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IDENTIFYING BARRIERS WHEN TEACHING SCIENCE AND MATHEMATICS IN LOW ECONOMY REGIONS: SWANSEA AND HAKKARI AS CASE STUDIES

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Abstract. *The purpose of this research was to identify the barriers that upper-secondary school science and mathematics teachers face during the teaching process in economically disadvantaged regions (Hakkari, Turkey and Swansea, UK). The research design was comparative case research and pursues qualitative methodological approach in collecting and analyzing the data about the barriers that teachers are encountering during the teaching process. The research sample consisted of 24 science and mathematics teachers from different upper-secondary schools in Hakkari and Swansea. Semi-structured interview forms, were developed and employed to collect the data. The thematic analysis was used to analyze the obtained data. The results revealed different categories in understanding the situations that science and mathematics teachers confront in both cases; student-related issues, pedagogical issues, teachers' lack of subject knowledge and socio-economic and cultural-based issues. As student-based barriers, lack of prior knowledge, students`attention span, and interest; and regarding teachers-based barriers, teachers` lack of class management and communication skills, and lack of student-centered methods found as similar barriers. Language and socio-economical problems were also shared barriers for both cities. In addition to those barriers, political and family-based issues which hindered educational attainment found as the main barriers by science and mathematics teachers in Hakkari.*

Keywords: *comparative case research, mathematics teachers, science teachers, teaching barriers.*

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Introduction

Knowledge has become one of the main sources of power in the global world and is necessary in order to be the part of global economy. In a way, it has become a global investment, and this makes education more important. The quality and equity of a country's education system can help shape its future. An education system in which all students have opportunities to learn can strengthen the capacities of individuals and societies that can contribute to economic growth and social well-being (OECD, 2014). Despite its necessity in the construction of a knowledge-based society and human development, educational systems confront serious problems in many countries, even in European countries which are highly developed (EACEA, 2018; Simões, Lourenco, & Costa, 2018). For example, teachers in both Turkey and Wales face certain barriers in the teaching process (Donaldson, 2015; Estyn, 2013; MEB, 2017; Ozyilmaz; 2017**).** These barriers, however, seem to vary from one country to another but share some common points. Different reports identified some barriers as teacher-based issues, curriculum-related issues, monolingual education issues, and racial and socioeconomic segregation issues. These barriers affect teachers, students, administrators, financial resources, the learning environment, families and other stakeholders. Among those barriers, socioeconomic status is an important factor during the teaching process. Socioeconomic status is not just about income. It also indicates social class, educational attainment, perceptions, and the physical and psychosocial statuses of societies. Bourdieu (1973) also defined the environment in which groups live and flourish via the term "habitus." He argued the role of schools in social reproduction and supported his view by claiming that students from different social classes have different habitus and ways to access the cultural resources that affect students' academic achievement. Douglas (1964) also emphasized in "cultural deprivation theory" that parental attitudes, family size, position within families and the scant care of babies in crowded families with less socioeconomic resources have a great impact on students' disposition in school and life. According to the PISA 2015 results, the students who socioeconomically had advantage tended to outscore disadvantaged students by large margins (OECD, 2016a).

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Teachers as part of the teaching process they are confronting those socioeconomic barriers and they have an important position in the development of the teaching process, which strongly affects teaching quality. Due to the characteristics of their profession, teachers are also in a position that shapes the future of society (Sisman & Acar, 2013). Therefore, teachers are responsible for helping students reach their academic potential. In this sense, teachers need to equip their students with a variety of skills and knowledge required for the future and for life; even more important is the need to nurture students in the ideals of a modern democratic society (Dewey, 1927 in Tirri & Kuusisto, 2016). Developed and developing countries need individuals with 21st Century skills such as creativity, teamwork, technology use, problem-solving, and critical thinking to become integrated into the knowledge-based society. To meet this need, students should also be equipped with science, technology, mathematics and engineering (STEM) skills. As a result, in order to train individuals who are experts in their field, to educate future scientists and engineers who will contribute to the development of the country and to produce science-based technological innovations, students should be equipped with science, mathematics and technology literacy skills (Miaoulis, 2009), which is the responsibility of teachers. Hence, teacher education should give priority to teachers, and the curriculum should be arranged in a way to consider the barriers faced by teachers since it has strong/direct influence on the quality of education (Brouwer, 2007).

Research Problem

The discussion provides a valuable context in understanding the issues related to the barriers during the teaching process; however, less attention has been paid to the barriers for teaching at the local level - especially in regions where there are diverse social-cultural and economic values. Furthermore, the focus was not specifically on the issues related to teaching in general or on the problems that science and mathematics teachers encounter during the teaching process. Also, due to the importance given to STEM education, more work has been loaded on the shoulders of science, mathematics and technology teachers at schools. Therefore, in this research, comparisons were made between secondary science and mathematics teachers in Hakkari and Swansea where there are depressed economies.

Research Focus

Studies conducted in the field claimed that there were similar barriers encountered individually by teachers, such as the length of the curriculum, lack of time, unsuitable laboratory facilities, insufficient tools and materials for experimental studies, students' lack of discipline and their low level of interest in learning science. Teachers' lack of professional development was also referred to as a constraint that seems to play an essential role in this process (Vasconcelos, Tores, Moutinho, Martins, & Costa, 2015, p.2). Furthermore, student absenteeism, the gap between the academic curriculum and the local labor market, and the time available for working with students with special needs are other barriers that have been found that are related to the classroom during the teaching process (Heaviside, Carey, & Farris, 1994; Cano, 2016).

This research took a closer look in this respect in two regions, Hakkari in the Kurdish part of Turkey and Swansea in the Welsh part of the U.K. The problems regarding the teaching process become especially evident in Turkey. A lot of studies carried out in different cities in Turkey found that the barriers reported by teachers mostly included inequality regarding the selection of principals, lack of training for teachers, poor teaching quality, employment problems, insufficient infrastructure and equipment, crowded classrooms, influence of politics on educational policies, ideological issues (ideological discrimination and favoritism), difficulties experienced by teachers in their careers, transition to secondary education or higher education, problems with students' learning, problems related to nationalization in education, differences between public and private schools, funding for education, central exams, memorization-based learning, an insufficient number of teachers, lack of school-parent cooperation, violence at schools, lack of technical professionalism (e.g. working with ICT), inequalities between students in accessing education and the overload in the curriculum (Akinci, Uzun, & Kisoglu, 2015; Ayvaci & Durmus, 2013; Balbağ & Karaer, 2016; Köstereliogğlu & Bayar, 2014; Metin, 2013; Özyılmaz, 2017; Yılmaz & Altınkurt, 2011).

