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Inconsistencies Between Mathematics Teacher's Beliefs on Ideal Geometry Teaching And Their Teaching Practice[1]

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ABSTRACT

This study is an attempt to reveal which teaching models are adopted more by mathematics teachers in Turkey, how they conduct geometry courses and the views on an effective geometry courses. The research is case study. Eight teachers, each with 8 hours, were observed for 64 periods in geometry courses. After that, semi-structured interviews (30-35 minutes) were carried out with them. The data were analysed using content analysis. As a result of analysis, it was shown that teachers subscribed to constructivist approach in interviews, although they used traditional teaching methods in their lessons. Consistencies between teachers' behaviours and statements were examined in terms of effective mathematics teaching. Consequently, the inconsistencies were observed about problem solving and associating mathematics with real life. It was thought that putting in practise the reforms on education would help for overcoming these inconsistencies.

Key Words: Effective mathematics teaching, geometry teaching, teacher belief, teacher education.

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Matematik Öğretmenlerinin İdeal Geometri Öğretimine İlişkin İnançları ile Öğretim Uygulamaları Arasındaki Uyumsuzluklar

ÖZET

Bu çalışmanın amacı Türkiye'deki ortaokul matematik öğretmenlerinin bir geometri dersine ilişkin görüşleri ile öğretim uygulamaları arasındaki uyumsuzlukları ve bu uyumsuzlukların nedenlerini ortaya koymaktır. Çalışmanın yöntemi durum çalışmasıdır. Sekiz öğretmen üzerinde yürütülmüştür. Öğretmenlerin her biri 8'er ders saati olmak üzere, geometri konularının anlatıldığı toplam 64 ders saatinde gözlemlenmiştir. Daha sonra öğretmenlerle 30-35 dakikalık yarı yapılandırılmış görüşmeler gerçekleştirilmiştir. Toplanan veriler içerik analizine tabi tutulmuştur. Öğretmenlerin, derslerinde geleneksel yaklaşıma daha yakın olmalarına karşın görüşmelerde yapılandırmacı bir öğretim yaklaşımından yana oldukları görülmüştür. Öğretmen davranışları ile ifadelerinin etkili matematik öğretimi bakımından tutarlılığı incelenmiştir. Sonuç olarak, farklılığın gerçek hayatla ilişkilendirme ve problem çözme hususlarında daha belirgin olduğu görülmüştür. Bu uyumsuzlukların giderilmesinde, eğitim öğretimdeki reform hareketlerinin uygulamaya geçirilmesinin de yararlı olabileceği düşünülmüştür.

Anahtar Sözcükler: Etkili matematik öğretimi, geometri öğretimi, öğretmen inançları, öğretmen eğitimi.

INTRODUCTION

View of mathematics and the way of having benefits from mathematics are closely related to how people learned it (Hare, 1999). In this regard, the curriculum was changed in order to improve math achievement and thinking skills of students such as critical and creative thinking in 2005-2006 in Turkey. Although almost eight years have passed from the passing of curriculum, the studies have shown that the curriculum couldn't be applied at the desired level at schools and the teachers was continuing to teach their lectures with their traditional methods (Isık & Kar, 2012; Toptas, 2012). Some studies showed that math teachers had negative opinions about applicability of curriculum in spite of the fact that they had positive opinions about the philosophy of curriculum. As the reason for this situation, some studies asserted issues such as time that is less than prescribed in the program, being crowded classrooms, lack of facilities in schools (in terms of material), management of school, lack of qualified books and parents which do not have enough information about curriculum (Mesin, 2008; Oren, 2010; Turk, 2011; Budak & Okur, 2012).

Although teachers continue traditional methods in practice, the positive opinions about the curriculum present a contradiction. To provide suggestions for resolving this contradiction, we focus on the differences between the teachers' opinions and practices in their classroom the teaching behaviours of teachers during their geometry lessons and their views about an ideal geometry lessons are compared in this study.

THEORETICAL FRAMEWORK

Pajares (1992) stated that "beliefs are instrumental in defining tasks and selecting the cognitive tools with which to interpret, plan, and make decisions regarding such tasks; hence, they play a critical role in defining behavior and organizing knowledge and information" (cited in Speer, 2006). Beliefs appear to be, in essence, factors shaping teachers' decisions about what knowledge is relevant, what teaching routines are appropriate, what goals should be accomplished, and what the important features are of the social context of the classroom (Speer, 2006).

The consistency between teacher beliefs and their teaching practices is a natural expectation. Stipek, Givvin, Salmon and MacGyvers (2001) stated in their study that teachers thinking traditionally often employ traditional practices and are generally result oriented. On the other hand, a teacher adopting constructivist philosophy focus on abilities developing within a learning process.

Speer (2006) stated that it is possible, however, that perceived discrepancies are sometimes the result of incomplete or inaccurate understanding of terms and descriptions used by teachers and researchers. These issues of attribution are further complicated by the potential of researchers and teachers to mean different things when using the same descriptions. However, despite the existence of teachers who possess positive views regarding a program in Turkey which advocates developing students' higher order thinking skills, it couldnot be put into practice which indicates an inconsistency. There are both national and international studies dealing with such inconsistencies and attempting to reveal the relationship between teacher beliefs on mathematics and their teaching practices.

