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In-Service Mathematics Teachers' Beliefs About Teaching, Learning and Nature of Mathematics and Their Mathematics Teaching Practices

Nahil M. Aljaberi[1] & Eman Gheith[1]

[1] Faculty of Arts, University of Petra, PO box 961342, Amman, Jordan

Correspondence: Nahil M Aljaberi, Faculty of Arts, University of Petra, PO box 961342, Amman, Jordan.

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Abstract

The aim of this study is four fold: (a) to investigate the beliefs of elementary (grades 1-3) and middle school (4-6 grades) math teachers about teaching, learning and nature of mathematics; (b) to explore their teaching practices of mathematics; (c) to study the impact of their educational qualifications, years of experience, major on their beliefs toward teaching, learning and nature of mathematics, and; (d) to explore the relationship between their beliefs about teaching learning and nature of mathematics and their teaching practices. Data were collected using two questionnaires: the Math Teacher Beliefs Scale and the Mathematics Teaching Practices Scale. The study sample consisted of 101 teachers who teach in 11 private schools located in Amman, Jordan. The result of this study showed that teachers' beliefs towards teaching and learning mathematics are more inclined towards being constructive or mixed in between. It was also concluded that the teaching practices lean towards constructivism. There were no significant differences attributed to years of experience, academic level, major, or at what stage they teach, whether it revolves around the their beliefs towards teaching and learning mathematics or towards teaching practices (from teachers' perspective). The study results revealed a statistically significant correlation between what the teachers believe and what teaching practices they put into use.

Keywords: mathematics teaching, teachers' beliefs, teachers' practices, constructivism

1. Introduction

1.1 Introduce the Problem

Quite many international educational systems show interest in developing their teaching programs as they find themselves obliged to move forward given the great expansion of technology and knowledge. Mathematics holds a valuable position for educators as well as educational systems, attributed to the immense relevance mathematics has on our lives.

Numerous researches and educational conferences emphasized the importance of developing mathematical discourses for all stages of education, considering the contemporary worldwide standards which were standardized by several organizations interested in developing mathematics. The (NCTM 1989) and (NCTM 2000) focused on the importance of building a teaching environment which supports student learning in mathematics and provides them with the opportunities to develop mathematical ideas, solve problems, and practice mathematical communication. In addition, these standards focused on the importance of developing teaching strategies and teaching practices which encourage effective teachers' beliefs about mathematics teaching and practices

The process of preparing teachers for this rapidly transitioning era (which is characterized by growth, speed, change and development) requires development of the knowledge of teachers and their skills. To accomplish this, there needs to develop the teachers' perceptions of the components of educational process, which includes employing their intellect and developing their awareness and sense of education (Stipek, Givvin, Salmon, & MacGyvers, 2001).

Various researchers have called for conducting studies on teachers' beliefs on learning and teaching in order to better comprehend teaching practices. They have also stressed the importance of inquiring into teachers' beliefs so as to provide knowledge on teachers' practices (Pajares, 1992). This could potentially enable pre- and in-service teacher preparation program designers and administrators to further develop and enhance their programs. This allows them to bring their focus to professional development, which reflects positively on

teachers' classroom practices, and thus on how well students learn math. Hence, understanding teachers' beliefs is the first step toward enhancing their performance.

Beliefs held by teachers are essential to understanding their thinking processes and the nature of the practices they put into use inside the classroom. Beliefs are a crucial ingredient in designing and planning learning, enhancing teachers' thinking, and developing suitable classroom practices. Beliefs can influence what teachers learn and what they then teach to students. Several study findings have indicated that beliefs are the main driving force for activities teachers perform with their students inside the classroom, and are also the most influential factor in learning processes (Poulson, Avramidis, Fox, Medwell, & Wray, 2001; Pajares, 1992). On the other hand, researchers such as Stipek, Givvin, Salmon, & MacGyvers (2001) indicated that certain compatibilities exist between teachers' beliefs and their teaching practices in the classroom.

Additionally, numerous other researchers, including Ambrose (2004) asserted that mathematical knowledge and beliefs related to this knowledge, as well as the teaching of math, are strongly entwined. Meanwhile, Poulson, Avramidis, Fox, Medwell, & Wray (2001) indicated that a complex connection exists between a teacher's beliefs and his or her teaching practices; beliefs drive performance, while teaching experience and practices have the ability to change (or supplement) an individual's beliefs. This relationship has often been described as polemical as practices do not always follow beliefs, but could sometimes be superior and of higher importance. Indeed, a large portion of studies have affirmed that teachers' classroom practices are influenced by their beliefs and perceptions of the learning and teaching process. However, further research and studies ought to be conducted to clarify how these beliefs influence classroom practices, as well as to reveal the true nature of what connects the two together.

Studies in the area of the teachers' perception of teaching and learning revealed that their perceptions and beliefs are divided into two types (according to the approach of teaching-learning): (1) traditional and (2) constructivist. By traditional beliefs, we mean that the teacher views their role as limited to passing on knowledge to the students in a clear, organized, and systematic way. Giving students clear problems with specific steps toward finding a solution guarantees that they follow the sequence of steps when leaning and paying attention in the class room. As for the constructivist conceptions in mathematics, it puts the learners and their needs in the first place, and it emphasizes the usage of the importance of teaching techniques which focuses on the learner, and makes him or her center of the learning and teaching process (Šapkova, 2014).

Many researchers, such as Rayyan (1997), suggested that it is essential to constitute sequences of changes and corrections to the systems of teaching and learning mathematics. This includes developing strategies and methods of teaching and learning mathematics. Traditional techniques (which are built upon the passivity of the learner) cannot create the desired change. Such techniques may also suppress the learner's thinking, which (in turn) would hinder his\her perception of the logical construct of mathematics. Beswick (2007) believed that constructivism views learning as an active construct of knowledge, which is accomplished through interacting with the environment, people, and the cognitive learning process in itself. Rayan (2010) emphasized on the importance of the constructivist approach in learning and teaching science and mathematics through encouraging teachers to care for experiences and preconceived concepts which are held by the student which he\she may come up with in a classroom setting. Also, she further emphasized on the importance of comprehension as one of the many goals of learning, and encourages incorporating students into the learning process to make them a part of it. On the other hand, Burrell-Ihlow (2006) assured that the transition towards constructivist practices in teaching cannot occur in the light of experiences and situations based on the traditional approach since it is based on transferring knowledge to students without the incorporation of an active role of the learner. Rayan (2010) believed that constructive teaching helps students develop mathematical thinking abilities in their different form, especially meta-cognitive thinking. Thus, and in line with the aforementioned, the learner becomes aware of his\her thinking. Numerous researchers indicate the presence of factors which affect the teaching practices for math teachers. Among those factors are teachers' beliefs and perceptions on mathematics and its learning and teaching processes (Stipek, Givvin, Salmon, & MacGyvers, 2001; Polly et al., 2013).

Maasepp & Bobies (2015) emphasized the importance of choosing mathematics teachers based on proficient standards in order to break the stereotypical representations of mathematics teachers and the subject area in general, so to reflect a more positive image of mathematical knowledge and teachers.

