Mathematics Teachers’ Beliefs and Its Contribution toward Teaching Practice and Student Achievement

B W Minarni1, H Retnawati2 and T V T Nugraheni3

1Graduate Program of Mathematics Education, Yogyakarta State University, Yogyakarta, Indonesia
2Mathematics Education Department, Faculty of Mathematics and Science, Yogyakarta State University, Yogyakarta, Indonesia.
3Teacher Primary Education, Faculty of Education and Language, Atma Jaya Catholic University of Indonesia, Jakarta, Indonesia
teysaiga@gmail.com

Abstract. This paper aims to discuss about relationship between: (1) mathematics teacher beliefs and teaching practice, (2) teaching practice and student achievement, and (3) mathematics teachers’ beliefs and student achievement. The method of narrative reviews is selected for the synthesis of finding. Teachers’ beliefs are part of the teachers’ competence. Teachers’ beliefs contribute to how teachers act in the classroom. However, teachers aren’t always realize some of their beliefs in teaching practice. This is due to several factors, such as social context and teachers’ thought. According to Indonesian curriculum in 2013 until 2018, it emphasizes student-centered learning. Applying beliefs supporting the student-centered learning views encourages students to learn actively. Student-centered learning makes students able to improve their knowledge and skills and contribute to student achievement. Conversely, if teachers’ beliefs aren’t aligned with teachers’ teaching practice, it will inhibit student-centered learning. Based on the literatures review in this paper, concluded that (1) mathematics teachers’ beliefs guide teacher to determine teaching practice considered correct, (2) student-centered learning improves student achievement, and (3) teacher’s belief and teaching practice aligning with student-centered learning can support students to construct actively their mathematics knowledge and improve mathematics learning achievement.

1. Introduction

Teacher competencies relate to the quality of mathematics learning [1] and student achievement [2]. The Indonesian Teacher Competency Test (UjiKompetensi Guru) was held in 2012 and 2015. The results of this test were used to provide an overview of teachers’ pedagogical and professional competencies. Besides teachers’ competencies, learning quality and student achievement can be influenced by other factors, such as policies curriculum, school supports, parent supports, etc. Mathematics teacher competency is ‘an integrated set’ or ‘a combination’ of skills, knowledge, values, and beliefs of the mathematics teacher [3]. While Blömeke and Delaney [4], states that teachers competency consists of cognitive abilities: professional knowledge and affective-motivational characteristics: professional beliefs, motivation and self-regulation. Teachers’ beliefs are part of the teacher's competency. Teachers’ beliefs and teacher's knowledge are inseparable [5, 6]. In other words, teachers’ beliefs also have a crucial role to teaching practice and student achievement.
Belief is defined as a person's conception or personal ideology [7]. According to Philipp and Skott [8, 9], beliefs are mentally an understanding of basic thoughts, understandings, or individual propositions that assumes to be true. The influence of teachers' beliefs in teaching practice occurs because of teachers' beliefs are able to guide teachers' thinking, interactions in the classroom [10, 11], and instructional innovations [33] applied in the classroom.

The quality of teaching practice can improve student achievement. Meanwhile, people considered the Indonesian student's achievement are not yet satisfying. For example, based on the results of the Programme for International Student Assessment (PISA) and The Indonesian National Examination (UjianNasional) in 2015, some students were weak in solving High Order Thinking (HOT) questions, such as reasoning, analyzing, evaluating [12]. This is partly due to low quality of teaching practice and school leadership [13]. Teachers' beliefs as a part of teachers' competencies can be one of the factors affecting student achievement. Therefore, teachers' beliefs are important and need to be explored deeply.

2. Research purpose
This paper tries to explore about teachers’ beliefs. The purposes of this paper are to discuss about relationship between: (1) mathematics teacher beliefs and teaching practice, (2) teaching practice and student achievement, and (3) mathematics teachers’ beliefs and student achievement.