Li and Yu (2010) studied on beliefs of a prospective teacher in China regarding mathematics. They detected an inconsistency between prospective teacher's belief regarding mathematics education (the belief on the nature of knowledge) and his or her teaching practice. Lack of

pedagogical content knowledge was revealed to be the underlying reason of this inconsistency.

Haser and Dogan (2012) analyzed the belief system of prospective mathematics teachers regarding mathematics. It was found out that over the years, prospective teachers' beliefs regarding mathematics change as well. They decided that the relationships between concepts become more important. The terms encountered in prospective teachers' beliefs regarding mathematics learning were mathematics, mathematical thinking and pleasure received from mathematics which are also encountered in daily life. Besides, a previous study indicated that prospective teachers consider mathematics as a static system. They also asserted that their views on the purpose of teaching and learning mathematics differ from each other. (Viholainen, Asikainen & Hirvonen, 2014). This result is caused by the nature of mathematics while another reason may be the variety of beliefs regarding mathematics teaching and learning.

Francis (2015) explored the belief systems of two elementary teachers, describe ways in which their beliefs and practices appeared to be misaligned, and provide reinterpretations of these perceived inconsistencies. She decided from the study that the teachers' statements and actions seemed to be inconsistent. In particular, the teachers identified time, testing concerns, and the influence of parent expectations as constraints and it was observed that they impacted the teachers' lesson planning and implementation.

Dionne (1984) suggests that mathematics can be seen as a combination of three basic components called the traditional perspective, the formalist perspective, and the constructivist perspective (as cited by Liljedahl, 2008). Similarly, Ernest (1989) mentioned three different philosophical views regarding the nature of mathematics. They are instrumental, Platonic and problem solving views. Based on these views, three different teaching models were defined as well. These are called instructor, explainer and facilitator mathematics teaching. Teachers complying with instructor teaching model adopt instrumental philosophy. They focus on learner's exhibition of accurate behaviours. According to this view, mathematics is as a set of rules, formulas, skills and procedures, and mathematical activity is that calculating using rules, procedures and formulas. Teachers who adopt explainer teaching model are closer to Platonic philosophy and they attach importance to conceptual learning. According to this view, mathematics consists of logic, rigorous proofs, exact definitions and a precise mathematical language. Teachers who adopt

facilitator teaching model try to aid learners to develop self-confidence during problem solving process. Relations between different notions and sentences play an important role. According to this view, mathematical activity involves creative steps. Teachers define mathematics teaching with different words based on the teaching model they adopt.

Wong, (2007), Perry (2007), Wang and Cai (2007) decided that effective mathematics teacher and teaching vary from culture to culture. However, there are some points which stand the same. There is a common view especially in international arena regarding an efficient mathematics teaching such as its association with daily life, the obligation of memorizing from time to time, the importance of mathematical comprehension, teacher's content knowledge, consideration of mathematics as a language and that it is a means of problem solving (Bryan, Wang, Perry, Wong & Cai, 2007; Kaiser & Vollstedt; 2007).

No matter how strong the theories regarding teaching are, not adopting these theories or not transferring them into practice despite the adoption will not result in a raise in quality. The philosophy that teachers adopt is related to their teaching practice directly and some studies which were carried out regarding effective mathematics teaching based on Ernest's model (Wong, 2007; Perry, 2007; Wang ve Cai, 2007; Bryan, Wang, Perry, Wong ve Cai, 2007; Viholainen, Asikainen ve Hirvonen, 2010). In order to analyse teachers' practice this model quitely suitable. It can be said that if a teacher adopts instuctor model, her/his teaching base on behavourist approach. Similirly, if a teacher adopts faciliator model, her/his teaching base on constructivist approach. As for explainer model, one can say that teacher's teaching base on a mix approach (both behavourist and constructivst). Thus, this study is an attempt to reveal which teaching models based on Ernest (1989) are adopted more by mathematics teachers in Turkey, how they conduct geometry lessons and the views on an effective geometry lessons. In addition, a detailed portrait of the differentiation between the designed and the practiced courses in Turkey will be uncovered.

METHOD

This is a case study because of that the selected schools are the most successful ones in Bursa and also the observed teachers are the effective ones according to students, their parents, school managers and inspectors. The purpose is to reveal practices of mathematics teachers in geometry classes and how they think a proper geometry course should be. Thus,

observation and interview methods were employed as the data collection tools. Therefore, this is a qualitative study.

Participants

Based on the research purpose, 8 middle school mathematics teachers were observed for 8 hours of classes. Characteristics of the observed teachers are given in the following table.