Many researchers indicate that beliefs on the nature of knowledge, how students learn, and mathematics teaching strategies were formed during the individual's previous experience as a student. Such beliefs have stronger emotional and evaluative elements as compared to knowledge, and they are usually referred to as ideologies, ideas, judgments, and values which shape the teachers' perspective before and during service toward

mathematics and become well-established to them (Memnun & Hart, 2012; Thomas & Pedersen, 2001). Furthermore, Cam (2015) assured the possibility of reinforcing or adjusting such cognitive beliefs in pre-service and in-service teachers.

Many studies reveal that the teachers' beliefs and conceptions towards mathematics affect their teaching practices, as well as the students' achievements and comprehension of scientific content. Such beliefs appear to affect the teachers' decisions as well (Sapkova, 2014; Memnun & Hart, 2012; Cam, 2015; Stipek, Givvin, Salmon, & MacGyvers, 2001). However, Shi, Zhang, & Lin (2014) did not envision a linear correlation between the teachers' beliefs and their teaching practices. Güven, Karataş, öztürk, Arslan, & Gürsoy (2013) emphasized the significance of teachers possessing positive attitudes towards mathematics so they would be capable of effective planning to provide students with useful mathematical experience.

The is no doubt that implementing the desired changes in both processes of teaching and learning mathematics requires familiarizing one's self with teachers' beliefs and conceptions about mathematics (which were formed in them since they started learning math early in their lives up until the end of their career counseling programs, whether in the university or during their practice of teaching) (Philippou & Christou, 1998). The study of teachers' beliefs and conceptions towards mathematics as effective factors on the processes of teaching and learning has occupied a significant portion in the educational literature that regards mathematics.

1.2 The Relationship Between Beliefs and Teaching Practices

Huang & Shiomi (2007) asserted that the teachers' teaching practices are affected by what beliefs those teachers hold regarding their abilities to make desired changes in the behavior of their students, and their belief that their teaching practices will lead to achieve the desired learning outcomes. Perkkilä (2003) held that the beliefs of math teachers are considered hidden factor which work to organize the quality of learning and teaching mathematics. Furthermore, it assures the importance of attentively caring for training teachers and focusing on learning theories and their connection to teaching mathematics in actual educational situations. Liljedahl (2008) asserted that acquiring the necessary knowledge to teach mathematics is considered crucial and essential. Although opinions differ on what is considered to be necessary knowledge to math teachers, there is agreement on the fact that knowledge of the nature of mathematics and its teaching and learning processes are basically necessary. Knowledge of mathematics should thus include mathematical concepts, methods, thought, and reasoning. Knowledge on learning and teaching mathematics is chiefly concerned with the methods of teaching and learning mathematics and the teaching practices in presenting mathematical knowledge.

Since the behavior of individuals is directed through what they believe to be more true rather than what is actually true, the behaviors of math teachers (whether before or during service) are directed through what they believe to be true about mathematics and its teaching and learning. Hence, talking about math teachers' knowledge of mathematics or methods of teaching mathematics is dependent upon their beliefs. Although there is controversy in educational literature between scientific knowledge and beliefs, both work hand-in-hand in teaching mathematics (Beswick, 2007; Golafshani, 2002).

The process of training and qualifying teachers through preparation programs helps them implement the learning theories and perform effective teaching practices. Memnun & Hart (2012) believed that the teachers' preparation programs affect their beliefs towards mathematics, thus; there should be focus on the topic of teaching mathematics to enhance the beliefs and conceptions of teachers toward the subject area. Designing the instruction is an important process which is done by the teacher, and it should be systemized; in order to achieve the desired learning outcomes. Gagne & Briggs (1974) described the process of designing the instruction as a systemized method to achieve better educational planning, and developing it to reach the goals of teaching and learning. Levin & Wadmany (2006) believed that personal beliefs which are held by teachers strongly influence their learning strategies in professional development programs and in improving their teaching practices. Those personal beliefs also affect decision-making to which is concerned with discourses and teaching practices. It was found that teachers lean toward adopting new classroom practices in accordance to what beliefs and personal qualities they possess. They perceive classroom behavior as the result of personal epistemological beliefs. Knowing the motives behind the decisions which teachers take does not solely rely on knowing the nature of knowledge they have acquired, but it is required to understand the technique which equips and directs this knowledge towards the process of decision making. This reflects the preferences and attitudes they hold toward those teaching practices. Additionally, in the field of learning mathematics, this cannot be accomplished without teachers who are aware of this orientation and possess beliefs and positive attitudes towards teaching practices.

Based on the points laid out above, this study aims to inquire into the complex relationship between teachers' beliefs and teaching practices. Additionally, it aims to shed the light on its nature and to classify beliefs

accordingly into three distinct categories (constructive, traditional, and mixed) which helps profile and describe the relation between teacher beliefs and their teaching practices. Furthermore, what distinguishes this study from others is that it inquiries into the teaching practices of math teachers from their own point of view, based on Gagne & Briggs' learning theory (1974). This theory includes nine basic activities which form an inclusive bigger picture of the majority of active and effective teaching activities and practices. These basic activities also help determine to which extent learners are aware and conscious toward these practices.

1.3 Theoretical Framework

1.3.1 Literature Review

The subject of teachers' beliefs has gained an undoubtedly large amount of attention by pedagogical researchers in the early 80's and 90's of the past century, and still receives much of this attention today. Numerous studies were conducted on this subject in term of purpose, approach, and targeted teacher sample. Various papers have looked into math teachers' beliefs and practices. While some tackled teachers' beliefs toward the nature, teaching, and learning of mathematics (where these beliefs were grouped as either traditional or constructive), others have explored the connection between teachers' beliefs and the practices they perform. Among those are (Polly et al., 2013), who conducted a study which investigates the inquisition of the relationship between past experiences for teachers, their beliefs towards learning mathematics, and their students' academic achievement. In this study, 35 teacher and 494 students from a number of elementary schools participated in this study. The study findings point toward a correlation between the teachers' beliefs and their experiences. However, no correlation whatsoever was found between the teachers' beliefs or experiences and their student's academic achievement.

Sapkova (2014) attempted to reveal possible correlations between traditional beliefs, the practices of math teachers, and their students' achievement. There was data analysis from numerous research projects with a sample of 190 math teacher and 2828 of their students enrolled in the ninth grade in different regions of Lativa. Study results revealed that traditional beliefs which are held by teachers are connected to low academic achievement for students in mathematical examination. Cam (2015) researched the interaction of cognitive beliefs held by pre-service teachers, their teaching experiences and practices. The findings showed that those cognitive beliefs can be enhanced for teachers through the usage of constructive teaching techniques, and that such beliefs not only affect their teaching experiences, but also the students' comprehension of the content. Güven, Karataş, öztürk, Arslan, & Gürsoy (2013) aimed to set a scale that is characterized by a high level of stability to measure the beliefs of pre-service and in-service math teachers toward teaching and learning mathematics.

Haney & McArthur (2002) conducted a study investigating two questions pinpointing science teachers' beliefs as constructivists, and to what extent these beliefs correspond with real teaching practices, and concluded that there were in fact two main types of beliefs: central beliefs and peripheral ones. Another study by Staub & Stern (2002) featured a sample of 496 elementary students whose performance and skills in mathematical problem-solving were measured. Their teachers' beliefs toward the cognitive and pedagogical mathematical content were measured as well, concluding that they possessed a set of constructivist beliefs which were strongly correlated with their students' abilities in solving mathematical problem. Furthermore, Thomspon (1984) investigated the correlation between teacher'conception of mathematics and instructional practices, where the findings indicated that teachers' beliefs and opinions toward mathematics play a significant and effective role in their teaching behaviors.

