Chapter 5

Do Geographic Information Systems (GIS) Move High School Geography Education Forward in Turkey? A Teacher's Perspective

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Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/32851

1. Introduction

Geographic Information Systems (GIS) can be defined as a comprehensive mapping system designed for capturing, storing, analyzing, synthesizing, querying, editing, retrieving, manipulating and displaying spatial data obtained from earth's surface in the form of charts, tables, 3D images and maps based on the richness of the information entered into the GIS database.

Numerous studies done on GIS in education in the international context indicated that in addition to increasing student and teacher motivation, GIS are very effective tools for incorporating project-based teaching and learning, and promoting students' geographic skills such as thinking geographically, analyzing and synthesizing spatial data, map reading and interpreting (Tinker, 1992; Geography Education Standards Project [GESP], 1994; Palladino, 1994; Audet & Abegg, 1996; Lemberg & Stoltman, 1999; Pottle, 2001; Shin, 2006). Tinker (1992), Palladino (1994), and Audit & Abegg (1996), who were the leading academicians, conducted the first research on education with GIS and underlined the positive relationships between education with GIS and the development of spatial skills of the students.

Wanner & Kerski (1999) found that GIS have the potential to accelerate the geographical inquiry skills of the students as well as analyzing and displaying geographic data. According to Pottle (2001), a GIS is a beneficial tool for learning and motivating students in the process of gaining important skills and knowledge from geography curricula. The outcomes of a study by Bednarz & Van der Schee (2006) show that there are three main benefits to geography teachers of integrating GIS into their geography courses, including the support of GIS on teaching and learning, the help investigating geographical problems at

different levels, and their widespread use in business in the existing century. GESP (1994) suggested that the presence of GIS in geography education is enhancing many geographic skills of the students including acquiring, organizing, and analyzing geographic information, and asking and answering geographic questions.

However, there are some other studies questioning whether education with GIS is certainly beneficial in every case or enhancing the spatial skills of the students. According to Bednarz (2004), there is no sufficient proof that a GIS enhances the spatial skills. The optimum conditions are needed to further expand its applications and we need to know whether there are any easier and better methods to reach the same objectives. In a study conducted on the effectiveness of GIS in courses, Kerski (2003) concluded that in spite of reinforcing the standard-based skills and spatial analysis, the inquiry-oriented lessons with GIS did not consistently increase geographic skills. Shin (2006) also argued that it is not possible to insist that using GIS was the best or the only medium to teach geography subjects; rather, education with GIS has a potential student learning that most other tools do not have. Some other research pointed out the importance of methods which will be applied during the process of education with GIS, and in the case of choosing wrong educational methods, GIS in education may result in failure of student learning (King, 1991; Walsh, 1992; Wanner & Kerski, 1999; Johansson, 2003; Baker & White, 2003; Bednarz, 2004).

2. Background

2.1. Adoption of GIS by education and other sectors in Turkey

Almost 50 years later then its first initiation in Canada (Yomralioglu, 2000), today GIS has been an extensively used technology in various sectors which use spatial data, including environmental protection, urbanization, planning, engineering, environmental protection, remote sensing, municipal works, transportation, forestry, and all levels of education. As for the education, the adaptation of GIS into education was even slower compared to other sectors. The utilization of GIS in education was first initiated at university level at US and Canadian universities in 1980s (Zhou et al., 1999). With the beginning of the 1990s, GIS found more place in secondary school curricula in North America and Europe (Johansson & Pellikka, 2006). Bednarz & Ludwig (1997) stated that most geography and social studies teachers were in the "pre-awareness" category in terms of adaptation of GIS in course environments. However, the studies of Kerski (2003, 2007) revealed that the teachers reached the "understanding" stage (Table 1).

Phase	Key question
Phase 1: Pre-awareness	
Phase 2: Awareness	What is GIS?
Phase 3: Understanding	How can I teach geography with GIS
Phase 4: Guided practice	How do I do GIS?
Phase 5: Implementation	

Table 1. Five phases in adaptation of GIS. Adapted from Bednarz & Ludwig, 1997.

However, in spite of providing an important potential to enrich geography education, the use of GIS has not been an integral part of geography education and its diffusion remained slow at secondary schools. The statistics showed that slightly less than 2% of American high schools and only 20% of the teachers out of 1,520 who have GIS software and knowledge use it in more than one lesson in more than one class (Kerski, 2003). The level of utilization of GIS in secondary education remained almost the same in the UK (Office of Standards in Education [OFSTED], 2004). In a study conducted on the Netherlands' geography teachers, 12% of the respondents stated that they were using GIS in their courses and 81% of them supported GIS having a greater role in teaching geography (Korevaar & Schee, 2004). The figure is almost the same in Singapore schools (Yap et al., 2008). In another study conducted in Turkey on attitudes of geography teachers to using GIS, Demirci concluded that almost all teachers that filled out the questionnaire form expressed that they haven't attended an education program about GIS, and don't know how to use GIS software, despite the fact that all of them they believe the in necessity of using GIS in geography lessons (Demirci, 2008).