Table 1: Characteristics of Participants (teachers)

	Sex	Experiance (years)	School Type	Graduation Department	School Level
Esin	Female	9	Private	Mathematics	Middle-High school
Cansu	Female	10	Private	Mathematics	Middle-High school
Lale	Female	13	Private	Mathematics	Middle-High school
Zeliha	Female	12	Private	Mathematics	Middle-High school
Filiz	Female	9	State	Mathematics Education	Middle
İsmail	Male	21	State	Mathematics Education	Middle-High school
Eray	Male	11	State	Mathematics Education	Middle
Riza	Male	20	State	Mathematics	Middle

Five of the teachers graduatedfrom mathematics departmentswhile the others graduated from mathematics education departments. Five of them had worked in high schools but now all of them work in middle schools. Four of the schools are private and the others are state schools in the province of Bursa. These eight schools have high level of achievement in the examination conducted for transition from middle school to high school (SBS/national placement test.

Data Collection and Analysis

An semi-structured observation form was developed by the researcher for data collection. For this research, Ernest's model was selected as the baseline. In order to determine that according to which model teachers act in their lessons, the form included the possible situations that could be encountered in a class. The observation form consisted of 126 items under three categories; introduction, lecture and assessment. Afterwards, expert views regarding this form were received and similar items were combined.

The items were reduced to 71 distinction questions. The observations form is attached (Appendix 1).

In order to finalize the observation form, one researcher conducted 7 hours of pilot study while other two researchers conducted 4 hours in middle school geometry courses. Following this process, expert views were received once again. During pilot study of the observation form, planning phase of the teacher and learner interest and attitude could not be observed objectively. Thus, these two titles were excluded from the form. Definition was also added to the sub-title taking into account expert views. Observation form consisting 66 items at the final stage was categorized under three main titles (introduction, lecture and assessment). The main title of lecture was organized under six sub-titles which were definition, concept teaching, material use, association, problem solving and method-technique. There was no need to create sub-titles remainingthe other two titles.

In observation form, there are items about both traditional and constructivist behaviours. For example the items "Teacher starts to lesson by informing students of the goals" and "Teacher uses multiple-choice question" refer to traditional methods while the items "Teacher starts the course with a collaborative discussion" and "Teachers makes activities which students can be active." refer to constructivist methods. Also there are some items regarding effective mathematics teaching like "Teacher uses concrete materials in the course" and "Teacher associates with daily life during the course."

Eight middle school mathematics teachers were observed during the courses in which geometry subjects would be lectured for 64 hours in total each of which took 8 hours. They were carried out as non-participant observation. In order to ensure reliability, 2 of the 8 teachers were observed by two researchers. When collected pieces of data were observed, it was seen that there is a consistency at a rate of 95% between the observations of two researchers. The rest of 6 teachers were observed by only one researcher using this form. For the analysis, it was determined how many times a teacher acted according to the mentioned item along the 8 lessons. Each teacher was considered to "possess" the behaviour if he or she exhibited such behaviour in 4 lessons or more.

After the observations, each teacher was interviewed in a semi-structural way for 30-35 minutes. During the interviews, teachers were asked about the purposes of geometry lessons in middle school. There were also questions on the indicators of an ideal geometry lesson. There are questions about the significance of problem solving and activities in mathematics. Data

obtained from the interviews were subjected to content analysis. First of all, interviews were transcripted and the data were coded. The interviews made with two teachers were analysed by two researchers independently. The codes revealed were compared. There was a consistency of 90% between the codes between two researchers. Researchers collaborated for non-complying codes and arrived at a consensus. After the consensus, categories was created according to codes. The interrelated categories were represented under the same theme. Three themes occured; "Purposes of Geometry Classes", "The Obstacles Preventing Geometry Courses from Fulfilling Their Purposes" and "Teaching Geometry". While presenting the findings, nicknames of the teachers were used.

FINDINGS

Below, there are findings in relation to teaching practices of teachers and the findings in relation to the geometry courses they designed respectively.

Findings About Teaching Practices

Findings in relation to teaching practices were obtained via observations. Eight teachers were observed for 8 lessons and observation forms were completed. The observations started when teacher would start the new topic. The observed lessons required both teaching conceptual knowledge and making exercise, problem solving. The topics depended on which grade was observed. They were linear equations, circle, polygons, quadrilaterals and solids (prism, pyrimid, cone…). Class sizes are among 25-30 students. The collected data were analysed by researchers. Generally, teachers review previous topics with students before introducing the new subject. There is still a traditional ambiance in the classes. Some teachers make associations with daily life; however, these associations were merely simple exemplifications. The behaviours which were not employed by teachers were mainly the behaviours appropriate for constructivist approach. For example questions and discussions keeping learners mentally active were not conducted in the classes. The most distinct behaviours which were not met by teachers were problem solving, associations and keeping students active (making learners discover the connections between concepts, conducting activities and the like).

It is possible to say that none of the 8 teachers were in compliance with facilitator model while 4 were in compliance with instructor model and

the rest 4 were in compliance with the explainer model. This can be explained with the following words for each teacher.