In the case of Wales, there are relatively few studies in this field. In general, these studies were related to the problems encountered by teachers in Wales during their teaching process: the overload in the curriculum, heavy work, heavy stress, difficult classroom management, long working hours, lack of security due to pos-

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sible redundancy and problems with student behaviors (Barmby, 2006; Smithers & Robinson, 2008; Whitehead, Preece, & Maughan, 1999). The purpose of selecting these two cities, which discussed in detail, was that both cities did poorly in the PISA test conducted in 2015 (OECD, 2016b), the socio-economic development level is quite low when compared to the rest of the country and both cities are bilingual.

In terms of the achievement levels in both regions, it was thought that it would be useful to compare the PISA results. It was seen from the PISA results in 2015 that both regions did relatively poor compared to the rest of the country. As it can be clearly seen from Table 1 and Table 2, both regions achieved lower scores than the OECD average, which was 500 points.

Table 1. 2015 PISA results of the regions in Turkey.

2015 PISA	West Marmara	Aegean	İstanbul	West Anatolia	Mediter-ranean	East Marmara	Middle anatolia	West Blacksea	Northeast Anatolia	East Blacksea	Southeast Anatolia	Middle east Anatolia
Science	448	443	438	436	436	434	420	416	414	413	387	382
Mathematics	442	433	432	431	430	429	422	411	409	399	385	370
Reading	458	446	443	441	437	436	427	414	406	404	390	384

Table 1 shows the PISA results for Turkey. Hakkari belongs to the Middle Eastern Anatolia region that did relatively poor in the PISA test compared to the rest of Turkey (OECD, 2016b).

Table 2. 2015 PISA results of the regions in the United Kingdom (UK).

2015 PISA	England	Northern Ireland	Scotland	Wales
Science	512	500	497	485
Mathematics	493	493	491	478
Reading	500	497	493	477

Table 2 shows the PISA 2015 results for the U.K., and the results of Wales were also relatively poorer than the rest of the U.K (OECD, 2016b).

Both regions are underdeveloped regions in the two countries. In Wales, the unemployment rate is 5.9% (U.K. 5.2%, South East 3.7%). Also, in Wales, only 4% of households fall in the wealthiest percentile compared to 11% in the South East (Office for National Statistics (ONS), December 2015). This situation can be one of the reasons that 29% of Welsh children lived in relative poverty between 2014-2015 (Welsh Government Report, 2016). Hakkari is in a similarly disadvantaged region in Turkey, which is among the provinces where public investments are the least and the rural unemployment rate is the highest (SEGE, 2011; TOBB, 2017).

Another reason for choosing those two cities were bilingualism. Wales is a county where approximately 19% of its population speaks the Welsh language and which is known as a bilingual area. Also, approximately 16% of pupils attend Welsh-medium schools and study Welsh as a first language. Ten percent of students that attend are bilingual, dual-medium, or English with a significant Welsh provision. The statistics have showed that in 2014, 22% of the seven-year-old learners were assessed through the medium of Welsh as a first language and 17% of the 14-year-old learners were assessed with Welsh as the first language. Ten percent of the learners in colleges identify themselves as Welsh speakers, and about seven percent of learning experiences are studied in Welsh or bilingually (Estyn, 2017; Jones, 2016). Also, the results of the survey that investigated linguistics skills has ensured that there are enough staff who can teach through the medium of Welsh, but studies have showed that there is still a shortage of Welsh-speaking staff (Estyn, 2017).

On the other hand, Hakkari is a city which is in the Kurdish part of Turkey. According to the CIA`s World Factbook (2019) report, Kurds constitute 19% of Turkey`s population. Among all residents, 12% of Kurds can speak Kurdish (Ceyhan, 2012; cited in IAGCI, 2019). Kurds in Turkey cannot get education in Kurdish. They can

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only take Kurdish lessons as optional courses. The Kurds in Turkey do not constitute a homogeneous group (Ozfidan, Burlbaw, & Aydin, 2018). Some Kurds barely speak Kurdish but have accepted their Kurdish genetics. Other groups do not know any other language except Kurdish, and this group represents the older men and women who did not have a Turkish education. The last group represents the bilingual Kurdish group in Turkey. This group can speak both Turkish and Kurdish fluently. This group consists of two parts, one of which are natives who cannot professionally speak both languages, the other is the one that speaks only Kurdish until six or seven years old, but after that receive all formal education in Turkish (Smits & Gündüz-Hoşgör, 2003). Even though the law has allowed the Kurdish to take optional courses in Kurdish, there are still challenges such as a lack of sources and a lack of teachers who can offer Kurdish at the schools (Ozfidan, Burlbaw, & Aydin, 2018).

Classroom Climate in Turkey and Wales

According to the TALIS results (2018), during the teaching process teachers in Turkey view the classroom disciplinary climate rather negatively when compared to the other 23 countries. A certain amount of class time is lost due to disruptive student behavior or administrative issues. Also, according to the same report, 43% of the teachers lack pedagogical preparation, 31% of the teachers are in schools where the principal reports that teachers arrive late and 35% of the teachers are in schools where absenteeism is reported by principals as hindering instruction a lot or to some extent.

According to an OECD report (2014), despite the positive climate of the school and good teacher-student relationships, not all Welsh teachers have such skills as adequate content and pedagogical knowledge to meet students' current or future needs. Also, based on the report prepared by Furlong (2015), the Welsh teachers did not possess the skills necessary to help students meet the innovations of the 21st Century curriculum. According to the reports above, similar to many other countries and regions, both regions have had some challenges and barriers for teachers that make their practices more difficult.

