iranian mathematics teachers in private and public high schools in the region 1 of Tehran.(there are 20 districts of department of education in Tehran, working under the policy of education ministry.)

In order to examine the teachers' overall strength of agreement or disagreement with traditional and non-traditional beliefs about mathematics, mathematics teaching and learning, each respondent's ratings in mathematical belief (mathematics, mathematics teaching and learning), on a Likert-type scale of 1 to 4, were obtained. The strength of their agreement in all three parts was measured from strongly disagree to strongly agree on a 4 point Likert-type scale. The score closer to 1 indicated stronger disagreement and stronger agreement was indicated by the score closer to 4.

Questionnaire was distributed among 100 high school teachers in the first educational region of Tehran.

The relations among teachers' beliefs about the nature of mathematics, mathematics teaching and learning were calculated using Pearson correlations among the subscales in the teachers' traditional beliefs and non-traditional beliefs.

26 questions in the questionnaire were categorized into 9 variables, each contains 2 to 4 questions: traditional belief about the nature of mathematics (TRDNR), modern belief about the nature of mathematics (MODNR), traditional belief about the students' learning and understanding (TRDLRN), modern belief about the students' learning and understanding (MODLRN), beliefs about students (BAS), traditional ways and views of teaching (TRDTCH) , modern ways and views of teaching (MODTCH), traditional belief about curriculum(TRDPRG)and modern belief about curriculum(MODPRG)

The "BAS" questions, like: "many students are not efficient enough to apply their knowledge of mathematics in their real life." represent only the general views of teachers about students but BAS1 and BAS2 are more or less some traditional beliefs about the students.

The teachers' overall strength of agreement or disagreement with traditional and non-traditional beliefs about mathematics, mathematics teaching and learning was calculated using statistical analysis.

RESULTS

Teachers' traditional points of view

Results show the teachers have stronger agreement with traditional beliefs than with non-traditional beliefs about the nature of mathematics, students' learning and mathematics curriculum (Table 1).

Table 1

	Min	Max	Mean	Std. Deviation
TRADNR	1.00	4.00	3.1119	.92770
MODNR	1.00	4.00	2.2600	1.03331
TRALRN	1.00	4.00	2.9255	.91708
MODLRN	1.00	4.00	2.1529	.93588
TRDPRG	1.00	4.00	3.4343	.68752
MODPRG	1.00	4.00	2.1919	.85329

It is also observed that the teachers are holding multiple, and conflicting conceptions about the nature of mathematics. For example, many teachers believe that mathematics involves certain facts and rules which should be accepted and simply learned and this adheres to traditional views about mathematics. At the same time, the teachers state that mathematics is a subject that should be constructed and this adheres to non-traditional beliefs about mathematics, or many of the teachers in spite of having constructivist views about the nature of mathematics believe that social, political and cultural conditions have little effect on construction of mathematical rules and facts. This implicitly exposes the idea that although mathematics has been constructed by mathematicians but they are not affected by social, political or cultural conditions.

The mixed views may also occur when a reform movement is fairly new. This can also be attributed to the incomplete process of the change in the teachers' beliefs about the nature of mathematics during the short period of the reform movement and yet the transition of their beliefs will be likely completed if the reform objectives are successfully implemented in the future or reform may fall away, leaving traditional views. (Cooney and Wilson, 2002)

Correlations among the Teachers' Beliefs

The relations among teachers' beliefs about the nature of mathematics, mathematics teaching and learning were calculated using Pearson correlations among the subscales in the teachers' traditional beliefs and non-traditional beliefs.

TRDNR questions represent three aspects of the traditional belief about the nature of mathematics: TRDNR1 states that Mathematics is the science of elite and genius people, TRDNR2 represents the certainty and universality of the mathematical rules and facts and TRDNR3 represents the objectivity of mathematical facts.

The correlation between BAS1 and TRDNR2 indicates the relation between the belief about the "dependency of students' social and professional progress in future to their mathematical knowledge" (BAS1), and the "absoluteness of mathematics nature" (TRDNR2). BAS1 has no correlation with TRDNR3 (objectivity of mathematics) or even TRDNR1("mathematics is the science of Elite").

On the other hand, BAS1 has a positive correlation with TRDPRG, which indicates the "dependency of students' social and professional progress in future to their mathematical knowledge" and the belief about the "universality of mathematics curriculum standards", are related.

This means implicitly that teachers believe "because the mathematical rules and facts are universal, absolute and unchangeable, then it is better we borrow our curriculum standards from the international communities or developed countries; then this curriculum guarantees students' progress in future social and professional lives"(Table 2).