3. Research methodology
The method of narrative reviews is selected for the synthesis of finding. Baumeister [46] states that narrative reviews combine results for several studies that may use different procedures and methods to answer different questions. In this paper authors present several theories and studies which have different procedures and methods to answer different questions but have similar conclusion. The theories and studies presented have relation with mathematics teachers’ beliefs, teaching practice, and students achievement. The theories and studies presented are synthesized and used to make conclusion of this paper.

4. Literature review
Teachers’ belief is a basic understanding, basic thought, conception or proposition about a thing considered true, either consciously or unconsciously by a teacher. Törner [14] constructs mathematics teacher beliefs based on three levels: (1) Global Beliefs; (2) Subject-Matter Beliefs; and (3) Domain-Specific Beliefs. Meanwhile, according to Ernest [15], the key component of mathematics teacher beliefs are three things: (1) teacher's view or conception of mathematics; (2) the teachers’ model or conception of the nature of mathematics teaching; (3) the teachers’ model or conception of the learning process of mathematics. Mathematics teachers’ beliefs are formed within the teacher through the knowledge and experience he has gained over a long period of time.

4.1. Relationship between Mathematics Teachers’ Beliefs and Teaching Practice
According to Richardson opinion [16, 17], teachers' beliefs about teaching and learning mathematics are heavily influenced by socialization in their profession and teacher experience during their student period. Teacher beliefs and teaching practice dynamically influence each other [18, 19, 20]. A similar theory of the relationship between mathematics beliefs and teaching practice is illustrated by Raymond [21] in figure 1:
In Figure 1, it is explained that mathematics beliefs have a strong influence on the mathematics teaching practice. Mathematics beliefs refer to teachers’ beliefs in nature of mathematics and mathematics pedagogy. While teaching practice consists of questions of mathematics, discussion, atmosphere, and evaluation.

Beswick [22, 23] summarizes the relationship between teachers’ beliefs about nature of mathematics, teaching mathematics, and learning mathematics according to Ernest and Van Zoest presented in Table 1:

**Table 1. Relationship between teacher’s beliefs about nature of mathematics, teaching mathematics, and learning mathematics according to Beswick**

| Beliefs about nature of mathematics by Ernest | Beliefs about mathematics teaching by Van Zoest al | Beliefs about mathematics learning by Ernest |
|---------------------------------------------|-----------------------------------------------|-------------------------------------------|
| Instrumentalist                             | Content focused with an emphasis on performance | Skill mastery, passive reception of knowledge |
| Platonist                                   | Content focused with an emphasis on understanding | Active construction of understanding |
| Problem solving                             | Learner focused                                | Autonomous exploration of own interests |

Ernest [15] states that mathematics teachers’ beliefs have a powerful impact on teaching practice. A number of studies [24, 25] investigating the relationship between teacher beliefs and teaching practice showed that teachers’ beliefs are consistent with teaching practice. Several studies are also found that sometimes teachers’ beliefs are not aligned with the teaching practice [26, 27].

4.2. **Relationship between teaching practice and student achievement**

According to the National Board for Professional Teaching Standard (NBPTS) [29] student achievement is the status of one's knowledge of matter, understanding, and skills. Tang and Hsieh [30] explain that one's mathematics ability is relatively stable and not easily changed. These limitations must be handled by teachers, for example, the teacher should notice how to arrange the learning strategies that will be used. Student achievement increases if the teacher not only delivers the material actively, but does it in a structured way, provides an overview or review of the learning objectives, and invites students to be actively involved in a discussion [31]. A number of studies investigating the relationship between teaching practice and student achievement showed that teaching practice are significantly affect the mathematics student achievement [32, 44, 45].

From 2004 to 2013, the curriculum in Indonesia has undergone several changes [13]. One of the changes is the emphasis on student-centered learning in the 2013 curriculum used until now. Student-centered learning is a learning approach that focuses on the involvement of student activities by
providing meaningful learning, inquiry, and authentic activities [33, 34]. Interaction between teachers and students, students with students, and students with learning resources can help students to construct their knowledge. This is shown through the results of Ing et al. research [35] which showed that teaching practice and how much active participation of students in learning have a significant effect on mathematics learning achievement.