Moreover, Raymond (1997) inquired into the correlation between elementary mathematics teachers' beliefs and their teaching practices, identifying a set of efficient factors which contributes to increasing this correlation. In addition, the study found those mathematics teachers' beliefs and practices were not wholly consistent, and that practices were more strongly correlated with beliefs regarding the content of the mathematics subject area as compared to pedagogy, as well as that those beliefs are affected by personal experiences. Also, findings indicated that teacher preparation programs had a limited effect on teachers' beliefs or practices. Peterson, Fennema, Carpenter & Loef (1989) has tested the relationship between the beliefs of first grade teachers and their pedagogical knowledge and accomplishments on the subject of mathematics. In this study, questionnaires were used and interviews were held with teachers to explore their beliefs and their knowledge of teaching. The students' learning of the content was measured as well (subtraction and addition). The study concluded a positive correlation between teachers' beliefs and pedagogical knowledge and the students' achievement on the subject of mathematical problem solving.

Rayyan (2011) aimed to identify the extent of constructive teaching done by math teachers in Al-Khalil and its connection to their instruction efficiency. Results revealed that the extent of constructive teaching was mediocre,

and there were no statistically significant differences between means of the extent of practice—according to the study's variables. A statistically significant positive correlation was found between the extent of constructive teaching held by teachers and their instruction efficiency.

Abu Mousa (2004) investigated the beliefs held by math teachers toward the nature of mathematics as well as the teaching patterns which they rely on in teaching 10th grade. Study results showed that teachers rely on direct display (traditional) and mostly use similar teaching techniques in class.

Al-Shara & Al-Miqdady (2014) explored math teachers' practices in executing mathematical discourses when teaching senior high-school students in Jordan. It was concluded from the study that most teachers (from the sample of 7 teachers) are completely directed by the general examination, which led to the distortion of the curriculum, and directing an execution to service the general examination. The study recommended that the curriculum organizers ensure a line-up process that grants the most important curricula the importance it deserves. In addition to this, the study recommended the re-organization of the school book content in a way which focuses on the mathematical thinking and concepts, and helps teachers get rid of the general examination orientation during teaching.

Stipek, Givvin, Salmon, & MacGyvers (2001) conducted a study which aimed to evaluate the beliefs and practices of math teachers, from 4th grade to 6th, at the beginning and end of the school year. The beliefs which were studied were: the nature of mathematics, learning mathematics, person in-charge of the students' activities in mathematics, nature of ability in mathematics, and the value of external incentives and the teachers' confidence and enjoyment in mathematics or teaching it. In the study, teachers' practices were observed and linked to their beliefs. Results revealed coherence between the teachers' beliefs, and the presence of correlation between them and the teachers' observed classroom practices. In addition to this, teachers' self-confidence is associated with their students' self-confidence in learning mathematics. Perkkilä (2003) addressed the comprehension and depiction of instruction practices and beliefs for 1st and 2nd grade teachers, and the modus of their teaching of mathematics. A questionnaire consisting of 70 items regarding the teachers' beliefs and conceptions towards mathematics, methods of teaching and learning, and teaching practices were used, especially in what regards using the school book. The study concluded that the teachers' beliefs toward mathematics were untraditional, but their teaching practices were connected and focused on the texts of the school book. This reflects incoherence between the teachers' beliefs and their teaching practices.

On the other hand, Wilkins (2008) found no statistically significant differences in teachers' beliefs toward the teaching process efficacy, and that elementary teachers use inquiry-based learning more frequently than higher elementary teachers. Furthermore, the findings indicated that several factors, including the mathematics teaching model, knowledge content, attitudes, and beliefs, all affect the teaching practices of elementary stage teachers, as well as that teachers' beliefs are negatively correlated with their mathematical knowledge and inquiry-based teaching methods.

Previous literature has come to use a wide range of categories to group and describe teachers' beliefs toward learning and teaching. However, the majority of these categories can be summed up into two main sets: traditional beliefs and constructive beliefs. Study results were conflicting to some extent when it came to how much impact these beliefs had on a teacher' classroom practices. A number of findings indicated that the nature of beliefs a teacher holds reflects on the teacher himself/herself and the strategies he/she integrates while teaching. On the other hand, some results indicated that there was no correlation between the two. Results of previous literature could be summarized as follows:

Numerous studies have tackled teachers' beliefs toward learning in general, while a number of these specifically focused on math teachers. Some of these studies focused exclusively on revealing teachers' beliefs toward learning and then group these beliefs into traditional and constructive; however, a number of others focused on exploring the correlation between teachers' beliefs and their teaching practices.

Results of these studies were somewhat conflicting when it came to the correlation between teachers' beliefs and how much these can influence their teaching practices. In other words, while some indicated a correlation between the two, a number of others showed no significant connections nor between beliefs and practices.

Variables and factors that may influence beliefs and attitudes of teachers toward the learning and teaching of mathematics differ greatly, yielding a variety of results.

Thus, the current study seeks to investigate the nature of elementary stage teachers' beliefs toward learning and teaching mathematics, as well as identifying whether there is a correlation between beliefs and teaching practices from their self-reported perspective. It aims to shed light on math teachers' beliefs regarding the learning and

teaching of their subject as well as the nature of mathematics. Furthermore, the study aims to categorize these beliefs under question into constructive, traditional, and a mix in-between, as well as how these relate to teaching behaviors. This attention given to teachers' beliefs could potentially improve pre-service training courses. This, in turn, could improve the overall teaching practices in mathematics.

1.3.2 Significance of the Study

Math teachers' beliefs and perceptions toward the learning and teaching of mathematics have received attention worldwide since the 90's and up until this day. Researchers hope to understand the teaching practices of math teachers in different grades and stages. There only exist a limited number of locally-conducted studies that tackle teachers' beliefs and perceptions toward teaching and learning mathematics, and how these beliefs could possibly relate to their teaching practices (Mohammad 2005; Alkhozam 2006). Thus, the significance of this study lies in the findings it could possibly conclude, and which could clarify the connection between teachers' beliefs and their teaching practices in Jordan, as well as enable us to understand, interpret, and predict teachers' practices. This, in turn, will contribute to the betterment of mathematics teaching.

1.3.3 Study Problem

A number of studies found that teachers' classroom practices related to the teaching of mathematics are affected by their beliefs (Cam, 2015; Sapkova, 2014; Memnun & Hart, 2012; Huang & Shiomi, 2007; Stipek, Givvin, Salmon, & MacGyvers, 2001; Peterson, Fennema, Carpenter, & Loef, 1989). While numerous others refute and contradict this claim, for example, (Mohammad, 2005; Wilkins, 2008; Shi, Zhang, & Lin, 2014), one cannot ignore teachers' beliefs and perceptions when aiming to enhance the math learning and math teaching processes and improve student performance in the subject area. Given the small portion of studies that tackle this issue in Jordan, this study was conducted in hopes of revealing math teachers' beliefs on the learning and teaching of mathematics, the nature of mathematics, and how that relates to their teaching practices.