The positive correlation between BAS2 and TRDNR3 shows the relation between the belief about "objectivity of mathematics" and the belief that "intelligent students are preferred to choose mathematics and physics field in high school*". BAS2 also have a negative correlation with MODNR2.

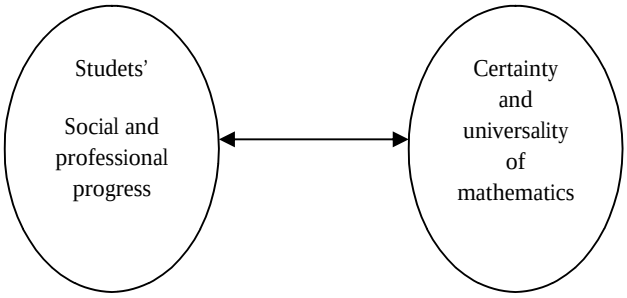


Table 2

		BAS1	TRDPRG	TRDNR2
BAS1	Pearson Correlation	1	.202(*)	.243(*)
	Sig. (2-tailed)	.	.045	.016
	N	99	99	99
TRDPRG	Pearson Correlation	.202(*)	1	-.141
	Sig. (2-tailed)	.045	.	.163
	N	99	99	99
TRDNR2	Pearson Correlation	.243(*)	-.141	1
	Sig. (2-tailed)	.016	.163	.
	N	99	99	99

*Correlation is significant at the 0.05 level (2-tailed).

Table 3

		BAS2	TRDNR3	MODNR2
BAS2	Pearson Correlation	1	.226(*)	-.254(*)
	Sig. (2-tailed)	.	.024	.011
	N	99	99	99
TRDNR3	Pearson Correlation	.226(*)	1	.049
	Sig. (2-tailed)	.024	.	.633
	N	99	99	99
MODNR2	Pearson Correlation	-.254(*)	.049	1
	Sig. (2-tailed)	.011	.633	.
	N	99	99	99

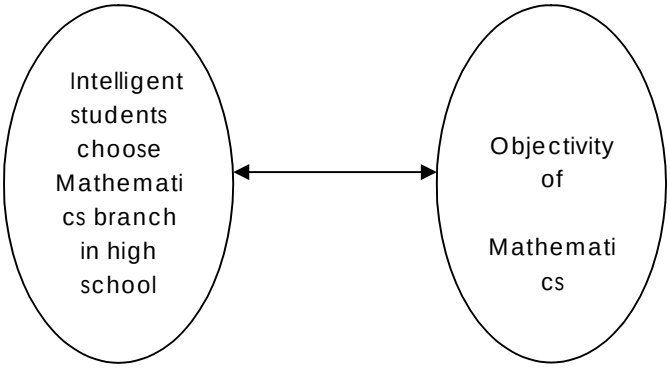
*Correlation is significant at the 0.05 level (2-tailed).

Table 4

		TRDLR2	MODPRG	TRDTCH1
TRDLR2	Pearson Correlation	1	-.206(*)	.209(*)
	Sig. (2-tailed)	.	.041	.038
	N	99	99	99
MODPRG	Pearson Correlation	-.206(*)	1	.067
	Sig. (2-tailed)	.041	.	.510
	N	99	99	99
TRDTCH1	Pearson Correlation	.209(*)	.067	1
	Sig. (2-tailed)	.038	.510	.
	N	99	99	99

Correlation is significant at the 0.05 level (2-tailed).

The relations between these three variables expose once more the teachers' Platonic point of view about the objectivity of mathematics ,it means that "mathematical facts are absolute and unchangeable objectives and could be discovered only by intelligent and special people. (Table 3)"



TRDLR2 has a positive correlation with TRDTCH1 and TRDNR3 and a negative correlation with MODPRG1. This may mean that the teachers who believes in the objectivity of mathematical facts; prefer "word explanation" of mathematics concepts or transferring the concepts to the students(correlation between TRDTCH1 and TRDNR3) . Such an approach is a traditional way of teaching. Consequently, it indicates that these teachers do not have a tendency to apply problem solving approach which facilitates the construction of meanings in the students' minds and they instead believe that through exercises and drills, students better understand the transferred (objective)concepts. (Correlation between TRDLR2 and TRDTCH1) (Table 4 and Table 5) .

The last relation discussed is the correlation between TRDTCH5 and BAS3.

The relation between TRDTCH5 and BAS3 may mean that the teachers who mostly limit their teaching

Table 5

		TRDTCH1	TRDLR2	TRDNR3
TRDTCH1	Pearson Correlation	1	.209(*)	.229(*)
	Sig. (2-tailed)	.	.038	.023
	N	99	99	99
TRDLR2	Pearson Correlation	.209(*)	1	.132
	Sig. (2-tailed)	.038	.	.193
	N	99	99	99
TRDNR3	Pearson Correlation	.229(*)	.132	1
	Sig. (2-tailed)	.023	.193	.
	N	99	99	99

* Correlation is significant at the 0.05 level (2-tailed).