Walters et al. [36] describes the characteristics of a student-centered mathematics based classroom as follows: (1). The classroom environment that supports mutual respect, has a good relationship with each other, focus on the individual. The focus on the individual in question consists of giving scaffolding, being aware of the differences, and making choices.(2). Associated with learning mathematics in the form of meaningful learning mathematics. Such meaningful mathematical learning is characterized by mathematical learning that supports in terms of (a) the use of mathematical reasoning to understand 'why' and 'how'; (b) communicating mathematical thinking and critiquing other people's reasoning; (c) making the connection of most mathematical concepts to the real world context; (d) participate and be diligent in solving mathematical problems provided outside the application of the given procedure.

4.3. Relationship between Mathematics Teachers’ Beliefs and Student Achievement

Based on the theoretical studies presented, mathematics teachers’ beliefs can directly influence the teaching practice. However, mathematics teachers’ beliefs are not necessarily aligned with teachers’ teaching practice. This matter can affect lacking of curriculum implementation. Therefore, mathematics teachers should actively involve in professional development. The involvement teachers in professional development is to keep teachers' beliefs aligned with their teaching practice and implemented curriculum.

Figure 2 shows the relationship between teacher professional development, teacher's knowledge and beliefs, teaching practice, and student achievement [37].

![Figure 2. Relationship between teacher professional development, teacher knowledge and beliefs, teaching practice, and student achievement.](image)

Based on figure 2, teachers' beliefs indirectly affect student achievement. Student achievement can be influenced by the quality of teaching practice. While the quality of teaching practice is influenced by teachers' knowledge and belief. Indirectly, teachers' beliefs can contribute to student achievement.

Teachers’ beliefs aligning with student-centered mathematics learning will be summarized as follows:

a. Beliefs in mathematics
   1) Problem solving [15]: looking at mathematics is a process of searching.
   2) Mathematics as a set of processes [38]: the mathematical activity involved involves creative steps such as producing mathematical formulas so that the activity is able to find or rediscover the mathematics.
   3) Mathematics as an inquiry process [39]: (a) mathematics involves creativity and new ideas that can be tried independently and (b) mathematical problems can be solved in many ways.
b. Beliefs in learning mathematics
   1) Students learn by actively constructing their knowledge [15]: (a) students construct an active understanding and (b) students explore independently their interests.
   2) Constructivist view [40]: students learn actively through finding solutions independently of mathematical problems provided by teachers.
   3) Student-oriented beliefs [41]: (a) students learn autonomously to solve problems in learning, (b) students need to study in groups when needed, (c) students learn by developing their skills and competencies, and (d) students learn through experience and knowledge.

c. Beliefs in teaching mathematics
   1) Constructivist view [30]: (a) teachers realize their role for facilitating students to conduct independent inquiries, (b) the best learning the students do is to find their own solutions and problems, (c) students should be given the opportunity to think independently about mathematics problems before the teacher shows how to solve them, and (d) thinking and reasoning processes are more important than the subject matter of the curriculum.
   2) Student-oriented teaching beliefs [41]: (a) teacher has belief that learning makes students learn to solve problems independently, (b) teaching provided by teachers enables students to learn cooperatively, (c) teachers facilitate students to develop their skills and competencies, (d) teachers make connections between prior knowledge and new knowledge that will be learnt by students, and (e) teachers provide learning activities by considering students interests and skills.

Meanwhile, Hong [42] and Isikoglu, Basturk, and Karaca [43] expressed teachers with a constructivist view as teachers with a student-centered learning.