The current study at hand explores the beliefs of math teachers in the elementary (grades 1-3) and middle school (grades 4-10) stages. Furthermore, the study has also categorized these beliefs into three major groups: constructive, traditional, and a mix in-between. Moreover, the study breaks down teachers' teaching practices into five dimensions derived from the nine activities that compose the theory of learning (Gagne & Briggs, 1974). In addition to this, the study tackles the relationship between teachers' beliefs and their teaching practices from the perspective of teachers themselves. Given this, the study thus complements what previous research papers have explored and tackled, as well as shedding the light on a number of significant issues concerned with pre-service training programs. The results could potentially help develop the process of learning and teaching mathematics in Jordan, especially given the fact that only a small number of studies in Jordan have tackled this subject in elementary and middle school teachers. Based on this, the researchers found it most appropriate to focus on the beliefs and practices of math teachers in this study.

1.3.4 Study Questions

1) What are the beliefs of math teachers (in the basic primary and middle school) toward teaching, learning and nature of mathematics?
2) Do the beliefs toward teaching, learning and nature of mathematics differ according to the teachers' academic qualification, years of experience, and major?
3) Do the beliefs of basic primary stage teachers differ from those of middle school teachers?
4) What are the teaching practices (which regard mathematics) from the viewpoint of the basic primary and middle school in-service math teachers?
5) Do the teaching practices for math teachers (in the basic primary and middle school) differ based on their academic qualification, years of experience, major, and the educational stage(Basic and middle)?
6) Do the teaching practices for math teachers in the basic primary stage differ (from their viewpoint) from the practices of middle school math teachers toward teaching and learning mathematics?
7) Is there a relationship between the beliefs of math teachers (in the basic primary and middle school) and their teaching practices (from their viewpoint)?

1.3.5 Operational Definitions

Beliefs are conceptual frameworks that teachers form through personal experiences and professional knowledge. Beliefs have stronger emotional and evaluative elements as compared to knowledge. Teachers may rely on these beliefs in designing, planning, and decision making related to the learning and teaching process (Pajares 1992).

Constructive Beliefs are a group of ideas, perceptions, and convictions a teacher may hold regarding learning and teaching. These assume that learners possess previous ideas and are active participants in building and developing knowledge with passion for learning. Constructive beliefs call for providing learners with an active and efficient learning environment, which encourages cooperative learning and critical thinking (Al-Omary, 2006; Ankoush, 2014).

Traditional Beliefs are a group of ideas, perceptions, and convictions a teacher may hold. These beliefs often assume that a teacher is the one and only source and transmitter of knowledge in the classroom. Traditional beliefs focus on student performance to determine whether the learning and teaching process is successful. These also focus on developing lower order thinking skills (Al-Omary, 2006; Ankoush, 2014).

Mixed Beliefs are a group of ideas, perceptions, and convictions a teacher may hold regarding the learning and teaching. These beliefs often fluctuate between traditional and constructive beliefs, where teachers hold a mixture of both. Teaching Practices are all actions, words, and practices a teacher may perform and integrate within his or her classroom in hopes of achieving student learning (Al-Omary, 2006).

2. Methodology

This study is based on the descriptive approach, which is considered a suitable approach for this type of study that aims to explore the mathematics beliefs and teaching Practices.

2.1 Population

The study population is mathematical teachers for the middle and basic primary in private schools in Amman-Jordan for the academic year 2016/2017.

2.2 Study Sample

The number of teachers whom were incorporated into this study reached 101 from 11 schools. Table 1 below indicates the distribution of the sample, in accordance to the following variables (educational stage, qualifications, and years of experience).

Table 1. Study sample distribution in accordance to the educational stage, academic qualifications, and years of experience

Academic Qualifications	Years of Experience										Sum
	Basic Primary Stage					Secondary High School Stage					
	<3	3-5	6-10	>10	Sum	<3	3-5	6-10	>10	Sum	
Community Major	1	0	2	8	11	0	0	0	0	0	11(10.9%)
Bachelors	14	25	18	8	65	10	0	3	2	16	81(80.1%)
High Diploma	0	0	3	1	4	0	0	0	1	1	5(5%)
Masters	0	1	1	1	3	0	0	0	1	1	4(4%)
Sum	15	26	24	18	83(82.2%)	10	1	3	4	18 (17.8%)	101

2.3 Instruments (Data Collection Tools)

To collect data, the researchers used two scales:

1) The Math Beliefs Scale
2) The Math Teaching Practices Scale

2.3.1 The Math Beliefs Scale

To determine the teacher beliefs about teaching, learning and nature of mathematics, a scale was designed after conducting literature review about learning and teaching mathematics. A number of items were written. The scale consists of three dimension assessed by (37) items, (15) items for beliefs about the nature of mathematics dimension, (11) items for beliefs about teaching mathematics, and (11) items for beliefs about learning mathematics. Each item requires the teacher to answer by “highly agree”, “fairly agree”, and “rarely agree”. A teacher is considered to be constructive in his or her beliefs if he or she scores (75) or higher on the total sum. A teacher will be mixed in between in his or her beliefs if he or she gets total between (50-74.9). In addition, teachers may be traditionally-inclined in their beliefs if they score 49 or less (Rayan, 2010; Ankoush, 2014; Beswick, 2007; Zakaria & Musiran, 2010).

After composing the study scale, it was subjected to the revision of a group of judges working in the field of mathematics at various Jordanian universities. This was done to ensure that the scale is appropriate and ensuring

the clarity of all items in the questionnaire targeting what the researcher intends to tackle. This has confirmed the validity of the scale, in addition to several alternations made based on feedback provided earlier for some of the items. The reliability coefficient (Cronbach's Alpha) was calculated using a sample group of (50) teachers. The reliability value for the scale as a whole was (0.90). In addition, the reliability for each dimension was as follows: (0.77) for the beliefs about the natural of mathematics, (0.77) for the beliefs about teaching mathematics, and (0.82) for the beliefs about learning mathematics. The reliability coefficient is acceptable for the purposes of scientific research. The Math Beliefs Scale focuses on three main dimensions, as follows:

First, it focuses on teachers' beliefs toward the nature of math where these beliefs were classified into three categories. Traditional beliefs view math as a difficult subject which requires a strong memory and is not easily learned. Constructive beliefs, on the other hand, view math as a science based on consistent relations, theorems, and generalizations within a coherent mathematical construct. Those who hold constructive beliefs may be more inclined toward using logical and constructive thinking and realistic representations of the world. The third category of beliefs is mixed in between, where teachers shift between traditional and constructive preferences. These were measured using 15 items in the scale. Below are a few examples of some of these items:

Mathematics requires a strong memory and is based on memorization.

Mathematics is a set of rules which should be remembered and then followed and executed.

Mathematics is the basic method of representing and clarifying the real world.

Mathematics is a group of consistent and connected rules and law.

Second, teachers' beliefs toward teaching math were also classified into the aforementioned three categories. Teachers with traditional beliefs saw that learning and teaching mathematics required them to focus on calculation skills and using specific methods and fixed-point algorithms to solve problems. Alternatively, teachers with constructive beliefs were prompted to use graphs and models while focusing on dialogues and strategies to solve problems, by that enhancing problem-solving and creating and integrating new ways in real-life situations. The third classification of beliefs is mixed in between, where teachers shift between traditional and constructive preferences. These were measured using 15 items in the scale. Below are a few examples of some of these items:

- Mathematics should be taught through a group of algorithms, rules, and laws.
- There are constant and stables ways to solve mathematical problems, and these should be upheld when teaching mathematics.
- Various visual representations, tangibles, resources, and symbols, etc. should be used when teaching mathematics
- Mathematical problems should be related to real life, and should not be limited to calculations and processes alone.