Table 6

		TRDTCH5	BAS3
TRDTCH5	Pearson Correlation	1	.236(*)
	Sig. (2-tailed)	.	.025
	N	91	91
BAS3	Pearson Correlation	.236(*)	1
	Sig. (2-tailed)	.025	.
	N	91	99

* Correlation is significant at the 0.05 level (2-tailed).

to the content of text books, (or may have little creativity to change the activities, content and examples of the textbook), feel a more reflection of students' fear of mathematics in their classes. The more general conclusion could be driven as "content focused curriculum may cause more fear of mathematics in students." (Table 6).

CONCLUSION

The overall, Iranian high school mathematics teachers in district 1 of education department of Tehran hold traditional beliefs about the nature of mathematics, Mathematics curriculum, students, students' learning and their own teaching.

This may have two reasons: first it is because of a strong traditional view of the society towards mathematics. Many mathematics teachers have studied in fields other than mathematics education in university, like engineering or even management. So their beliefs about mathematics and its education have been influenced by society rather than by university. Secondly, most of the mathematics teachers in district 1 of Tehran are experienced teachers with at least more than 15 years experience of teaching. Educational reform based on constructivism is completely new or even unknown among most of Iranian teachers.

On the other hand, relation between different variables shows that teachers' beliefs about nature of mathematics, mathematics curriculum, students, students' learning and their own teaching, may influence one another.

Informing mathematics teachers about recent reforms and approaches in the mathematics education will affect their beliefs and consequently their profession.

REFERENCES

Battista M.T.(1994) Teacher beliefs and the reform movement in mathematics education.. PhiDelta Kappan 75(6). 462-470.

Cooney, T. J. and Wilson, M. (2002). Mathematics teacher change and development. In G. C. Leder, E. Pehkonen, and G. Törner (Eds.), Beliefs: a Hidden Variable in MathematicsEducation? (pp. 127-147). Dordrecht: Kluwer.

Golafshani N., Ross John A.(2006) Iranian Teachers' Professed Beliefs about Mathematics, Mathematics Teaching and Mathematics Learning. 3rd International Conference on the Teaching of Mathematics at the Undergraduate Level, Association, Istanbul, Turkey

Hersh, R. (1986). Some proposals for revising the philosophy of mathematics. In T.Tymoczko (Ed.) New Directions in the philosophy of mathematics (p. 9-28). Boston:Birkhauser.

Kuhs T. M., & Ball D. L. (1986). Approaches to teaching mathematics: Mapping the domains of knowledge, skills, and dispositions. East Landing: Michigan State University, Center on Teacher Education.

Nathan, M. J. & Koedinger, K. R. (2000). Teachers' and researchers' beliefs about the development of Salgebraic reasoning. Journal for Research in Mathematics Education,31(2), 168–190.

Romberg T. A. (1992). Toward a World Class Curriculum in the United States. In I. Wirzup & Streit (Eds.), Developments in School Mathematics Education around the World: V. 3. Reston, VA: National Council of Teachers of Mathematics. Pages 223-235

Thompson, A. (1992). Teachers' beliefs and conceptions: A synthesis of the research. In D. Grouws (Ed.), Handbook of research in mathematics teaching and learning (pp. 390–419). New York: Macmillan.

♥♥IJESE♥♥
ISSN: 1306 3065

Appendix

Teachers' beliefs about the nature of mathematics

TRDNR1	Mathematics is the science of Elite
TRDNR2	Concepts and facts of mathematics are absolute and infallible
TRDNR3	Concepts and facts of mathematics are objective, pre-existent and might be discoverd.
MODNR1	Mathematics is a man made phenomena which has been constructed and developed by people through the years.
MODNR2	Concepts and facts of mathematics might be influenced by social, cultural and political conditions.

Teachers' beliefs about the students' learning

TRDLR1	Students better understand mathematics concepts through word explanation
TRDLR2	Students better understand mathematics concepts through several drills on taught subject
MODLR1	Students better understand mathematics concepts through problem solving
MODLR2	for learning mathematics there is no need to many drills and exercise.

Teachers' beliefs about mathematics curriculum

TRDPRG	Mathematics curriculum should be consistent to international standards of education or developed countries mathematics curriculum
MODPRG	Mathematics curriculum should be local and in consistency with cultural and social conditions.

BAS1	Students' social and professional progress in future, depends on mathematics more than any other course in high school
BAS2	Intelligent students should mostly choose mathematics and physics field in high school.
BAS3	Most of students have a fear of mathematics.