Concerning these challenges, it was found that there is not much focus on the comparison between the barriers that science and mathematics teachers encounter during the teaching process even though science and mathematics teachers are important for STEM education to meet current society's needs. Therefore, it is believed that the present research would contribute to the related literature. Aware of this gap, the research aimed to identify the barriers regarding the student-related and teaching-related issues which science and mathematics teachers face in these regions and which influence their teaching process. In order to serve the aim the following questions were asked:

1. What are the students-based barriers during mathematics and science teaching?
2. What are the teachers-based barriers during mathematics and science teaching?

Research Methodology

General Background

The research focused on the barriers that science and mathematics teachers face in regions that are socio-economically disadvantaged, such as Hakkari and Swansea. Therefore, the research design was based on the comparative case study, and a qualitative methodological approach was used. The research relies mostly on primary sources which are collected from interviews held with 24 mathematics and science teachers from both regions. The data collected from different upper-secondary schools in both regions and the process took six months. The research was conducted during 2016 - 2017 academic year.

Sample / Participants / Group

The research included two groups of participants, and one of the groups included 12 teachers from Hakkari and the other included 12 teachers from Swansea. The permission was obtained differently in the two cities. In Hakkari, the permission was obtained from the Director of National Education Manager of Hakkari. In Swansea, the permission was obtained from the Ethics Committee of University of Wales Trinity Saint David (UWTSD).

All fields of science and mathematics were covered in both regions equally such as physics (*n=6*), chemistry

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(*n=6*), biology (*n=6*) and mathematics (*n=6*). These participants were determined based on ease of accessibility from different upper-secondary schools in Hakkari and Swansea. All the participants were teaching at public schools in both cities. The schools were public secondary schools selected based on ease of accessibility. More detailed information about the participants can be seen in Table 3 below:

Table 3. Teachers' demographic background.

Teachers in Hakkari	Gender		Age	Experience as a teacher/ years
	Female	Male		
Physics	1	2	30-40	5-20
Chemistry	3	-	25-40	3-15
Biology	2	1	25-35	3-10
Mathematics	2	1	25-40	3-15
Teachers in Swansea				
Physics	2	1	30-40	5-20
Chemistry	3	-	45-55	20-
Biology	2	1	40-55	10-20
Mathematics	1	2	25-50	5-10

According to Table 3, the teachers from Swansea were older and had more working experience than those in Hakkari.

Instrument and Procedures

The research data were collected via semi-structured qualitative interviews. The interviews were conducted in Turkish (Hakkari) and English (Swansea). The interviews were held once during the Fall Term (2016) and were digitally recorded.

The questions included the perceptions and aspects of the science and mathematics teachers, such as the roles and responsibilities of teachers, students, cultural and other issues that impact on teaching decisions and barriers while teaching science and mathematics at the secondary level. The questions in the semi-structured interviews were prepared based on the problems identified in the related literature, and after the approval of five academicians in the field of science and mathematics, a pilot study was carried out. An appropriate interview guideline was prepared and used to ensure reliability in data collection. The interview guideline included seven semi-structured questions which were developed in line with the related literature and were all related to the research questions. All the participants were asked to provide fully informed consents prior to the research process, and they had the right to withdraw at any time in the research process. The research data collected were discussed with the participants for validation. Each interview lasted approximately 15-30 minutes.

Data Analysis

The interviews were transcribed, and the data obtained were analyzed by the researchers, who were working in the physics and chemistry departments. The data were analyzed using the thematic analysis method. In thematic analysis, the data are analyzed mainly in a deductive manner and in accordance with previously determined concepts. The concepts (categories and codes) were determined based on the previous studies (Akinci, Uzun, & Kisoglu, 2015; Ayvaci & Durmus, 2013; Barmby, 2006; Little, 2005; Smithers & Robinso, 2008), and on the review of the related literature.. After that, the categories and the codes were prepared according to the research questions as follows: student-based issues, teacher-based issues, curriculum-based issues and cultural and language-based issues. In light of the research questions for this study, the teachers' interpretations in Swansea and Hakkari were

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compared and analyzed. In addition, in order to show which teacher represented each view, the teachers were coded as T1, T2, T3, and so on. To represent the cities and the teachers' subject fields, the first letter of the cities and the first letter of the subject field were used together, and the symbolic number of the teacher was added.

Research Results

Student-Based Issues in the Classroom

As one of the result of the interviews held with 24 teachers, the student-based issues in Swansea and Hakkari within the teaching process were determined as a barrier. The views of the teachers working in Swansea and Hakkari are given in Table 4.

Table 4. Student-based issues during teaching.

			Hakkari				Swansea				Total
Category	Code	Explanation	Physics Teachers	Chemistry Teachers	Biology Teachers	Mathematics Teachers	Physics Teachers	Chemistry Teachers	Biology Teachers	Mathematics Teachers	
Student-based issues	Prior knowledge	Prior knowledge is insufficient	3	2	3	3	2	3	2	1	19
	Lack of interest	Students have Lack of interest	1	3	3	1	1	2	2	1	14
	Attention span	Not Enough	1	3	3	1	3	2	1	0	14

The results presented in Table 4 show that according to a great majority of the teachers in Hakkari (11 teachers), the students came into the classroom with a lack of prior knowledge. Parallel to this data, a great majority of the teachers (eight teachers) in Swansea also mentioned students' lack of prior knowledge. As a result, 19 out of 24 teachers stated that students came into the classroom without any prior knowledge. Regarding this issue, a biology teacher and a chemistry teacher in Swansea said:

> *T8Sb: We do have children who do not read much, and they have not got very good background knowledge of science.*
> *T6 Sc: So little prior knowledge, chemistry is quite a hard subject for them anyway. I assume that they all know nothing. They do not realize that the science they have seen at school is chemistry*

According to the interviews held with the science and mathematics teachers in Swansea, the teachers had problems regarding the students' prior knowledge as can be seen in the views of $T3_{Sb}$ and $T6_{Sc}$: "they have not got very good background of knowledge of science" and "I assume that they all know nothing." It obviously shows students` lack of prior knowledge.