Third, teachers' beliefs toward learning math were also classified into the aforementioned three categories. Traditional beliefs called for learning math through bringing students' attention to memorizing how problem-solving strategies are executed; such strategies were used as specified by the teacher. Constructive beliefs focused on students' role in building and assessing mathematical knowledge, as well as finding and building self-constructed problem-solving strategies while highlighting creativity. Mixed in between beliefs, however, would shift focus between constructive and traditional approaches. These were measured using 11 items on the scale. Below are a few examples of some of these items:

- Students should learn to use specific strategies when solving mathematical problems
- Memorizing mathematical rules and laws is a basic and necessary component for learning mathematics
- Students should support the steps they use to solve mathematical problems with justifications, reasons, and proof.
- Demonstrating a student's good thinking skills and ability to come up with new strategies is more important than coming up with a final solution that is correct.

2.3.2 Math Teaching Practices Scale

The researchers prepared a math teaching practices scale based on the nine activities present in the theory of leaning which were set by Gagne & Bridges (Kruse, 2009; Khadjooi, Rostami, & Ishaq, 2011). The scale consists of 56 items spread out on five dimensions as follows: (8) items for the motivation and reinforcement dimensions, (8) for the setting goals and display requirements dimensions, (24) for provide knowledge and

guidance of teaching, (10) item for formative and summative assessment dimensions, and (6) items for Enhance retention remembering dimensions. The scale has also been reviewed by a number of specialists in mathematics, and has been modified according to their suggestions and feedback. The scale has been applied (administered/given) to a sample of (50) teachers (pilot group). The coefficient of internal consistency (Cronbach's Alpha) was calculated and it reached (0.92). In addition, the reliability for each dimension was as follows: (0.65) for the motivation and reinforcement dimension, (0.74) for the setting goals and display requirements dimension, (0.86) for provide knowledge and guidance of teaching, (0.74) item for formative and summative assessment dimension, and (0.70) items for enhance retention remembering dimension. The reliability coefficient is acceptable for the purposes of scientific research. The Teaching Practices Scale measures teachers' teaching practices when teaching math as traditional, constructive, or mixed in between as follow:

First, motive and reinforcement in teachers' practices to motivate students and reinforce their achievements are measured by 8 items. Examples of these are shown below:

- I motivate my students to solve mathematical problems they encounter.
- I show interest and positive reinforcement for the way my students think and deal with alternative ideas.
- I support that my students challenge themselves and reinforce how they advance in their achievements.

Second, examining previous requirements and setting goals measure teachers' teaching practices related to examining, displaying, and clarifying goals to students, as well as specifying the requirements necessary for achieving mathematical knowledge. These are measured through 8 items. Examples of these are shown below:

- I rely on mathematical constructs in building and expanding mathematical and scientific knowledge based on students' prior knowledge.
- I present mathematical content to learners in a logical and correct order based on students' prior knowledge.

Third, providing stimuli and teaching patterns, as well as directing learning and the classroom environment are related to measuring practices adopted by teachers. Teachers provide such stimuli and mathematical knowledge while steering the learning and teaching process and preparing a suitable learning environment. This dimension is measured through 24 items. Examples of these are shown below:

- I allow students to discuss their solutions for mathematical problems with their peers.
- I use inquiry when teaching mathematics to reinforce positive attitudes toward the subject area.
- I work hard to create a stimulating classroom environment that encourages students to learn mathematics.

Fourth, extracting academic performance and formative and summative assessment dimensions is related to practices adopted by teachers when carrying out the evaluation and assessment process, whether it is formative and summative. This dimension is measured by 11 items, of which a number are displayed below as an example:

- I use a variety of assessment methods (writing/discussion, etc.) to reveal my students' perceptions toward practical mathematics and how it is applied.
- I identify the challenges faced by some of my students who struggle to perform as needed in mathematics.
- I present students with hints while learning mathematics and assure them that there is more than one method for solving mathematical problems during exams.

Fifth, reinforcing retention and recall skills is related to practices that support retaining learning and its continuality and ability to recall information when needed. This is measured by 6 items, of which some are displayed below as an example:

- I review challenging mathematical subjects and lessons with my students.
- I supplement my teaching with puzzles and contests as they help students recall mathematical concepts and problem-solving strategies.
- I prepare training and tracking schedule for each student based on his or her abilities and needs to help in the retention and recall process.

2.4 Limitations of the Study

- The results of this study are limited to the following factors:
- The study was limited in regards to the in-service teachers at private schools in Amman.
- The results were determined by characteristics of the scales used, and their ability to detect differences

between teacher's beliefs and their math teaching practices from their point of view.

- All study subjects are females.

2.5 Statistical Processing

The mean and standard deviation values were calculated for the sample's responses on the study scale. These values were later grouped into three main levels (law, medium, and high) based on a number of studies that have tackled similar subjects, including (Rayyan, 2011). Furthermore, an analysis of variance (ANOVA) was used to calculate the f-value and t-value.

3. Results

To answer the 1st question (What are the beliefs of math teachers (in the basic primary and middle school) toward teaching, learning and nature of mathematics?), the number of teachers and their percentages were calculated in each aspect of the Math Beliefs Scale toward teaching and learning mathematics (which was composed for the purpose of this study). Teachers' responses were classified on the scale into three categories based on their beliefs. Constructive beliefs are 75% and higher, 50-74.9% are mixed in between, and less than %50 constitutes to traditional ones. Table 2 below shows these results.

Table 2. Number of teachers and their percentage on the Math Beliefs Scale in its three aspects

Nature of Beliefs	Nature of Mathematics		Teaching mathematics		Learning mathematics	
	Number	Percentage	Number	Percentage	Number	Percentage
Constructive	27	26.4%	58	57.4%	60	59,4%
Mixed in between	66	65.7%	40	39.6%	36	35.6%
Traditional	8	7.9%	3	3%	5	5%

Results in table 2 reveal that (65.7%) of the study sample had mixed in between beliefs regarding the nature of mathematics, and (26.4%) of teachers had constructive beliefs on the same dimension. The study results also revealed that (57.4%) of the sample study had constructive beliefs on the teaching mathematics dimension. Meanwhile (39.6%) of teachers had mixed in between beliefs on the same dimension. Results also showed that (59.4%) of teachers had constructive beliefs on the learning mathematics dimension, while (35.6%) of teachers had mixed in between beliefs on the same dimension.

To answer the 2nd question (Do the beliefs toward teaching, learning and nature of mathematics differ according to the teachers' academic qualification, years of experience, and major?), means and standard deviations to the teachers' scores on the mathematics beliefs' scale in its three aspects were calculated, according to the variables of the years of experience(less 3, 3-5, 6-10, higher 10), academic qualification (Diploma, Bachelors, Higher Diploma, Masters) and Major (Education, Literate, Scientific, Others). Table 3 shows the results.