Teacher Rıza was observed when he taught prisms to 8th grade students. He starts the class by using expressions which would inform learners about the objective. The concepts are defined by himself and the connections between the concepts are explained by himself as well. He provides information regarding the next class and associates this class with the previous one. The class also covers associations with the daily life. However, these are merely examples from daily life within the lecture. For example; while lecturing the subject of sphere with 8th graders as a part of prism subject, examples like melon, ball, globe, orange and plums were provided. The class goes on with routine problems and exercises. The questions employed were the ordinary ones that can be found in every test book. One of the problems that he used was "Find the volume of cone of which radius of base is 5 cm and height is 9 cm.". He employs question-answer and chalk-and-talk methods in his classes. The assessment he tries to make during the class indicates that he attaches importance both to the process and the product. Considering all these facts, it is possible to assert that Riza employs a teacher-oriented method and is closer to instructor teacher model.

Teacher Eray was observed when he taught prisms to 8th grade students, like Teacher Rıza. He makes no preparation for his students to introduce the new subject. As soon as he enters classroom, he just writes questions on the board as exercises and starts to lecture the subject directly with these questions. One of the questions was that: "What is the lenght of face diagonal of the cube of which surface area is 150 cm^2." By the use of this question, he immediately started to talk about properties of a cube. When he wants to teach a concept, he neither defines the concepts nor makes his students define them. He indicates no connections between the concepts. He builds associations with the previous classes and informs students about the next class. There are mainly routine problems and exercises in his classes. He generally prefers lecturing and he conducts a traditional class which is distant from the new mathematics curriculum. Considering the behaviours of Eray, it is possible to deduce that he is closer to instructor model.

Teacher Filiz was observed when she taught area of quadrilaterals to 5th grade students. Contrary to other two teachers, she addresses questions to her students at the beginning of the lessons and students think about the topics which they learnt before and try to link with hew topic. Teacher's this

behaviour activates prior knowledge of students. Though she defines the concepts, she lets her students dwell on the associations between the concepts. For example, in a lesson she had a activity make students. In this activity students built a paralellogram by using rectangle. After activty, although she explained the relation between these two concepts, before her explination she dwelled students to explain what happened. The materials which were employed are concrete ones that have a role in literature of efficient mathematics teaching. They serve to produce efficient learning. She employs discussion method despite her class is mainly based on exercises. She also conducts activities. Though she seems closer to constructivism, she makes explanations during the class and also employs lecturing. This indicates that she complies with cognitive-behaviourist ecole. She focuses not only on the correct answers but also on the process of achieving correct answers during the class. She assigns test questions as homework. It is possible to say that Filiz is closer to explainer teacher model.

Teacher İsmail was observed when he taught prisms to 8th grade and linear equations to 7th grade students. He starts the class by informing them about the objective. However, he is a good-humoured man with witty speeches which interests learners. He focuses on prior knowledge of learners during the class. He prefers defining the concepts and the connections between the concepts. For example, he explained the difference between cube and tetragonal prism. He concentrates on drawings rather than concrete materials. Despite the lacks in the associations, he frequently uses examples from daily life. The examples he chooses really draw the attention of learners. While starting the subject of linear equations with 7th grades, he talked about why taximeters turn on with a fixed number. He received the views of learners. Upon this, he started to explain linear equations. The questions selected by him to solve during the class are routine. One of the questions is as follows: “What is the surface area of the equilateral triangle of which lenght of base edge is 12 cm and height is 20 cm?” They serve the purpose of exercise. He employs question-answer and lecturing methods in his classes. Teacher İsmail can be accounted as an instructor teacher just like Riza and Eray.

Teacher Cansu was observed when she taught circle to 7th grade students. She revises the previous subjects briefly and informs learners about the objective to prepare them for the class. She gives them time to think over the concept and later she defines the concepts. She prefers explaining the connections between the concepts instead of making learners discover them. She uses smart board. In terms of association, she only makes associations

with the previous subject and informs about the next one. Associations with the daily life are rare. The problems solved during the class are mainly routine problems. Apart from smart board, the class is closer to traditional classes. Taking into account such behaviours, it is possible to say that Cansu also complies with the instructor teacher model.

Teacher Esin was observed when she taught prisms to 8th grade students. She asks questions to prepare learners for the class. She also uses concrete materials before moving on to the new subject to make learners remember the previous subjects. Though she defines the concepts, she lets her learners to think over the concepts. However, she is not inclined to make learners discover the connections between the concepts. She uses concrete materials during the class. She integrates technology to her classes and uses smart board. Though she solves routine problems, some of the problems she chooses require associative abilities covering contextual-operational and conceptual-operational knowledge. For example one of the problems is as follows: "When a triangular prism made from wood is thrown to water, half of it sinks and 120 cm3 water is overflow from the bucket. Lenght of sides of triangle are 6 and 8 cm. What is the height of prism?" Assessing the behaviours of Esin, it is possible to categorize her as explainer teacher.