On the other hand, the views of the teachers about the lack of prior knowledge, unlike Swansea, are rooted from different cultural backgrounds. The views of the teachers in Hakkari about the reasons for the lack of prior knowledge can be seen in Table 5 below.

Table 5. The reasons for lack of prior knowledge

Comments	Physics Teachers	Chemistry Teachers	Biology Teachers	Mathematics Teachers	Total
Indifferent and crowded families	1	1	2	2	6
Influence of political state	1	-	2	2	5

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According to Table 5, the reason for the students' lack of prior knowledge in Hakkari are mainly based on cultural issues, such as crowded families and the influence of political issues, which also cause absenteeism in class. In relation to the results found in the table above, a biology teacher in Hakkari made a more detailed comment on students' family backgrounds and on the influence of political situations on students' prior knowledge:

> T13Hp: Well, I do not know if it is because of lack of teachers, or because of teachers who come to school and leave a year later after their training period is over. When this is the case, I do not expect the children to be efficient or things to be permanent. Also, there are such families: for example mothers, women who get married at the age of 14 or 15; for example, my students have eight or nine siblings. I ask them how old their mothers are, and they say 34. I am 35. Now, in such a situation, the woman has lack of education; she does not ask the child "what are you doing, what did you learn at school?", um, the father is also not interested. Families do not care, they just want their children to go to school; they do not want them to spend their time outside doing nothing. They say it is enough for them to know that they are at school; they do not want anything else, and they are unbelievably indifferent. It is not only lack of children's prior knowledge; it is also families' indifference. I do not associate it with anything else. Children do not, um, have intelligence problems.

> T19Hb: In addition, sometimes, students do not come to school due to political issues. Lessons become disconnected then. When that happens, there occurs lack of prior knowledge, which in turn causes the student to experience difficulty understanding the subsequent subjects. Err, these are student-based problems that we meet. There are also family-based problems such as not motivating the students enough for school, not making them conscious enough, for example not coming to school consciously also affects learning.

Those two teachers from Hakkari expressed the barriers related to cultural issues as the lack of interest of families towards education, students without their families` support, and the crowded family including eight to nine kids. All of these factors have negative influence on prior knowledge.

In addition, two physics teachers from each city and a chemistry teacher in Hakkari stated that the students were not successful in physics/chemistry courses due to their lack of prior knowledge about mathematics; moreover, the physics and chemistry teachers in Hakkari associated this situation with the sociocultural structure such as a lack of the mother tongue in the education system in Turkey, and they expressed this as a problem as follows:

> T16Hc: It is not only mathematics, it is also literature, I mean because of their lack of Turkish, students cannot learn the verbal parts of my course as they are not proficient in Turkish. There is also one other thing peculiar to our area, our school. It originates from the students' mother tongue.
> T14Hp: That is, mathematics is actually a skill that should be acquired at primary or elementary school. That is the biggest problem we are having. In other words, when I read and evaluate the students' written papers, I see obvious mistakes of children especially about four operations and about basic algebra! I mean, it's hard to do something about this. I mean, how can I teach Newton's Law of Motion to a child who knows almost nothing about algebra?

Regarding lack of mathematical skills, the physics teacher in Swansea described his/her ideas as follows:

> T2Sp: Sometimes some other pupils who are not good at maths may not enjoy the physics, you do come across that problem that they don't like physics they tend to prefer biology.

According to physics teachers from each cities lack of mathematical skills was a barrier that prevented and decreased students` learning and interest in physics.

In the case of teachers in Swansea regarding cultural issues that affect prior knowledge, a physics teacher in Swansea described his/her ideas as follows:

> T1Sp: You certainly find that within this school, most of the children we have come from a rural community, from farming backgrounds. So as far as their subject knowledge is concerned, they are very much into environmental projects. Like windfarms, the cost of them, location … It's something that they have a real interest in. It's a bit more difficult in physics, because most of the work we do, such as stuff like space, has no real relevance to them.

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According to Table 4, when the data regarding the student-based issues in the learning process are examined, it is seen that eight out of 12 teachers in Hakkari stated that the students were not interested in lessons and that the same rate was true for the teachers in Swansea. A chemistry teacher in Hakkari made the following comments about the issue:

> T16Hc: Whether these students are teenagers, the personal problems of teenage students are also reflected in their courses. A ninth grade student is a little bit more childish. Grade 10 students, even our best students, may not show enough interest in lessons due to the teenage psychology.

Another chemistry teacher in Swansea expressed his/her feelings as follows:

> T6Sc: That changes. A-level, because they have chosen the subject, they are interested. GCSE, they have to do chemistry and some do find it difficult. You know you have to talk about formulas and similar things. They find equations difficult and sometimes calculations difficult. They do not enjoy it as much, then so they have interest.

According to the comments of the teachers from each city, it could be stated that the teacher from Hakkari identified the barriers based on the students' physical and psychological development. On the other hand, the teacher in Swansea defined the problem as a lack of interest based on the difficulties of the subject. The teacher from Swansea related the students' lack of interest to the difficulty level of the course.

In addition to the student-based barriers in the learning process, the data in Table 4 were obtained regarding the students' attention. When these data were analyzed, it was seen that among the 12 teachers in Hakkari, eight of them said the students had little attention span and that six of the 12 teachers in Swansea gave the same answer. In relation to this, a mathematics teacher in Hakkari described the situation as follows:

> T23Hm: Attention span is related to the students' level of loving the subject and the teacher, and it`s also related to the students` interest in lessons. In other words, if the student loves his teacher, he has more attention span in his lectures and he then starts to love the course. He can do more for his teacher, especially if he loves the teacher. Any student who is already interested is interested in any kind, but a student who is not interested is forced by his/her teacher. Therefore, sometimes, things go on with the teacher's support

Regarding the attention span, a chemistry teacher in Swansea made the following comment:

> *T5Sc: The attention span is probably lower than it was when I first started teaching. Sometimes, when you do a revision lesson, you do need to stand up and do a bit of lecture, and I find it harder to do that now than in the past. Also, that is probably because of all the distractions they face. Teaching means a lot more activities for students and much less lecturing these days, so I do find it more difficult to listen for prolonged periods of time. But saying all of that, I can conduct revision lessons with them, and I can stand and talk to get it done if necessary. I just feel I'm very hasty, because I feel I'm losing their attention a little bit more quickly than I used to.*

The teacher in Hakkari related the attention span of the students to the degree of students` love for their teachers. The teacher in Swansea related attention span to innovative teaching methods that distracted students`s attention more than before.