5. Result and discussion
   According to the literatures review, the results of this paper are shown in table 2.

| No.  | Theories                                                                 | Researchers                  | Procedures                                                                 | Results                                                                 |
|------|--------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1.   | Relationship between Mathematics Teachers’ Beliefs and Teaching Practice | Kul and Celik [24]          | Case Study of nine pre-service teachers from Faculty of Education at the University of ArtvinCoruh [24] | There is a consistent associations between beliefs and teaching practice in a classroom-based setting. |
|      |                                                                          | Polly, McGee, Wang, Lambert, Pugalee, & Johnson [25] | Survey of 53 elementary school teachers [25]. Data collected by survey of 51 mathematics teachers from seven schools in Selangor [25] | There is a positive relationship between the teacher beliefs and teaching practice. |
|      |                                                                          | Zakaria & Maat [47]         | Data analyzed by ANOVA.                                                   |                                                                         |
|      |                                                                          | Lin, Chuang, & Hsu[33]      | Data collected by survey of 500 in-service elementary teachers. Data analyzed by statistic | There is a positive relationship between the teaching beliefs and the instructional innovation. |
|      |                                                                          | Wilkins [48]                | Data collected by survey of 481 in-service elementary teachers. Data analyzed by statistic | A majority (63%) of teachers’ beliefs and practices were found to be relatively consistent. |
| No. | Theories | Researchers | Procedures | Results |
|-----|----------|-------------|------------|---------|
|     |          | Barkatsas-Tasos & Malone [18] | Case study | Teacher beliefs were found to have the strongest effect on teachers’ practice. |
|     | Sometimes teachers’ belief are not aligned with the teaching practice [15] | Wilkins [48] | Data collected by survey of 481 in-service elementary teachers. Data analyzed by descriptive and AMOS. | Ann’s teaching practice is inconsistent with her beliefs. |
|     |          | Lopes & Santos [49] | Data collected by survey of 279 primary teachers from Portuguese public schools. Data analyzed using SPSS. | There are (37%) of the teachers’ beliefs and practices were found not to be relatively consistent. |

2. Relationship between teaching practice and student achievement

| Teaching practice can affect student achievement. | Al-Agili, Mamat, Abdullah, & Maad [32] | Data collected by survey of 201 respondents. Data analyzed by CFA and EFA using SPSS and AMOS. | The result showed that the teaching practice influenced positively the students’ achievement. |
|                                                  | Clements, Agodini, & Harris [44] | Data collected by survey of 3,818 students (1st-grade) from 364 classrooms and 2,796 (2nd-grade) from 269 classrooms. | |

3. Relationship between mathematicsteachers’ beliefs and student achievement

| Indirectly, teachers’ belief can contribute to student achievement. | Šapkova [50] | Data collected by survey of 190 mathematics teachers (grades 7-9) and their 2828 grade 9 students from different regions of Latvia. Data analyzed by Wilcoxon criterion. | There is exists a correlation between Latvian teachers’ beliefs on teaching mathematics and their students’ achievements. |
|                                                              | Muijs & Reynolds [51] | Data collected by survey of 103 teachers and over 2000 students from 36 schools. Data analyzed by SEM. | There is an indirect relationship between the teacher beliefs student achievement. |

Based on table 2, we can state that there is a relationship between teachers’ belief and teaching practice. A teacher who has teacher-centered teaching belief tends to use more teacher-centered practices in classroom. In the other hand, a teacher who has student-centered teaching belief tends to use more student-centered practices in classroom. It also can be concluded that teachers’ beliefs can affect how teachers teach in their classroom and teachers’ beliefs can guide teachers to determine the correct teaching practice. But based on table 2, it is also found that sometimes teachers’ beliefs are not aligned with teaching practice. This is due to several factors, such as social context (curriculum, coworkers, leaders, etc.) [7, 28], the situation class and prevailing social teaching norms [21]. Meanwhile, it is also influenced by internal factors, such as the minimum linkage between beliefs.
possessed by the pedagogical knowledge of the teacher and with other knowledge, as well as the level of consciousness to integrate his beliefs in the learning practice [7] or teachers’ thought (e.g., the awareness to change the view through alternatives that are different from the previous ones believed). Continuing Professional Development (CPD) can be an alternative solution to change teachers’ beliefs and practices. Teachers can involve in CPD activities such as conferences, workshops, courses, action research, group or individual education research, reading literatures, professional learning community, etc. CPD can encourage teachers to reflect and change their beliefs and practices. It isn’t an easy thing to change teachers’ beliefs and practices. An effective CPD and government involvement are needed for changing teachers’ beliefs and practices.