Some researchers sought the factors of why GIS technology is being integrated very slowly into the K-12 curriculum. We can classify these factors including:

- Limited time: Learning and implementation of GIS takes a long time (Kerski, 2003). Allocation of limited time and balancing other demands from the school system (Shin, 2006). Insufficient time in the curriculum to better incorporate GIS into education (Meyer et al., 1999).
- Curriculum problems: Limited extent of GIS in the curriculum; lack of necessary digital data, lesson plans, learning objectives, and instruction problems (Yap et al., 2008; Demirci, 2009).
- Teacher problems: Lack of necessary GIS skills of teachers. Teachers' attitudes, perceptions of technology and lack of consciousness about the benefits of GIS or the pre-awareness status of teachers in incorporating GIS into their courses (Bednarz & Ludwig, 1997). Some teachers have negative conceptions of geography in that they view geography as memorizing names and features, so they do not believe that GIS do any good for spatial analysis (Patterson et al., 2003; Bednarz & Ludwig, 1997).
- In-service training: Unavailability of GIS training and exposure, insufficient peer support and inadequate lesson demonstrations by experienced GIS teachers (Yap et al., 2008).
- Issues on physical conditions: Lack of access to appropriate hardware and software, GIS-based resource packages, etc. (Meyer et al., 1999).

Unfortunately, the integration of GIS into public or private sectors of Turkey was almost 20 years later than North American countries in the 1980s. The integration of GIS into the Turkish education sector was even slower (Table 2). The adoption of GIS into universities was initiated in the 1990s by a graduate thesis aimed at exploring the GIS potential in Turkey. The first departments that dealt with GIS were Geodesy and Photogrammetry Departments. The number of departments employing GIS courses then increased sharply between 1990 and 2004 (Olgen, 2004, Yomralioglu, 2002). The first undergraduate level GIS course and fully equipped GIS education laboratory in a geography department was established in 1998. In the following years, the number of geography departments providing

GIS courses and GIS laboratories increased slowly. In a study conducted in 2009, Demirci reported that there were only 6 geography departments in Turkey, out of 36 either in Art and Science or Education Faculties, which had a GIS laboratory (Demirci, 2009).

Cornerstones of GIS	**Year**
The first use of GIS by a private company	1981
The first use of GIS by General Command of Mapping	1986
The first use of GIS in the public sector, such as General Directorate of Land Registry and Cadastre, Turkish Statistical Institute, and State Meteorological Service	1990
The first use of GIS in higher education	1991
The first national conference on GIS	1994
The first use of GIS by municipalities (Metropolitan Municipality of Bursa)	1996
The first GIS course in a geography department	1998
The first GIS education laboratory in a geography department	1998
The first national GIS conference organized by a geography department	2001
The first GIS for teachers workshop	2004
The first national geography curriculum including GIS-related activities	2005
The first international conference on GIS organized by a geography department	2008
The first GIS course materials (books, CDs, and course activities) for secondary schools	2008
The first GIS-based civil involvement project concerning secondary school students aiming at integrating GIS-based activities into geography courses	2009
The first GIS education certificate program for geography teachers	2011

Table 2. Cornerstones of GIS in Turkey. Adapted from İncekara, 2010; İncekara & Karakuyu, 2010; Demirci, 2009, Yomralioglu, 2002.

2.2. GIS in Turkish secondary school curriculum

The 2005 geography high school curriculum has been playing an important role in terms of adoption of GIS into geography courses in that it is the first geography curriculum of Turkey in which the concept of GIS was included. By 2005, The Turkish Ministry of National Education initiated an overall reform for the national curriculum, including geography. The new geography course curriculum suggested maximum adoption of technology into geography courses and particularly underlined the importance and necessity of the extensive integration of GIS into geography education. By the initiation of the 2005 curricula, many efforts were ongoing in order to make GIS a widely used tool and method in geography education through a number of activities, including conferences, panels, in-service GIS training, certificate programs, student projects, course materials, papers, workshops, etc.

In the content of the 2005 high school geography curriculum, GIS applications are recommended for some attainments. The new geography program has a constructivist base and spiral structure. Attainment is examined consecutively. Content foreseen by the attainment is provided (Yasar & Seremet, 2009). Geography teachers may develop GIS activities, projects, panels, etc., or analyze existing ones (Milli Eğitim Bakanlığı [MEB], 2005). GIS is an important part of the "Geographic Skills and Applications" learning module of the new curriculum along with map skills, use of information technologies skills, critical thinking skills, and field trip skills of the students. By investigating the 2005 geography curriculum content, there are 21 GIS activities. These GIS-related course activities are placed in different grades and learning modules (Tables 3 and 4). The general characteristics of these activities are:

- Irregular distribution from ninth to twelfth grade.
- With 9 activities, the tenth grade includes the highest number of GIS-related activities.
- Each GIS-related activity refers to two or more skills such as observation, map, critical thinking, field trip, perception of time, organizing the geographical data skills, etc.
- The two modules which have the highest number of GIS activities are "A spatial synthesis: Turkey "and "Human systems" modules. "Environment and society" is the only learning module in which there are no GIS activities suggested.