According to the results in Table 4 and Table 5, the science and mathematics teachers from both countries expressed the barriers that are based on students, such as a lack of prior knowledge, lack of interest, short attention span, lack of family care and the negative influence of sociocultural and political issues on students.

Teacher-Based Issues During the Teaching Process

Table 6 presents the teachers' responses to the question of "How do your skills and experiences influence your teaching?."

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Table 6. Teacher-based issues during the teaching process.

			Hakkari				Swansea				
Category	Code	Explanation	Physics Teachers	Chemistry Teachers	Biology Teachers	Mathematics Teachers	Physics Teachers	Chemistry Teachers	Biology Teachers	Mathematics Teachers	Total
Teacher-based issues	Subject knowledge	Enough	3	3	3	3	3	3	3	3	24
	Pedagogical skills	Enough	2	3	3	1	3	3	3	3	21
		Not enough	1	-	-	2	-	-	-	-	3
	Communication Skills	Enough	2	2	1	2	3	3	3	3	18
		Not enough	1	1	2	1	-	-		-	5
	Class management	Enough	2	2	2	1	2	1	2	3	15
		Not enough	1	1	1	2	1	2	1	0	9
	Teaching Styles	Only Traditional	2	1	1	2	-	-	1	-	7
		Both method but mainly traditional	-	-	-	-	1	2	1	2	6
		Both method but mainly student centered	-	1	1	1	1	-	-	-	4
		Both method used equally	1	1	1	-	1	1	1	1	7

When the interview results in Table 6 were examined, it was found that all of the teachers in both Hakkari and Swansea stated that they did not have any problems with their own subject knowledge and that they had enough subject knowledge. Similarly, all of the teachers of science and mathematics in Swansea reported that their pedagogical skills were enough and that they did not encounter any pedagogical skill-based problems during teaching. However, when the responses of the science and mathematics teachers in Hakkari were analyzed, it was seen that except for three teachers, nine considered their pedagogic skills to be enough. A mathematics teacher in Hakkari and a physics teacher in Swansea made the following comments regarding a lack of pedagogical skills:

> *T22Hm: Of course, I have problems with pedagogical knowledge, so, for example, before the class, what I do, let's say before I have a video of it. How can I transfer it? So I cannot pass it off. I use the Internet or I had a friend who teach mathematics in the same way. I have a very close friend from my branch, and I can contact him. That's how I'm trying to solve a problem.*

In relation to the same issue, a physics teacher in Swansea made the following comments:

> T1Sp: I think that you learn it during the teaching practice, and you try to put it in place, but it is quite difficult at times. It is something that you develop over years. In the way that you question and answer in sessions. Some people are naturally gifted at that type of thing, and others have to work on it. It all depends on the person and their personality.

As can be seen from the teachers' comments, pedagogical skills were seen as a skill that develops over time.

When the section related to communication skills was examined in Table 6, it was found that seven science and mathematics teachers in Hakkari and 12 science and mathematics teachers in Swansea said they had enough communication skills. However, a chemistry teacher and a biology teacher in Hakkari expressed their problems regarding communication skills as follows:

> *T17Hc: In terms of communication skills, um, as I said, how does that happen, err when we communicate with students um, unavoidably, as I said, err the age difference between the teacher and the student can also cause communication problems. Sometimes we do not understand the students. Except that, as I said educational sciences, we begin to understand the students through our experience. Err, we use our pedagogical knowledge, and we have to try it just like the experiments in the laboratory. We try, we fail, for example, we don not do those mistakes in the next lesson.*
>
> T20Hb: Communication skills are very difficult to enter with students and with the students here because they immediately connect the political dimension and relate to Turkish-Kurdish part. Now I came from the west part of Turkey.

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> When you come from the west, you do not know the problems here in the east. You know, you cannot understand them. In class management, our students are already a little violent. I mean, they like to break the lesson and hit their friends in class. I sometimes cannot establish communication with them.

According to the comments of the two teachers from Hakkari, a lack of communication skills was associated with the age differences between the teachers and the students as well as with the political issues that made communication harder between the local students and the non-local teachers. On the other hand, it could be asserted that, as seen in Table 6, there is no problem with the communication skills of the teachers in Swansea.

When the teachers' class management skills were examined, it was seen that seven science and mathematics teachers in Hakkari and eight sciences and mathematics teachers in Swansea said they had enough class management skills. On the contrary, one mathematics teacher in Hakkari and one chemistry teacher in Swansea who had problems with class management expressed their thoughts as follows:

> *T6Sc: Class management, I would say sometimes I am not good at it if the children are naughty and playing up because I do not like shouting. Boys they can, they do not, they take longer to get on the task. Not all boys, but some, they are not so keen. Girls are good, they come in, they have their pencil case and books, I mean they are prepared. The boys, not all of them, they do not bring their books, they forget their pencils, so they are not in the mode to learn, they are thinking of other things.*
> *T22Hm: Class sizes, 34 people is too much in a very serious sense. When I was here in upper-secondary schools, we had 15-20 people in class. We had two science classes, so we all got in the way, we could do what we wanted, so our heads were a little bit better. So, now, including these children, we have 34 students, and we have more difficulties with them. It is very extremely difficult.*

According to the comments of the teachers from both cities, it could be stated that class management viewed by the teacher from Hakkari is a gender problem. The teacher reported that in comparison to the male students, the female students were more manageable, while for the teacher from Swansea, class management becomes harder due to class size and the population of the classroom.

Based on the data obtained, it could be assumed that the teachers' subject knowledge, pedagogical knowledge, communication skills and classroom management skills had an impact on the teaching process. It could be asserted that in both cities, the teachers considered their subject knowledge and pedagogical skills to be sufficient. Also, it was revealed that the teachers who thought their communication skills were not enough were mainly from Hakkari. Furthermore, the teachers who thought that they had difficulties in class management were almost quantitatively equal in both cities.