Teacher Lale was observed when she taught similarity of polygons and circle to 7th grade students. Sheinforms learners about the objective and reminds them of the previous subjects. She does not dwell much on concept definitions and the connections between the concepts. She frequently employs concrete materials and visuals during her classes. She rarely builds associations with daily life. During the classes, she mainly builds associations with the previous subjects. It is clear that Lale is experienced in problem solving. The problems she chose consist both the routine and non-routine ones. She has problems covering operational, conceptual and contextual knowledge. She employs various methods in her classes and conducts discussions. She leads an efficient class. Considering the behaviours of Teacher Lale, it is possible to categorize her as explainer teacher.

Teacher Zeliha was observed when she taught solids and area of quadrilaterals to 5th grade students. Just like Lale, Teacher Zeliha informs learners about the objective as well. She starts the class by revising the previous subjects. Though she defines the concepts, she lets her learners think over the concepts and she also provides them the opportunity to associate a new concept with a previous one. She employs concrete materials actively. She has behaviours regarding the association phase less than others.

While solving problems, she prefers rather routine problems and exercises. In addition to lecturing and question-answer methods, she also employs discussion. Considering her behaviours leading learners to think, she can be categorized as explainer teacher as well.

Findings About Teachers' Views on Geometry Courses

These findings were obtained from the interviews conducted with teachers. As a result of interview analyses, teacher views regarding an ideal geometry class were categorized under three themes. These themes are Purposes of Geometry Classes, The Obstacles Preventing Geometry Courses from Fulfilling Their Purposes and Teaching Geometry. Data analysis results are summarized in the tables below. The situations mentioned by only one of the teachers aren't included in the tables. They are explained separately.

As seen in Table 2, all 8 of teachers focused on the use of geometry in everyday life. However, they also stated that using geometry in everyday life is not enough; it should contribute to school life as well. Apart from the statement given above, there were teachers expressing that learners should develop abstract thinking (Esin), problem solving (Filiz), high level thinking (Eray), analytical thinking and patience (Zeliha) abilities. They also stated that geometry teaching should contribute mental development of learners.

Table 2: Teacher's Views Regarding The Purposes of Geometry Teaching

Theme	Category	Code
Purposes of Geometry Teaching	To contribute to school life	enabling core knowledge (4) (Z, L, C, Es), getting ready for national exams (3) (İ, L, Es), getting ready for further education life (2) (Z, L)
	To contribute to everyday life	using the knowledge in daily life (8), giving point of view (3) (Z, Er, C), developing visual spatial ability (2) (Z, Es), developing thinking skill (2) (Z, F), expanding student's horizon (2) (L, C), developing reasoning skill (2) (L, F)

Table 3 shows the reasons preventing teachers from fulfilling the purposes. Timing problems and intensity of the curriculum were shown as the strongest reasons.

Table 3: The Obstacles Preventing Geometry Courses From Fulfilling Their Purposes

Theme	Category	Code
The Obstacles Preventing Geometry Courses from Fulfilling Their Purposes	Obstacles originating from students	student's readiness (2) (Z, L), lack of previous knowledge (2) (Z, L), student's inactivity (2) (İ, F)
	Obstacles originating from education system	Lack of time (8), intensive curriculum (8), national exams (6) (Z, İ, Er, L, Es, F), crowded classes (4) (R, L, C, F), heterogeneous classes (3) (R, Er, L)

Other teachers apart from Riza and Cansu consider SBS as a serious obstacle. According to them, the students must be successful in SBS and because of that they can't carry out their purposes. They have to solve routine problems and exercises. The learner-originated problems were learners' being result-oriented (İsmail), not understanding the problem (Lale) and the demands to solve tests (Filiz). İsmail said that students were result-oriented so they wanted everything prepared and saw the result immediately. Filiz, like İsmail, said that students wanted to solve multiple-choice questions so she couldn't carry out constructivist activities. Some teachers also stated there may be obstacles caused by the teachers. Teacher-originated problems were defined as not teaching mathematical thinking (Zeliha), not having a specific method (İsmail), encouraging memorization by the primary school teacher and knowledge level (Esin, Eray), the fact that teachers do not have time for themselves (Lale) and not motivating the learner (Cansu).

Teacher views on ideal geometry teaching are shown in Table 4 which is as follows.

Table 4: Teacher Views Regarding Ideal Geometry Teaching

Theme	Category	Code
Teaching Geometry	View on learning environment	using concrete materials (8), associating daily life (8), using visuals (8), active participation (6)(Z, İ, L, C, Es, F), using previous knowledge (6)(Z, R, Er, L, C, F), use humour (5)(Z, İ, C, Es, F), using discovery teaching method (4) (Z, İ, C, Es), re-guided reinvention (4) (Z, C, Es, F), teaching conceptual knowledge (4) (Z, İ, R, L), performing an application (4) (Z, İ, Es, F), using technology (4) (Z, R, C, Es), limited class size (4) (İ, R, Es, F), with drawings (4) (İ, R, Es, F), without memorization (4) (L, C, Es, F), memorization after understanding (3) (Z, R, Es), with games(3)((L, C, F), with problem solving (3) (Z, Er, L), with activities (3) (Z, L, F), solving questions (3) (Z, R, C), repeating (3) (Er, C, Es), teaching operational knowledge (2) (İ, R)
	View on teachers	motivating students (3) (Z, İ, C), rewarding students (2) (İ, F), teacher's content knowledge (2) (R, L), let students finding alternative solving ways for problems (2) (R, F)
	View on students	be appropriated activity by student (4) (Er, C, Es, F)
	External factors	mathematics classes (2) (İ, Es)