According to table 2, it can be said that there is a relationship between teaching practice and student achievement. Theories and studies also show that type of teaching practice improving student achievement is student-centered learning. Student-centered learning allows students to construct their knowledge actively. Based on table 2, it is found that there is a relationship between mathematics teachers’ beliefs and student achievement. Theories and studies show that mathematics teachers’ beliefs indirectly affect student achievement. The affect mathematics teachers’ beliefs to student achievement is mediated by teaching practice. For example, a mathematics teacher who has consistency between belief and student-centered learning tends to provide meaningful learning, inquiry, and authentic activities. Student-centered learning able to improve student achievement compared with teacher-centered learning. Teachers with teacher-centered learning belief tend to provide a traditional learning. In a traditional learning, teachers will transfer their knowledge without involving student activism.

6. Conclusion
The mathematics teachers’ beliefs are the understanding, basic thought, conception or proposition mentally about a thing considered true, both consciously and unconsciously by a teacher of mathematics covering his belief in mathematics, learning, and teaching mathematics. According to the literatures review, we conclude that (1) mathematics teachers’ beliefs guide teacher to determine teaching practice considered correct, (2) student-centered learning improves student achievement, and (3) teacher’s belief and teaching practice aligning with student-centered learning can support students to construct actively their mathematics knowledge and improve mathematics learning achievement. Therefore, further research is needed to show that teachers’ beliefs aligning with student-centered learning have an effect on learning achievement. In addition, government and education stakeholders need to facilitate teachers to be involved in continuing professional development. On the other hand, teachers are expected to have an awareness to engage in continuing professional development.

7. Acknowledgments
The authors thank to Ms. HeriRetnawati for giving advises during the process of writing this paper. The authors also give thanks to ICRIEMS 5 committee for giving us an opportunity to publish this paper.