Preferred Teaching Styles During Teaching Process

According to Table 6, the science and mathematics teachers used traditional and student-centered methods in different percentages. Among them, six teachers in Hakkari and one teacher in Swansea stated that they used only the traditional method when they taught. A biology teacher in Hakkari expressed his feelings as follows:

> T21Hb: Unfortunately, we still have to implement the traditional method based on the curriculum. I mean, I cannot apply the student-centered method here. Why? Because, for example, we always, as teachers, have to follow the curriculum and we have to teach the subjects in the curriculum in each term, so if I apply a student-centered method, then I cannot reach (means finish) the curriculum. That`s why I am just using the traditional method.

In relation to this, a biology teacher in Swansea reported as follows:

> T8Sb: I think I am teacher-centered. I know I am using the chalk and talk. I show many things on the board, so it just does not go only telling something. I do not support the method of student-centered education because it is difficult to prepare students for the exam. For example, if I go to them and ask them about water, they come to me with a piece of interesting information, which is 'a beautiful thing', but the things they found are not true. Therefore, the student cannot prepare for the exam with the wrong information they have found.

As it is obvious according to the comments of both teachers, the reason for choosing the traditional method was the strict curriculum and the exam-based education system.

Another code related to the methods used in the teaching process is that the teachers who stated that they used both methods but mainly the teacher-centered method were the science and mathematics teachers in Swan-

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sea as it can be seen in Table 6. A mathematics teacher in Swansea described this as follows:

> *T10Sm: It depends again on the child, but it tends to be, for me, more the traditional method. I do use the others, it's just I find the traditional, which works better in my class. But I use a lot of questioning, whereas I do tend to do the introduction and I am standing there teaching them, I am trying to draw as much out of them as possible as well. So I ask lots of questions, open-ended questions, to get them to respond. So it's not just me standing there talking for 30 minutes you know. But I do like the board and say 'come on let's all do this together now'. But there are times when we do problem-solving questions. I give them the question and then I give them prompts, just to try and get it all out of them. I use different styles depending on what it is. I am trying to get out of the lesson. But if I were to go for one, I think I would go for more traditional, as a teacher myself.*

As it can be seen from the comments above, the teacher reported that the reason for using both methods was related to the students' background, but he/she also admitted that he/she mainly used the traditional method.

In addition, it can be seen in Table 6 that some teachers often used the student-centered methods, but they also had to use the traditional method in some cases. A biology teacher in Hakkari expressed her/his thoughts about the subject as follows:

> T19Hb: I am trying to use two methods, frankly, I am not just the student-centered or traditional. Our classrooms are crowded. The curriculum is overloaded, if you were just student-centered, you cannot go on to the next unit. So the unit has to be finished, and the curriculum should be completed. In some places, for example, I use the write-tell-and-ask method, I'm writing, I'm telling and I`m just passing the subject like that, but in some cases, I ask them to prepare a project or a material. That's how we are on our smart boards. Because of the overloaded curriculum, in some cases, I use the traditional method.

A physics teacher in Swansea reported his/her views regarding the same code as follows:

> *T2Sp: It`s mostly student-centered. So changing the activities as often as possible keeps them busy. It`s more activities for them to do mostly, with a little bit of explaining at the beginning, but mostly student-based.*

According to both teachers' comments, the teachers preferred to mainly use the student-centered methods, but due to the curriculum, they sometimes had to use the traditional methods in order to complete the curriculum.

Lastly, when you look at the analysis of the data about the methods used in the classroom environment as can be seen in Table 6, seven teachers stated that they applied both methods equally. Among those teachers, three of them were from Hakkari and four of them were from Swansea. In Hakkari, a biology teacher reported as follows:

> T21Hb: Now, I usually use all the methods. I choose the method according to the subject, and there are some subjects that are very comprehensive. For example, it must be tidied up, should be transferred to the student, for example, the traditional method is more successful for doing that, but there are some, for example, experimental or work-based or mathematical issues, and the student should be centered here. That's what I'm trying to do.

A chemistry teacher in Swansea expressed his/her thoughts about the situation as follows:

> T5Sc: I like to use both methods. I would say that I prefer not to use a single method. I do not always choose the traditional method or the student-centered method. I am in the middle of two more. We sometimes work with the student, which allows them to work together as they love. But sometimes, I have to demonstrate new materials to them, and I explain and tell them on the board.

According to both comments, those teachers preferred to use both methods equally. They related that situation to the subjects they taught.

The comments showed that the teachers used both methods equally depending on the subject and on the course given. For certain courses, they preferred to use the traditional method. To ensure the students could work together, they used student-based methods. In light of the findings, the problems encountered by the teachers during the teaching process were examined based on students and teachers. It is seen in Table 4 and Table 5 that these problems are related to the students' prior knowledge, lack of interest and attention span, which are big issues for both cities. According to the teacher-based issues, which can be seen in Table 6, it is possible to say that these barriers are related to the subject knowledge, pedagogical knowledge, communication skills, classroom management skills and the teaching methods used during the teaching process.

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Discussion

Student-Based Barriers During Teaching Process

As one can see in Table 4, the student-based barriers mentioned by the teachers in both cities were grouped under three categories: lack of prior knowledge, lack of interest and little attention span. As one can see in Table 4, a great majority of the teachers interviewed in both cities stated that the students had lack of prior knowledge. When the related literature was reviewed, it was seen that similar results were obtained in previous studies. It is a common barrier encountered by researchers, teachers`, and teachers`educators, who stated that students had lack of prior knowledge that hindered their learning (Basturk, 2012; Incikabi & Serin, 2017; Kates, 2014; Lopez, Freed, & Kijai, 2003; Svinicki, 1993). Prior knowledge has an important place in students' learning, and when it comes to teaching it can be an important barrier too. In order to solve this problem, it is important for teachers to create rich learning environments, because prior knowledge also affects how a student perceives new information (Svinicki, 1993). Ausubel (1968) expressed the importance of prior knowledge as, "If I had to reduce the whole educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly" (p.18).