Table 3. Teachers' score means and standard deviation values, the calculated F value on the Math Beliefs Scale as a whole, and to its three dimensions according to the variables of the years of experience, major, and academic qualification

Variables		Number	Nature of Mathematics		Teaching Mathematics		Learning Mathematics		Scale as Whole	
			M	S.D	M	S.D	M	S.D	M	S.D
Years of Experience	Less3	25	1.34	0.3	1.55	0.28	1.53	0.35	1.46	0.27
	3-5	27	1.33	0.31	1.49	0.36	1.5	0.35	1.41	0.30
	6-10	27	1.33	0.28	1.5	0.33	1.6	0.32	1.46	0.27
	Higher 10	22	1.43	0.33	1.58	0.35	1.5	0.29	1.53	0.28
	Sum	101	1.35	0.3	1.54	0.33	1.54	0.33	1.5	0.28
	F Value		0.58		0.348		0.427		0.615	
	Sig.		0.63		0.791		0.734		0.607	
Qualification	Diploma	11	1.33	0.38	1.5	0.41	1.4	0.45	1.41	0.35
	Bachelors	8	1.35	0.29	1.53	0.32	1.51	0.31	1.5	0.28
	Higher Diploma	5	1.5	0.33	1.62	0.33	1.68	0.29	1.58	0.21
	Masters	4	1.3	0.33	1.6	0.13	1.7	0.29	1.52	0.28
	Sum	101	1.35	0.3	1.5	0.33	1.54	0.33	1.46	0.59
	F Value		0.46		0.21		3.4		0.7	
	Sig.		0.77		0.94		0.01		0.59	

Major	Education	60	1.35	0.28	1.5	0.32	1.49	0.35	1.4	0.27
	Literate	13	1.34	0.34	1.59	0.3	1.62	0.22	1.49	0.28
	Scientific	24	1.38	0.37	1.57	0.39	1.65	0.31	1.5	0.32
	Other	4	1.35	0.17	1.6	0.14	1.57	0.3	1.5	0.12
	Sum	101	1.35	0.30	1.54	0.33	1.55	0.31	1.47	0.28
	F Value		0.59		0.428		1.74		0.74	
	Sig.		0.98		0.734		0.165		0.657	

As it shows in the table, all calculated F values are not statistically significant to the years of experience variable (on the Math Beliefs Scale). On the other hand, the calculated F value of the academic qualification is statistically significant but only on the learning mathematics aspect. This means that teachers differ in their beliefs on the matter of learning mathematics based on the differences in their academic qualifications. To know the source of this differentiation, the Shaffieh statistics were used, and results revealed the presence of statistically significant differences toward teachers of high diploma and masters, on the aspect of learning mathematics.

To answer the 3rd question, (Do the beliefs of basic primary stage teachers differ from those of middle school teachers?) the number of teachers and their percentages (based on the educational stage (basic and middle)) has been calculated, according to the three dimensional aspects (nature of mathematics, teaching and learning it). As well as to constructive, traditional and mixed in between, in a accordance to the classification of the beliefs. Table 4 reveals the results.

Table 4. Number of teachers and their percentages according to the educational stage (basic and middle) based on the three dimensional beliefs, and the classification of those beliefs to constructive, traditional, and mixed in between

Stage	#	Nature of Mathematics			Teaching Mathematics			Learning Mathematics		
		Cons.	Mixed	Trad.	Cons.	Mixed	Trad.	Cons.	Mixed	Trad.
Basic	83	22	53	8	46	34	3	46	32	5
Primary		26.5%	63.8%	9.5%	55.3%	40.1%	3.61%	55.4%	38.5%	6.02%
Middle	18	5	13	0	0	6	12	14	4	0
school		27.8%	72.2%			33.3%	66.6%	77.9%	22.2%	
Sum	101	27	66	8	58	40	3	60	36	5
		25%	61.1%	7.4%	57.4%	39.6%	3%	59.4%	35.6%	5%

From the results, we could conclude that the teachers' beliefs in the basic primary stage were mixed in between in the aspect of the nature of mathematics. The percentage of their beliefs was (72.2%). On the aspect of teaching mathematics, teachers' beliefs were more constructive (in the basic primary stage) than the teachers' of the middle school, which were (55.3%). Teachers' beliefs of the middle school stage lean more towards traditionalism (66.6%). On the aspect of learning mathematics, the teachers' beliefs of the basic primary and middle stage were highly constructive, with percentage of (55.4%) and (77.9%) respectively.

To determine whether teachers' differ in their beliefs toward teaching and learning mathematics according to the educational stage (Basic primary, Middle school), the means and standard deviations of the teachers' scores on the mathematics beliefs' scale were calculated, in addition to the t-score. Table 5 reveals the results.

Table 5. Means of the teachers' scores, standard deviations and the T-score on the mathematics beliefs' scale – according to the educational stage

Variables	#	Nature of Mathematics		Teaching Mathematics		Learning Mathematics		Scale as a whole	
		M	S.D	M	S.D	M	S.D	M	S.D
Basic primary	83	1.34	0.3	1.52	0.32	1.5	0.33	1.44	0.28
Middle school	18	1.4	0.33	106	0.33	1.69	0.29	1.55	0.28
T-value		-0.9		-0.99		-2.12		-1.48	
Sig		0.768		0.812		0.734		0.969	

Table 5 reveals that teachers do not differ in their beliefs towards mathematics on the educational stage variable. All T-value were not statistically significant.

To answer the 4th question (What are the teaching practices (which regard mathematics) from the viewpoint of the basic primary and middle school in-service math teachers?) Teachers' numbers and percentages on the five dimensional math practices teaching scale were calculated, as well as the scale as a whole. Teachers were classified according to their practices: constructive, traditional, and mixed in between. Table 6 shows the results.

Table 6. Teachers' numbers and percentages on the math practices teaching scale, according to the type of practice

Teaching Scale Dimensions	Constructive Practices		Mixed in between Practices		Traditional Practices	
	Number	%	Number	%	Number	%
Motive & Reinforcement	66	65.3%	34	33.7%	1	1%
Goals & Requirements	59	58.4%	30	29.7%	12	11.9%
Presenting Stimuli	74	73.3%	25	24.8%	2	2%
Academic Performance and Evaluation	36	35.6%	50	49.5%	15	14.9%
Retention and Recall	59	58.4%	30	29.7%	12	11.9%
Scale as a Whole	58	57.4%	42	41.6%	1	1%

Results in table 6 show that the highest percentage in constructive practices reached (73.3%), whereas traditional practices were (1%) and mixed in between practices were (49.5%). The teachers' constructive practices on the aspect of providing stimuli reached (73.3%) (Which is the highest), followed by (65.3%) on the aspect of motives and reinforcement. The aspect with the lowest percentage was academic performance and evaluation (35.6%). This aspect scored the highest in mixed in between classification.

To answer the 5th question (Do the teaching practices for math teachers (in the basic primary and middle school) differ based on their academic qualification, years of experience, major, and the educational stage(Basic and middle)?), mean and standard deviation values, as well as F values for teachers' scores on the Math Teaching Practices Scale were calculated according to the different variables of the years of experience (less 3, 3-5, 6-10, higher 10), academic qualification (Diploma, Bachelors, Higher Diploma, Masters) and Major (Education, Literate, Scientific, Others), as shown below in Table 7.