8. References
[1] Hill H C, Ball D L and Schilling S G S2008 Unpacking pedagogical content knowledge:Conceptualizing and measuring teachers’ topic-specific knowledge of studentsJ. for Res. in Math.Edu.39 372–400
[2] Hill H C, Rowan B, and Ball D L2005Effects of teachers’ mathematical knowledge for teaching on student achievement American Edu. Res. J. Summ.42371–406
[3] Pantića N and Wubbels T 2010 Teacher competencies as a basis for teacher education: Views of Serbian teachers and teacher educatorsTeach. and Teach. Edu.26 694–703
[4] Blömeke Sand Delaney S2012 Assessment of teacher knowledge across countries: a review of the state of researchZDM 44 223–47
[5] DayC2002 School reform and transitions in teacher professionalism and identity Int. J. of Edu. Res.37 677–692
[6] Fives H andBuehl MM 2008 What do teachers believe? Developing a framework for examining beliefs about teachers’ knowledge and ability. Conte. Edu. Psy.33134–76
[7] Ernest P1989 The knowledge, beliefs and attitudes of the mathematics teacher: a model. J. of Educ. for Teach.: Int. Res. and Ped.d.15 13–33
[8] Philipp R A2007 Mathematics teachers’ beliefs and affect 2nd Handbook of Research on Mathematics Teaching and Learning: A Project of The National Council of Teachers of Mathematics F K J Lester (Charlotte, North Carolina, USA: Information Age Publishing) pp 257–315
[9] Skott J2015 Towards a participatory approach to ‘beliefs’ in mathematics education From beliefs to dynamic affect systems in mathematics education: Exploring a mosaic of relationships and interactions B Pepin and B Roesken-Winter (London: Springer International Publishing) pp 3–23
[10] Šapkova A 2013 Study on latvian mathematics teachers’ espoused beliefs about teaching and learning and reported practices Int. J. of Sci. and Math. Edu.11733–759
[11] Shadiq F2010 Keyakinan dan kecenderungan praktek pembelajaran peserta didik matematika berdasar hasil tes awal di SEAMEO QITEP in mathematics Eduamat I 54–71
[12] Nizam2016 Laporan Pusat Penelitian Pendidikan Badan Penelitian dan Pengembangan (Jakarta: Kementrian Pendidikan dan Kebudayaan) p 41
[13] OECD/Asian Development Bank 2015 Education in Indonesia: Rising to the Challenge (Paris: OECD)
[14] Törner G2002 Mathematical beliefs—a search for a common ground: some theoretical considerations on structuring beliefs, some research questions, and some phenomenological observations Beliefs: A Hidden Variable in Mathematics Education? ed G C Lederet al (Dordrecht: Springer Netherlands) pp 73–94
[15] Ernest P 1989 The Impact of Beliefs on the Teaching of Mathematics Mathematics, education, and society: 6th Int. Congress on Mathematical Education vol35, ed CK Keitete al (Paris: Division of Science Technical and Environmental Education UNESCO) pp 99–100
[16] Clark L M, DePiper J N, Frank T J, Nishio M, Campbell P F, Smith T M, . . . and Choi Y 2014 Teacher characteristics associated with mathematics teachers’ beliefs and awareness of their students’ mathematical dispositions. J. for Res. in Math. Edu. 45246–84
[17] Pepin B 1999 Conf. Thematic Network on Teach. Edu. in Europe (Libson)
[18] Barkatsas-Tasos A and Malone J 2005 A typology of mathematics teachers’ beliefs about teaching and learning mathematics and instructional practices. Math. Edu. Res. J. 17 69–90
[19] Nisbet S and Warren E 2000 Primary school teachers’ beliefs relating to mathematics, teaching and assessing mathematics and factors that influence these beliefs Math. Teach. Edu. and Dev. 234–47
[20] Askew M, Brown M, Rhodes V, Wiliam D and Johnson D 1997 Effective teachers of numeracy: report of a study carried out for the teacher training agency (London: King’s College, University of London)
[21] Raymond AM 1997 Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice J. for Res. in Math. Edu. 28550–76
[22] Beswick K 2012 Teachers’ beliefs about school mathematics and mathematicians’ mathematics and their relationship to practice. Educ. Stu. in Math. 79 127–47
[23] Beswick K 2005 The beliefs/practice connection in broadly defined contexts Math. Education Res. J. 17 39–68
[24] KuU and Celik S 2017 Exploration of pre-service teachers’ beliefs in relation to mathematics teaching activities in classroom-based setting Int. J. of Res. in Edu. and Sci. 3245–57
[25] Polly D, McGee J R, Wang C, Lambert R G, Fuglee D K and Johnson S 2013 The association between teachers’ beliefs, enacted practices, and student learning in mathematics The Math.
[26] MelladoV1998 The classroom practice of preservice teachers and their conceptions of teaching and learning science *Sci. Edu.* 82 197–214

[27] Simmons P E, EmoryA, Carter T, Coker T, Finnegan B, Crockett D, *et al.* 1999 Beginning teachers: Beliefs and classroom actions *J. of Res. in Sci. Teach.* 36 930–54

[28] Handal B2003 Teachers’ mathematical beliefs: A review. *The Math. Edu.* 13 47–57

[29] NBPTS2011 Student learning, student achievement: how do teachers measure up? *ed* Student Learning, Student Achievement Task Force (1525 Wilson Boulevard, Suite 500 / Arlington, VA, 2220: National Board for Professional Teaching Standard)p1–74

[30] Tang SJ and Hsieh FJ2014 The cultural notion of teacher education: future lower secondary teachers’ beliefs on the nature of mathematics, the learning of mathematics and mathematics achievement *Int. Perspectives on Teacher Knowledge, Beliefs and Opportunities to Learn: TEDS-M Results* ed SBlömeke et al(Dordrecht: Springer Netherlands) pp 231–253

[31] MuijsD and Reynolds D2000 School effectiveness and teacher effectiveness in mathematics: some preliminary findings from the evaluation of the mathematics enhancement programme (primary). *Sch. Efect. and Sch. Improv.* 11 273–303