As seen in Table 4, teachers focused on some factors for geometry teaching such as learning environment, teacher, and certain issues with learners as well as some specific external factors. All of the eight teachers stated that the class should be associated with daily life and concrete materials should be used. They also emphasized the importance of using visuals. All the teachers except from Eray and Riza stated that learners should participate in the class actively. Apart from factors concerning learning environment, there are elements concerning teachers, learners and some external factors. Apart from the statements given in the Table, Eray expressed that the systems of the countries which are successful in PISA should be taken as example. It was stated that in an ideal geometry class, PISA type questions (Esin), non-routine problems (Filiz) should be solved and importance must be given to interdisciplinary associations.

Findings Obtained As a Result of Comparing Teaching Practices and Views on Geometry Teaching

At the end of the observations and interviews, inconsistencies between teaching practices and ideal geometry classes were observed. Table 5 showing teaching practices and the association between them and their views is below. The symbols on the table are as follows: S+ refers to “Said”, S- refers to “Not Said”, D+ refers to “Did” and D- refers to “Did Not Do”. The table continues in the following page.

Dealing with each teacher separately, it is possible to say that Riza stated that the class should be supported with drawings (drawings of geometrical shapes) while he did not employ this method in his classes. Eray is in compliance with instructor teacher model, however, he stated that PISA type questions should be solved. Yet, he did not employ non-routine contextual problems which is what characterizes PISA type questions.

Table 5: Comparing Teacher's Teaching Practices and Views on Geometry Teaching

	Riza		Eray		Filiz		İsmail		Cansu		Esin		Lale		Zeliha	
To contribute to daily life is the purpose of geometry teaching.	S +	D +	S +	D -	S +	D -	S +	D +	S +	D -	S +	D -	S +	D -	S +	D -
Courses should associate with daily life.	S +	D +	S +	S -	S +	D -	S +	D +	S +	D -	S +	D -	S +	D -	S +	D -
It is important for students to participate lessons actively.					S +	D -	S +	D -	S +	D -	S +	D -	S +	D -	S +	D -
Students should discover the concepts.					S +	D -	S +	D -	S +	D -	S +	D -	S +	D -	S +	D -
Geometry should be taught with geometric drawings.	S +	D -														
Non-routin problems should be solved.			S +	D -	S +	D -					S +	D -				
Teaching should be with discovery teaching method.							S +	D -	S +	D -	S +	D -				
Interdisciplinary associations should be made.											S +	D -				

İsmail, Esin and Cansu stated that learning should be based on discovery, however, they defined the concepts and explained the associations between the concepts. İsmail built associations with daily life complying with his behaviours and statements yet, learners were passive listeners at this stage. Though Esin stated that non-routine problems should be solved, she mainly used routine problems. Despite mentioning interdisciplinary associations in the interviews, there was not any practice in her classes complying with this situation.

Although Filiz expressed that learners should discover the concept themselves, she defined the concepts herself in her classes. Though the demand of solving multiple choice practice questions was seen as an obstacle preventing learners from fulfilling the purposes of the geometry classes, she assigned multiple choice practice questions to her students as homeworks. Despite mentioning the necessity of solving non-routine problems in the classes, she conducted her classes with routine problems.

Lale highlighted the importance of associations with daily life. However, it was observed that she did not actually do this in her classes. Zeliha expressed that the purpose of geometry teaching was to broaden

learners' horizons. However, she did not seem to fulfil this purpose in her classes. She did not solve any problems to serve this purpose.

DISCUSSION and CONCLUSION

Pajares (1992) stated ''beliefs cannot be directly observed or measured but must be inferred from what people say, intend, and do – fundamental prerequisites that educational researchers have seldom followed'' (As cited by Leatham, 2006). In order to infer a person's beliefs with any degree of believability, one needs numerous and varied resources from which to draw those inferences. You cannot merely ask someone what their beliefs are (or whether they have changed) and expect them to know or know how to articulate the answers (Leatham, 2006). So that different methods must be used. Primary sources for information about teachers' beliefs include questionnaires and interviews (Speer, 2006).

In this study, eight teachers were observed and interviewed. Following the interviews conducted with them, observations and interview results were compared. There were situations showing consistency and inconsistency. Though teachers acted generally more traditional in their classes, they reflected a more constructivist approach in their interviews. They reported that a learning environment in which the learner becomes active is an indispensable part of an ideal geometry class. This result corresponds to the results of Isık and Kar (2012), Toptas (2012) which claims that teachers still employ traditional methods to conduct classes. Also Speer (2006) stated that it is quite plausible that there are situations where teachers state beliefs that are inconsistent with what they carry out in their classrooms. On questionnaires or in interviews, terms used by researchers to describe beliefs and practices (for example, "problem solving," "cooperative learning," etc.) may not carry the same meaning for teachers as they do for the researchers. For example he interviewed and observed two teachers who are doctoral students in mathematics. Similar to our research, he found that there were some inconsistencies between their beliefs and practices. One of teachers thought that students must be independent, solve problems in their groups and teacher must assume a Socratic role. But in the class he didn't make students independent. Although he asked many questions, he did not probe for student understanding or illuminate the mathematical ideas and relationships he professed to value. The other teacher thought that he had to be a guide in mathematics classes. He believed that it was important to guide students through problems and act as "an intellectual resource" of information. But in class his instructional practices did not involve "guiding"

students to solutions to problems in the ways that might be inferred from what he said during interviews.