Table 7. Means, standard deviations and the F value for the teachers' scores on the Math Teaching Practices Scale in regards to years of experience, major and academic qualification

Variables		#	Motives & Reinforcements		Goals & Requirements		Stimuli		Academic & Evaluation		Retention & Recall		Scale as a Whole	
			M	S.D	M	S.D	M	S.D	M	S.D	M	S.D	M	S.D
Years of Experience	<3	25	71.5	17.9	77.5	19.8	74.9	14.7	66	16.3	66.3	18.6	72.3	13.7
	3-5	27	73.2	11.1	81.3	15	74.9	13.3	66.9	16.4	77.7	16.4	75.7	11.6
	6-10	27	78.3	11.8	83.8	12.3	77.9	12.3	69.3	17.7	68.2	20.4	77	10.9
	>10	22	77.9	12.9	85.5	14.5	79.8	12.3	65	23.5	68	20.4	79.3	12.8
	Sum	101	75.1	13.7	82	15.9	83.6	12.4	66.9	18.3	79.9	23.4	76	12.3
	F Value		1.54		1.168		1.778		0.244		3		1.38	
	Sig.		0.209		0.326		0.157		0.865		0.034		0.254	
Qualification	Diploma	10	81.3	13	81.3	14.4	79.8	12.4	62.3	28	77.3	26	75.9	15.1
	BA	81	74.6	13.7	81.6	16.7	78.1	13.7	66.8	17	71.8	19.6	75.4	12.2
	High Diploma	5	81.3	19.2	82.5	11.1	83	10.8	75	15.4	71.7	19.2	80	11.2
	Masters	4	76.6	7.8	90.7	8.1	88	11.6	71	20.6	83.3	13.6	83.3	7
	Diploma	10	81.3	13	81.3	14.4	79.8	12.4	62.3	28	77.3	26	75.9	15.1
	F Value		0.769		0.309		0.837		0.582		0.589		0.657	
	Sig.		0.548		0.871		0.505		0.582		0.589		0.657	
Major	Education	60	75.9	12.6	81.9	14.3	78.9	12.6	66.8	18.5	72.5	18.1	76	11.5
	Literate	13	70.2	22.1	76.9	24.6	72.9	20.3	65	20	71.2	19.4	71.5	17.6
	Scientific	24	76.6	11.6	86	12.1	82.7	9.5	79.8	18.1	74.7	23.5	79.1	10.7
	Other	4	71.9	8.1	75	18.4	76.1	13.4	57.5	8.7	72.9	27.6	71.7	12.2
	Sum	101	75.1	13.7	82	15.9	78.9	13.3	66.9	18.3	72.9	20	76	12.3
	F Value				1.2		1.6		0.595		0.1		1.28	
	Sig.		0.5		0.31		0.19		0.62		0.96		0.286	

Table 7 shows that teachers do not differ in their teaching practices (from their point of view), with the difference of the academic qualification, major, or years of experience. This is true whether it's on the scale as a whole, or on its five dimensions (excluding retention and recall to the years of experience variable, and in favor of teachers' with 3-5 years of experience).

To answer the 6th question (Do the teaching practices for math teachers in the basic primary stage differ (from their viewpoint) from the practices of middle school math teachers toward teaching and learning mathematics?), by determining whether teachers differ in their teaching practices based on the educational stage, the means and standard deviations were calculated, as well as the T-score. Table 8 reveals the results.

Table 8. Teachers' means, standard deviations, and T values on the teaching practices scale in regards to the educational stage at which they teach

Variable		#	Motives & Reinforcements		Goals & Requirements		Stimuli		Academic Performance & Evaluation		Retention & Recall		Scale as a Whole	
			M	S.D	M	S.D	M	S.D	M	S.D	M	S.D	M	S.D
Educational Stage	Basic	83	76	11.8	82.7	13.4	79.1	12	66.9	18.8	72.5	19.3	76.3	11.2
	middle	18	71	20.4	78.5	24.6	77.9	18.6	67	16.3	74.5	23.5	74.7	17
	Sum	101	75	13.7	82	15.9	78.9	13.4	66.9	18.3	72.9	20	76	12.3
	T-value		1.35		1.02		0.354		-0.016		-0.393		0.494	
	Sig		0.329		0.007		0.434		0.468		0.288		0.311	

Table 8 reveals that teachers do not differ in their teaching practices (from their viewpoint) in regards to differences in their educational stage taught. This is regardless to whether it is on the scale as a whole, or on its five dimensions (with the exception of goals & requirements dimension, and in favor of the basic primary school teachers).

To answer the 7th and final question (is there a relationship between the beliefs of math teachers in the basic primary and middle school and their teaching practices from their viewpoint?), means and standard deviations were calculated for the teachers' scores on the mathematics beliefs' scale, and the teaching practices scale. The correlation coefficient (Person) was calculated as well, between two variables: mathematics beliefs, and teaching practices. Table 9 reveals the results.

Table 9. Teachers' means, standard deviations, and correlation coefficient on the math beliefs scale and the math teaching practices scale

	Means	Standard Deviation	Correlation Coefficient
Beliefs	76	12.3	0.481**
Practices	73.24	14	

Table 9 shows that the correlation coefficient (Person) between the teachers' beliefs and their teaching practices as statistically significant (r =0.481).

4. Discussion and Conclusions

4.1 Discussion

The study has explored math teachers' beliefs in private schools located in Amman, Jordan to shed some light on a quite noteworthy issue: the professional development of teachers in accordance with a more modern approach in developing the process of learning and teaching in the 21st century. What sets the 21st century apart from any other era is the revolutionary development of technologies used in processing knowledge. This entails that students are now required to acquire a new set of skills and qualifications, which weighs down on the shoulders of teachers.

The aim of the study was fixated upon unveiling the beliefs of elementary (grades 1-3) and middle school (4-6 grades) math teachers, which were then categorized into traditional, constructive, or a mix in-between. The study also aims to inquire into the teaching practices of these teachers on five dimensions derived from the theory of learning put by (Gagne & Briggs, 1974), as well as into the correlation between teachers' beliefs toward math and their self-reported teaching practices. Moreover, the study does not ignore the influence of years of

experience, university major and academic qualification on teachers' beliefs and practices.

To fulfill the aims of the study and answer the questions put forth, a literature review was conducted on the subject area. Based on this review, two study tools were prepared. The first scale measures teachers' beliefs toward math on its three different dimensions: the nature, teaching, and learning of mathematics. The other scale, however, measures teachers' self-reported teaching practices from their own perspective.

The statistical analysis determined that math teachers hold numerous beliefs that are traditional, constructive, or in-between. It has also shown that math teachers' beliefs generally fluctuate between traditionalism and constructivism, as 59.4% of all teachers in the sample held constructive beliefs, while 35.6% held a mixture between the two types. However, the percentage of teachers in the sample who strictly held traditional beliefs did not exceed 5%. These results are largely consistent with those of Rayyan (2011) and Perkkilä (2003).

Results have further indicated that math teachers had a mixture of beliefs (in-between traditional and constructive) on the nature of mathematics dimension, with a mean value of (65.7%) (Being the highest), and mostly constructive beliefs on the learning and teaching of mathematics scale with a mean value of (57.4%). Results also revealed that teachers' beliefs in all three categories revolved around a mixture between constructive and traditional, with a mean value of (73.94%). On the other hand, the samples mean scores on different dimensions were as follows: (77.4%) in learning mathematic (being the highest, as well as constructively-inclined), followed by 77% in teaching mathematics (constructively-inclined as well), and finally (67.4%) in the nature of mathematics (having the lowest mean, with a mixture between traditional and constructive beliefs). Results indicate that the differences between teachers' beliefs on different dimensions were statistically significant.

The results discussed above could be due to the immense change that the Jordanian educational system had previously undergone. These changes have positively reflected on teacher preparation programs and curricula. In turn, they have also played a big role in forming and molding teachers' beliefs toward their future responsibility as 21st century educators.