Concerning this finding obtained in the research, prior knowledge is considered to be one of the most important dynamics that provides ideas about how learning takes place. This situation was clearly expressed by Piaget (1983), who described learning as constructing and adopting new meanings based on previous experiences. In that sense, it is important that in the process of teaching science and mathematics subjects, teachers should create or adopt students' prior knowledge assessment tools to diagnose and stimulate their prior knowledge. Furthermore, it is thought that having an outline about students' existing knowledge prevents a great number of barriers such as surface learning, misconceptions, and direct memorization (Hailikari, Katajavuori, & Lindblom-Ylanne, 2008).

Hansen (2005) defined interest as the expression of liked or disliked activities (p.281). In the present research, a great majority of the teachers ((n=14) stated that the students were not interested in science and mathematics. According to teachers from both cities, lack of interest was found as a barrier that effected students` learning, attention span, and students` attitudes towards the subjects. The conducted research also showed that the science and mathematics teachers defined the barriers that decreased students` interest as difficulties of the subjects, lack of mathematical skills, and monolingual education. Similar results can be found when the literature is reviewed. For instance, in their study conducted with 62 science teachers, Chan, Luk, and Zeng (2014) found that according to a great majority of teachers, students' lack of interest was caused by their thoughts that the subject is difficult. In a study carried out with 94 teachers, Jovanovic, Simic, and Rajovic (2013) reported that 85.7% of the teachers said students had a lack of interest. A similar result was found in a study conducted with 19 teachers by Vasconcelos et al. (2015). Little interest in physical sciences results in having a low motivation to learn, less success, and these, in turn, negatively affect the training process of scientifically literate individuals, which is one of the most basic targets of the present day (Acar & Yaman, 2011). For this reason, it is thought that multilingual teaching, the used methods, seating arrangement, should be developed in a way that they attract students' interest and arouse their curiosity and which can be helpful to decrease the barriers that prevent their interests towards science and mathematics.

In the present research, of all the teachers, 58% (*n*=14*)* of them stated that the students had a lack of attention. Ding, Li, Li, and Kulm (2008) showed lack of attention as one of the behavioral disorders seen in the classroom. Stephenson, Linfoot, and Martin (2000) conducted a survey with 130 teachers of grades K–2 at 21 primary schools in Sydney, Australia. They found that distractibility or attention span, is among the most worrying problems (in Ding, Li, Li & Kulm 2008). Studies also demonstrated that lack of attention is an important barrier among secondary school students (Beaman, Wheldall, & Kemp, 2007; Little, 2005). The reasons for the lack of attention include time-related problems experienced by teachers, technological equipment, students' moods and climatic conditions (Aburahma, 2015; Dear, Kim, Candido, & Deuble, 2015; Ding, Li, Li, & Kulm, 2007; Haddad, Osmond, & King, 2016; Pereria & Smith-Adcock, 2011; Schneider, 2002). Lack of attention is thought to be both the result and the cause of a lack of motivation, indifference and failure. Thus, in order to eliminate the lack of attention, environments and contexts that can attract students' attention should be emphasized. In addition, teachers should spend extra time and effort on students who have a lack of attention.

When the results of the research are examined, it can be seen that in addition to the views of the teachers in Swansea, the teachers in Hakkari said student-based issues such as family structure, socioeconomic background, monolingual education, political factors and lack of attendance in class affected the students' prior knowledge and

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learning environment. Bourdieu (1977) stated that cultural capital shapes pupils' success in an education system. Also, Douglas (1964) notes that family size and parental attitudes influence children`s achievement because encouragement and interest in children's education in larger working-class families are less than in smaller families. Based on this, it could be stated that socioeconomic and cultural issues are effective on students, and can be barrier on their learning (Basturk, 2012; Chevalier & Lanot, 2010; Gürlen, Cihan, & Dogan, 2019; Hamid & Baldauf, 2011; Hamid, Sussex, & Khan 2009, p.298; Vasconcelos et al., 2015). For this reason, teachers can support racially and ethnically diverse students' academic learning by engaging their cultural and sociopolitical understandings (Bortkeviciene et al., 2018; Gay, 2013; González, Moll, & Amanti 2005; Lee 2001).

The Influence of Teachers-Based Issues on Teaching Process

Teacher knowledge is certainly a component of the teaching profession, and professional competency does not just involve the knowledge itself. Skills, attitudes, and motivational variables also contribute to the mastery of teaching and learning (OECD, 2016b). As it can clearly be seen in Table 6, the teacher-based issues mentioned by the teachers in both cities were grouped under four categories: subject knowledge, pedagogical skills, communication and class management skills and teaching methods.

The results of the research showed that all of the teachers in both Hakkari and Swansea said they had enough subject knowledge. Recent studies have shown that teachers' subject knowledge and pedagogical knowledge have strong influence on students' learning a subject well (Ball, Lubienski, & Mewborn, 2001; Kleickmann et al., 2017; Metzer & Woessmann, 2010¸ OECD, 2016b). Given the importance of teacher knowledge for student progress, teacher training can be regarded as a key target of an educational reform (Kleickmann et al., 2017).

In the literature, the characteristics of a good teacher generally include the following: a good classroom manager, the ability to set the environment according to different learning styles, good pedagogical content knowledge, the ability to detect students' prior knowledge and misconceptions, having a positive perception of the classroom environment, possessing enthusiasm for his/her teaching, being aware of the situations that affect learning both in and outside of school, respecting the students, making good decisions, preparing the learning environment and encouraging the students to learn (Coe, Aloisi, Higgins, & Major, 2014; Ida, 2017; Millar, 1987). Teacher's sufficient subject knowledge and pedagogical knowledge mean that one of the prerequisites for qualified education has been fulfilled.