Teachers employ concrete materials in their classes; they give importance to using visual materials in addition to memorizing. This result corresponds to the literature of efficient mathematics teaching. However, efficient mathematics literature also focuses on association with daily life and problem solving (Wong, 2007; Perry, 2007; Wang & Cai, 2007; Bryan, Wang, Perry; Kaiser & Vollstedt; 2007). It was seen that observed teachers did not met the expectation at these two points.

All of the teachers stated in interviews that geometry teaching is necessary to contribute to daily life. They also asserted that associations with daily life should be built in the classes. However, observation results indicated that only İsmail and Riza built associations with daily life. In addition, the associations built by Riza were rather primitive. Six teachers (Zeliha, İsmail, Lale, Cansu, Esin and Filiz) asserted the importance of active participation in an ideal geometry class. However, none of them let their learners to discover the concepts or they became the active ones in situations where learners were supposed to be. In this sense, it is possible to say that participation of learners in classes was not a mental but a physical one. Considering the terms expressed by teachers in the interviews, they correspond to the ones mentioned in Haser and Dogan (2012) emphasized by prospective teachers which were “mathematics in daily life”, “mathematical thinking” and “pleasure received from mathematics”.

As a result of evaluation of each teacher, common points of inconsistencies can be categorized under two divisions:

(1) The reflections of current educational ambiance on education process (SBS, intensity of the curriculum, lack of time…)

(2) The reflections of teacher beliefs concerning the nature of knowledge (epistemological belief, pedagogical content knowledge)

These results correspond to the ones obtained in studies regarding the obstacles of program’s practicability (Mesin, 2008; Oren, 2010; Turk, 2011; Budak & Okur, 2012) and the studies focusing on teachers’ pedagogical content knowledge and epistemological beliefs (Li & Yu, 2010).

Teachers complained about lack of time and they said they couldn’t prepare the lessons in compliance with constructivist methods. Similarly, Francis (2015)’s study was showed that according to teachers, a problem-solving approach takes more time than more traditional methods. In this

regard, it would be ‘‘sensible’’ that if there were time constraints to cover a fixed curriculum, then you use the less time-consuming traditional methods.

In order to eliminate these inconsistencies, central examinations like SBS and OSS (national student selection examinations), which is being implemented in Turkey, should be replaced by examinations consisting questions to test whether the objectives stated in mathematics curriculum were achieved or not. Besides, teacher education should be enhanced. In order to have teachers complying with explainer and facilitator model, cautions should be taken against the education given at universities. These cautions should be about preventing the inconsistencies between epistemological beliefs of teachers and their teaching practices. In this sense, prospective teachers should not only be informed about constructivist approach but they should be expected to practice this approach in the class.

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APPENDİX 1

DERSİN SINIFI/KONUSU: TARİH:

ÖĞRETMEN: SINIF MEVCUDU:

Amaç: Türk Eğitim Sisteminin içindeki başarılı matematik öğretmenlerinin geometri konularının öğretiminde sergiledikleri davranışlardan yola çıkarak etkili bir geometri dersinin özelliklerini belirleyebilme.

-: yapmıyor ±: kısmen yapıyor +: yapıyor

1	**DERSE GİRİŞ**	**-**	**±**	**+**	**Açıklamalar**
1.1	Öğrencileri hedeften haberdar ederek güdülüyor.				
1.2	Bağlam içinde sunulan örneklerle derse başlıyor.				
1.3	Öğrencileri önceki konuları hatırlatarak derse başlıyor.				
1.4	Öğrenciyi somut materyal kullanarak derse hazırlıyor.				
1.5	Öğrencilere sorular yönelterek derse başlıyor.				
1.6	Tartışma açarak öğrencileri derse hazırlıyor.				
1.7	Öğrencilerde ilgi ve merak uyandırıyor.				
1.8	Öğrenciyi güdülemek için güler yüzlü davranıyor.				
1.9	DİĞER				
2	**İŞLENİŞ**				
2.1	**TANIM BİLGİSİ**				
2.1.1	Öğrencilerin ön bilgilerini harekete geçirecek uygulamalar yapıyor.				
2.1.2	Öğrencilere kavramların tanımları üzerine düşünme fırsatı veriyor.				
2.1.3	Kavramların tanımlarını kendisi veriyor.				
2.1.4	DİĞER				
2.2	**KAVRAM ÖĞRETİMİ**				
2.2.1	Kavramlar arasındaki ilişkileri öğrencilere bulduruyor.				
2.2.2	Kavramlar arasındaki ilişkileri kendisi açıklıyor.				
2.2.3	Öğrencilerin kavram yanılgısını gidermeye çalışıyor.				
2.2.4	Öğrencilerin bilgi eksikliklerini gidermeye çalışıyor.				
2.2.5	DİĞER				
2.3	**MATERYAL KULLANIMI**				
2.3.1	Somut materyaller kullanıyor.				
2.3.2	Ders kitabını aktif bir şekilde kullanıyor.				
2.3.3	Tahtayı aktif bir şekilde kullanıyor.				
2.3.4	Teknolojiyi kullanıyor.				
2.3.5	Öğretimde görselliğe önem veriyor.(Şekil, şema vs.)				
2.3.6	Öğrencilere defter kullandırıyor.				
2.3.7	Kendi ders notlarını kullanıyor.				
2.3.8	DİĞER				