Furthermore, the results indicate that the variables of years of experience and major had no effect on teachers' beliefs toward mathematics. This, however, is not the case with teachers' beliefs toward the learning of math when it came to academic qualification, in favor of teachers with a higher diploma and M.A. degree. This may be due to the educational courses taught to undergraduates in these programs, as they heavily integrate subjects related to learning, thinking skills, and learning and teaching strategies. Such topics are the cornerstone to completing an educational diploma or master's degree.

In addition, the results have also shown that teachers' beliefs toward math in general do not differ by stage taught, meaning that both elementary and middle school teachers do not generally differ in their beliefs toward math across all three dimensions.

In regards to teachers' perceptions of their teaching practices, the study results reveal that these were generally inclined toward constructivism. Teachers who had constructive perceptions were (57.4%) versus (41.6%) who had a mixture between traditional and constructive beliefs. Conversely, only 1% of all teachers in the sample had traditional perceptions toward their teaching practices. A deeper look at the results shows that teachers' perceptions differ according to the teaching practices used by them in the classroom. These results tended to be more constructive when it came to the practices of motive and reinforcement at (65%), at (58.4%) in goals and requirements, and at (73.3%) at presenting stimuli.

On the other hand, when it came to teaching practices concerned with academic performance and evaluation, teachers who had constructive perceptions were no more than (35%). The variance analysis indicated that the differences on these dimensions were statistically significant. When we look back at activities described in the Theory of Learning Gagne & Briggs (1974), which a large part of this study is based on, we can see that practices related to motive and reinforcement were the most constructive of all teaching practices. Much attention was given to teacher preparation programs, whether in B.A. or diploma programs, in numerous courses which tackle how to set up goals and requirements, present cognitive topics, and reinforce and motivate learners using modern learning strategies. This has affected teachers' perceptions toward a more constructive inclination. Contrariwise, teacher preparation and in-service teacher programs have neglected modern strategies that can be used to assess and evaluate learners. This may have helped hinder the transition from traditional to constructive learning.

What has previously been discussed is largely consistent with the works of Liljedahl (2008) on the importance of acquiring the knowledge necessary to teach mathematics and gain knowledge on the subject, as well has being

aware of the teaching practices necessary for teaching mathematical knowledge. Alternatively, these findings differ to a degree from Šapkova (2014) on the importance of teachers' beliefs and much influence they have on their teaching approach put into use. Šapkova's (2014) indicated that teachers' constructive beliefs contradicted the traditional teaching practices they perform in their classrooms.

Other variables which were incorporated into this study (such as years of experience, academic qualifications, and major) were ineffective and had no statistical significance when it came to teaching practices. In reference to this, findings indicate that teachers do not have different teaching practices on any of these previously mentioned variables in general, nor on four (out of five) dimensions of the scale. The only exception to this rule was the retention and recall dimension, and in favor of teachers who had 3-5 years of experience. These results are consistent with those of Rayyan (2011) which exhibited that variables of sex, experience, academic qualifications, and stage taught had no effect on teachers' teaching practices.

Results also point out that teachers do not differ in their teaching practices from their own perspective if they teach different stages (elementary or middle school) on the scale as a whole and on four (out of five) of its dimensions. The only exception was that of the dimension of goals and requirements and in favor of elementary stage teachers (grades 1-3). This could be due to that teacher preparation programs were immensely interested in preparing and qualifying elementary level teachers when it came to setting goals and requirements for the learning process.

Study findings further revealed a Positive correlation between teachers' beliefs and their teaching practices, which goes hand in hand with the study conducted by Burrell-Ihlow (2006), who stated that the majority of these practices were constructive and that transitioning toward constructive practices in teaching is majorly based on previous experiences built upon the constructive (and not the traditional) teaching approach.

Findings presented in this study are also largely consistent with those of Rayyan (2011), who revealed a positive correlation between the extent to which math teachers practice constructive teaching and their beliefs about teaching mathematics. Findings also correspond with those of Abu-Mosa (2004), who indicated that teachers who use direct presentation (traditional teaching techniques) also follow traditional steps in teaching. In other words, beliefs are correlated with teacher practices, whether they are traditional or constructive. Furthermore, the findings are also consistent with a number of others conducted in previous years, including Šapkova (2014), Memnun & Hart (2012), Cam (2015) and Stipek, Givvin, Salmon, & MacGyvers (2001), highlighting the strong correlation between teachers' beliefs and their teaching practices.

In contrast, Shi, Zhary, & Lin (2014) concluded that there was no steady connection between beliefs and teaching practices exist. They did, however, indicate a strong significant correlation between the two. Conversely, Güven, Karataş, öztürk, Arslan, & Gürsoy (2013) found that teachers' beliefs and attitudes ought to be constructive and mathematically-inclined to enable teachers in helping their learners gain and acquire math learning experiences. The latter matches the findings of Levin & Wadmany (2006) on the influence of teachers' beliefs on their teaching practices and what role these beliefs play in creating desired changes in student behavior. In alignment with the above, the findings also complement those of Memnun & Hart (2012) as well as Polly et al. (2013) regarding how math teachers' beliefs toward mathematics influences their classroom practices and experiences when giving math lessons.

Based on the information presented above, this study stresses the importance of teachers' beliefs, being a set of roles that teachers should be able to perform. These beliefs reflect on teachers' constructive practices in the classroom and provide teaching opportunities that allow learners to reflect, evaluate, and understand mathematics. This can be achieved through conducting continuous courses and workshops to help train teachers on how to use constructive strategies when learning and teaching mathematics, and through focusing on teachers' activities in such a way that highlights the significant role they play in building knowledge, as presented through the constructivist theory. This could potentially impact teachers' attitudes and believes toward the learning and teaching process of mathematics in a positive manner. The researchers have also called for the implementation of constructive mathematics teaching strategies in undergraduate courses for educational science majors and pre-service teacher preparation programs.

4.2 Conclusions

This study concluded that teachers' practices in the basic and middle schools tend to constructive but need to emphasize practices related to performance, performance and evaluation, and all that support the conversion of these practices to constructive practices through teacher training programs.

The study also showed that the teachers' beliefs about learning and teaching mathematics tend to be constructive but need to emphasize the dimension of the nature of mathematics by improving the level of teachers in the field of mathematical knowledge and enabling them to emphasize understanding the nature and importance of mathematic.

Teachers differ in their beliefs towards the teaching and teaching of mathematics according to their qualifications and for those who hold the degree of higher diploma. This is an indication of the importance of preparing teachers educationally through the programs of training teachers or enrolling in the Diploma Program of Education after obtaining a bachelor's degree.

There is a positive correlation between teaching beliefs and practices, which emphasizes the importance of teachers having constructive beliefs about learning and education, which are also reflected in their teaching practices.

5. Recommendations

In light of the results of the study, the researchers recommend the following:

1) Provide training programs for teachers to improve their teaching practices in mathematics according to constructive approach.
2) Update the pre-service mathematics teachers' programs in line with ongoing developments in the curricula and methods of mathematics teaching.
3) Conduct further studies to explore the beliefs of pre-service mathematics teachers regarding learning and teaching mathematics.
4) Conduct further studies related to the relationship between teachers' beliefs towards learning and teaching mathematics in higher grades.
5) Conduct a study to identify the sources that contribute to the formation of beliefs and perceptions of mathematics teachers on learning and teaching mathematics.

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