[32] Al-Agili M Z G, Mamat M B, Abdullah L and MaadH A 2012 The factors influence students’ achievement in mathematics: a case for Libyan's students. *Wrdl. Appl. Sci. J.* 171224–30

[33] LinM H, Chuang T F, and Hsu H P 2014 The relationship among teaching beliefs, student-centred teaching concept and the instructional innovation. *J. of Serv. Sci. and Mnge.* 7 201–10

[34] Garrett T 2008 Student-centered and teacher-centered classroom management: A case study of three elementary teachers. *J. of Clas. Intr.* 4334–47

[35] Ing M, Webb N M, FrankeM L, Turrou A C, Wong J, ShinN and Fernandez C H 2015 Student participation in elementary mathematics classrooms: the missing link between teacher practices and student achievement? *Edu. Stu. in Math.* 90 341–56

[36] WaltersK., SmithTM, LeinwandS, Surr, Stein A and Bailey P 2014 *An up-close look at student-centered math teaching: A study of highly regarded high school teachers and their students* (Washington, D.C.: the American Institutes for Research) P 5

[37] DesimoneLM 2009 Improving impact studies of teachers’ professional development: Toward better conceptualizations and measures *Edu. Res.* 38181–99

[38] Liljedahl2008 *Symp. the Occasion of the 100th Anniversary of ICMI(Roma)*

[39] tatto MT, SchwilleJ, SenkSL, IngvarsonL, RowleyG, BankovK, . . . ReckaseM 2012 *Policy, practice, and readiness to teach primary and secondary mathematics in 17 countries.* (Herengracht 487, 1017 BT Amsterdam, the Netherlands: Int. Association for the Evaluation of Educational Achievement)

[40] OECD2009 Teaching practices, teachers’ beliefs and attitudes *Creating Effective Teaching and Learning Environments: First Results from TALIS(Electronic Materials)* pp 92-120

[41] De Vries S, Van de Grift W J C M and JansenEP W A 2014 How teachers’ beliefs about learning and teaching relate to their continuing professional development *Teach. and Teach.: theo. and prac.* 20 338–57

[42] HongHY2014 Developing Student-Centered Teaching Beliefs Through Knowledge Building Among Prospective Teachers *Knowledge Creation in Education* ed SChen et al(Singapore: Springer Singapore) pp 189–204

[43] Isikoglu N, Basturk Rand Karaca F 2009 Assessing in-service teachers' instructional beliefs about student-centered education: A Turkish perspective *Teach. and Teach. Edu.* 25 350–6

[44] ClementsDH, AgodiniR and HarrisB 2013 *Instructional practices and student math achievement: Correlations from a study of math curricula* (New Jersey Avenue, NW, Washington, D.C, USA: Institute of Education Sciences)

[45] Ganyaupef E M 2013 Teaching methods and students’ academic performance *Int. J. of Hum. and Soc. Sci. Inv.* 2 29–35
[46] Baumeister RF 2013 Writing a literature review *The Portable Mentor: Expert guide to a successful career in psychology* ed M.J. Prinstein (NY, New York: Springer) pp 119-132

[47] Zakaria E and Maat SM 2012 Mathematics Teachers’ Beliefs and Teaching Practices *J. of Math. and Stat.* **8** 191–4

[48] Wilkins J L M 2008 The relationship among elementary teachers’ content knowledge, attitudes, beliefs, and practices. *J. Math. Teach. Edu.* **11** 139–64

[49] Lopes J and Santos M 2013 Teachers’ beliefs, teachers’ goals and teachers’ classroom management: A study with primary teachers. *Rev. de Psi.* **18** 5–24

[50] Šapkova A 2014 The relationships between the traditional beliefs and practice of mathematics teachers and their students’ achievements in doing mathematics tasks *Prob. of Edu. in the 21st Cen.* **58** 127–143.

[51] Muijs D and Reynolds D 2002 Teachers' beliefs and behaviors: What really matters? *J. of Clas. Intr.* **37** 3–15