2.4	**İLİŞKİLENDİRME**	**-**	**±**	**+**	**Açıklamalar**
2.4.1	Ders süresince günlük yaşamla ilişkilendirme yapıyor.				
2.4.2	Disiplinlerarası ilişkilendirmeler yapıyor.				
2.4.3	Ders sonunda sonraki ders ile ilgili bilgi veriyor.				
2.4.4	Öğretim sürecinde konuyu önceki konularla ilişkilendiriyor.				
2.4.5	Öğretim sürecinde konuyu sonraki konularla ilişkilendiriyor.				
2.4.6	DİĞER				
2.5	**PROBLEM ÇÖZME**				
2.5.1	Gerçek hayat problemleri ile dersi işliyor.				
2.5.2	Rutin problemlerle dersi işliyor.				
2.5.3	Rutin olmayan problemlerle dersi işliyor.				
2.5.4	Farklı zorluk düzeyinde problemler kullanıyor.				
2.5.5	Farklı bilgi türlerini gerektiren problemler kullanıyor.				
2.5.6	Formülü (modeli) öğrencilerin geliştirmesine imkan veriyor.				
2.5.7	Problem çözme sürecinden sonra öğrencilerin bulduklarını açıklamalarına imkan sağlıyor.				
2.5.8	Öğrencilere problemi çözerken yardımcı oluyor.				
2.5.9	Çoktan seçmeli sorular çözdürüyor.				
2.5.10	Soru sorduktan sonra öğrencilere düşünmeleri için zaman tanıyor.				
2.5.11	Alıştırmalar yaptırıyor.				
2.5.12	DİĞER				
2.6	**YÖNTEM-TEKNİK**				
2.6.1	Öğretimde farklı teknikleri bir arada kullanıyor.				
2.6.2	Öğrencilerinin seviyelerine göre ders anlatıyor.				
2.6.3	Öğrencilere etkinlikler yaptırıyor.				
2.6.4	Sınıf içi tartışma ortamı oluşturuyor.				
2.6.5	Öğrencilerin bireysel çalışmasını destekliyor.				
2.6.6	Öğrencilerin işbirlikli çalışmasını destekliyor.				
2.6.7	Öğrencilere açıklamalar yapıyor.				
2.6.8	Öğrencilerin sorularına net cevaplar veriyor.				
2.6.9	Anlatılanları ders süresince tekrar ediyor.				
2.6.10	Öğrenilenleri pekiştirmek için örnekler veriyor.				
2.6.11	Öğrenilenleri pekiştirmek için öğrencilere örnekler verdiriyor.				
2.6.12	Zorluk çeken öğrencilerle birebir ilgileniyor.				
2.6.13	Sınıf içerisinde geziyor.				
2.6.14	Öğrencilere yapmaları gerekenleri aşama aşama söylüyor.				
2.6.15	Ezbere olanak sağlıyor.				
2.6.16	Konuyu özetliyor.				
2.6.17	Öğrencilere pekiştireçler ve ödüller veriyor.				
2.6.18	Öğrencilere gerektiğinde cezalar veriyor.				
2.6.19	Matematiksel dil ve sembolleri kullanıyor.				
2.6.20	Öğrencilerine matematiksel dil ve sembolleri kullandırıyor.				
2.6.21	DİĞER				

3	**DEĞERLENDİRME**	**-**	**±**	**+**	**Açıklamalar**
3.1	Öğrencilerin yaptıkları işlemlerde/verdikleri örneklerde sonucun doğruluğu ile ilgileniyor.				
3.2	Öğrencilerin yaptıkları işlemlerde/verdikleri örneklerde süreçte yaşananlarla ilgileniyor.				
3.3	Ödevler veriyor.				
3.4	Akran değerlendirmesi yaptırıyor.				
3.5	Dersten sonra öğrencileriyle ilgili notlar alıyor.				
3.6	Ders sonunda küçük sınavlar yapıyor.				
3.7	Öğrencilerine matematik günlükleri kullandırıyor.				
3.8	Öz değerlendirme yaptırıyor.				
3.9	DİĞER				

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