The results of the research showed that 42% (*n*=5) of the teachers in Hakkari found their communication skills as a barrier. They related it to social and psychological differences. Communication has an important role in society, it is "the ground of meeting and the foundation of the community" (Montagu &Watson, 1979, p.vii). When the teachers ignore this meeting point during teaching process learning can not be accomplished by students (Krasnoff, 2016). As it was also found in the literature review, a great majority of the teachers were found to have communication problems (Krasnoff, 2016; Öztürk, 2000; Valverde, 2005). In a study conducted with inspectors by Özgan and Yılmaz (2009), it was found that inspectors considered teachers' communication skills to be inefficient. As stated by Yavuzer (2003), "in education, communication is the most important indicator of education. Communication is quite effective in teaching academic skills, target knowledge and class management. A teacher should have knowledge about psychology and communication so that he or she can be good in his job" (p.145).

Teachers have various roles in class and at school. One of the most important of these roles is class management. In conducted research, five out of 12 teachers in Hakkari and the same number of teachers in Swansea said they were unsuccessful in class management. In a class environment in which class management is weak, effective learning and teaching cannot be expected (Nemenzo, 2018; Ünlü & Aydos, 2008). Brophy and Good (1994) stated that class management increased student participation, decreased negative behaviors and contributed to students' success by maximizing the time allocated to learning (p.169-180). Thus, it is thought that teachers should be supported in relation to effective class management and trained accordingly. In addition, teachers' quality of education should be increased for a radical solution to this problem. A common point frequently reached that cannot be ignored in academic studies is related to the finding that despite the undeniable importance of teachers in a qualified education, there are not enough qualified teachers (Hirsh, 2001; Köstereliogˇlu & Bayar, 2014). According to these researchers, a great number of teachers do not have enough training during their pre-service period, and they graduate before they are ready to teach as required (Ipek, Turgut, & Tunga, 2016; Palardy & Rumberger; 2008; Porter & Brophy, 1988 as cited in Köstereliogˇlu). This situation causes gaps in education.

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Teaching styles are important since they show the results of teachers' views and behaviors. Teaching styles also reflect the quality of teaching during the teaching process since teachers' styles also show how much students can learn (Zhou, 2011). To make learning meaningful and to equip students with the desired qualifications, a matching teaching method is used as an important mediator. Therefore, in the present research, the science and mathematics teachers expressed the mediators that they used in the classroom. As it can be seen from the results (see Table 6), despite encouragement to apply constructivist-based innovations which are also emphasized in the education policy in both countries (Donaldson, 2015; MEB, 2017), the teachers preferred to use traditional teaching styles. They reported that by using these methods, it was easy to follow the curriculum and was the safest way to prepare students for the "general/national exams." Similar results can be seen in previous studies (Avci &Kayabasi-Ketenoglu, 2018; Okur Akcay, Akcay, & Kurt, 2016; Skutil, Havlíčkova, & Matějíčková, 2015; Utkur, 2016; Yuksel, 2007; Zhou, 2011). From these perspectives, it could be stated that the reluctance of teachers not to abandon their teacher-centered styles was also related to the formal curriculum and the education policy which forces teachers to assess their students through traditional ways such as paper-based assessments. In addition, the learning of science and mathematics must be constructive and student-centered. On the other hand, the results revealed that there was also some teachers who use the student-centered method or who used both the traditional method and the student centered method. Relying on the results, teachers in both cities expressed the formal curriculum needs as a barrier to change their teaching methods in order to create an inclusive learning environment. The literature gives us valuable resources about the reasons why teachers use different styles during the teaching process: restricted time, overloaded curriculum, the size of the classroom and lack of knowledge about how to apply new methods (Yuksel, 2007). For an effective teaching process, teachers should adopt a variety of teaching styles and methods that give an equal chance to a wide range of students' learning.

Conclusions and Implications

The research's findings indicate that student and teacher related issues and socioeconomic conditions are the underlying factors that form barriers for science and mathematics teachers that work in disadvantaged regions, such as Swansea and Hakkari. The research's outcomes showed that the student-based barriers in Hakkari and Swansea share similar characteristics, which are in particular related to a lack of prior knowledge and a lack of interest or short attention span. Despite this, the students in Hakkari also experience [further] socioeconomic and political difficulties and barriers, compared to the students in Swansea. The student-based barriers in Hakkari, in this context, are socially and economically related to crowded families, a low level of education in families, language issues and lack of parental care. The barriers are also politically related to the problems lead by the armed conflict between Turkish security forces and Kurdish militants.

The results also indicated that both Hakkari and Swansea science and mathematics teachers experience/have teacher-based barriers, in particular during the teaching process. This included a lack of class management, pedagogical skills, and communication skills. Despite this, both regions showed variance in the degree of teacher-based barriers. Teachers in Swansea believed that they had sufficient pedagogical and communication skills, while the teachers in Hakkari found their pedagogical and communication skills quite insufficient, and they defined lack of pedagogical skills as a barrier to communicate with students' cultural backgrounds. Furthermore, the results also suggested that, although science and mathematics teachers in Hakkari considerably prefer to use teacher-centered teaching styles, the teachers in Swansea prefer to use both student-centered and teacher-centered methods. Furthermore, the results also suggested that, although science and mathematics teachers in Hakkari considerably prefer to use teacher-centered teaching styles, the teachers in Swansea prefer to use both student-centered and teacher-centered methods.

In summary, in the light of the results, it was seen that the science and mathematics teachers grouped the barriers affecting the teaching process as student-based, teacher-based, curriculum-based, and a sociocultural issue. In addition to that, it was found that the political structure of the city negatively affected the teaching process and that the continuity of teaching and learning could not be ensured in the regions where the war and the political conflicts were dominant. Based on the results, the following suggestions can create a better teaching process: preventing changes in the curriculum which requires continuity, developing cooperation between schools and education departments, decreasing the curriculum-based overload and solving the time-restriction problem, teaching students through practices and using blended teaching methods based on classroom needs, improving physical conditions at schools (laboratory, class attendance, technological devices), trainings for effective use of

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technological devices and providing teachers with workshops, conferences and seminars, increasing the control over the teachers and teacher candidates during their teaching practices to make sure that they meet learners' needs, training teachers who are theoretically and pedagogically insufficient, revising teacher training centers and departments of teacher education, and organizing the educational environment according to sociocultural values. In order to make more comprehensive recommendations, it would be more useful to work with more teachers from different cities, and to include teacher's trainers, students`families and policymakers in both countries.

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