Activities, attainments, and learning modules	**Grades**				**Total**
	9th Grade	**10th Grade**	**11th Grade**	**12th Grade**	
Number of GIS-related activities suggested	5	9	3	4	21
Number of related attainments	6	10	5	6	27
Number of GIS activities in learning modules					
Natural systems	3	1	-	-	4
Human systems	-	5	2	-	7
A spatial synthesis: Turkey	2	3	-	2	7
Global environment: regions and countries	-	-	1	2	3
Environment and society	-	-	-	-	-

Table 3. Distribution of suggested GIS-related activities, attainments, and learning modules by grades in the 2005 secondary school geography curriculum. İncekara, 2010; MEB, 2005.

When we look at the subject-based distribution of GIS activities, we see that they are also irregular to each grade. Subjects including political and cultural alliances, relationships and patterns, maps, economy, population, international economics, natural and human systems in Turkey, and population characteristics have more than one GIS-related activity while there are no activities recommended for soil, water, vegetation cover, and tourism units (Table 4).

Subjects	Grades				Total
	9th Grade	10th Grade	11th Grade	12th Grade	
Maps and map components	3	-	-	-	3
Natural and human systems in Turkey	2	3	-	1	6
Landforms	-	1	-	-	1
Population	-	4	-	-	4
Economy	-	1	1	-	2
Settlements	-	-	1	-	1
International economic, politic, and cultural alliances, relationships, and patterns	-	-	1	1	2
Global and regional connections of Turkey	-	-	-	1	1
Regions and countries	-	-	-	1	1
Total	5	9	3	4	21

Table 4. Subject-based distribution of GIS-related activities in the new geography curriculum. İncekara, 2010; MEB, 2005.

2.3. Use of technology and GIS in geography courses in Turkey

There are a number of studies in Turkey on the availability of educational technologies in geography, the most used technologies in geography education, the attitudes of geography teachers towards using educational technologies in their lessons, and to what extent the technology use is included by geography teaching programs and textbooks. One of these studies, Özel (2007), concluded that geography teachers don't use educational technologies sufficiently and they are partly competent to use these technologies in their courses. Moreover, the study revealed that computer, VCD players, and LCD projectors were the most used technologies by geography teachers. Sonmez et al. (2009) and Demirci (2009) stated that along with the negative effect of the lack of necessary technologies in public schools, many technologies are unknown to many geography teachers, and that this may only be overcome by more in-service training opportunities provided by the ministry of education.

In another study by Tas at al. (2007), it was found that almost all of the geography teachers seemed to have enough consciousness that the technology is beneficial and necessary to enhance student learning and motivation; however, the diversity of the up-to-date technologies couldn't be reflected to the classroom environment due to a number of factors, including physical infrastructure of schools, competency, etc. The studies by Demirci (2008, 2009) supported the results of previous studies that LCD projectors and Power Point Presentations were among the most used technologies by geography teachers. Moreover, he found that 53% of the geography teachers expressed that they didn't have a computer in

their classrooms, 49% of them didn't have an LCD projector, and 63% of the teachers didn't have an internet connection in their classrooms.

There are two up-to-date studies done by Incekara (2011a, 2011b) specifying the use of technology in geography teaching and the learning process in Turkey. In one of them, Incekara (2011a) investigated the technology use of geography teachers in their courses and the effect of the 2005 program on their attitudes to using technology in their courses. The results indicated that a large majority of geography teachers (%84) agreed that the geography teaching program of 2005 supports the greater use of technology in geography teaching and learning. Additionally, they expressed that they started utilizing the technology more than they used it before the initiation of the 2005 program with a big majority of 80.5%. It is quite encouraging that almost 90% of respondent geography teachers recognize the significance of educational technologies in ideal geography teaching. However, almost half of them stated that the limited physical infrastructures and facilities of their schools prevented the efficient use of technology in their courses. Almost one-third of the respondents stated that they didn't have enough knowledge about how to integrate technology into their courses (Table 5).

Statements		**Level of agreement**				
			Strongly disagree/ Disagree 1/2*	**Neutral 3***	**Agree/ Strongly agree 4/5***	**Total**
1	The 2005 geography teaching program supports the greater use of technology	*n*	12	16	152	180
		%	6.7	8.9	84.4	100
2	I utilize the technology more in my courses with the 2005 geography teaching program	*n*	17	18	145	180
		%	9.5	10	80.5	100
3	Technology must be used for ideal geography teaching	*n*	12	8	160	180
		%	6.7	4.4	88.9	100
4	The limited facilities of the school prevent me from using technology sufficiently	*n*	68	22	89	179
		%	37.9	12.3	49.7	100
5	I have enough knowledge about how to incorporate technology into my courses	*n*	29	29	120	178
		%	16.3	16.3	67.4	100
*1: Strongly disagree 2: Disagree 3: Neutral 4: Agree 5: Strongly agree						

Table 5. Opinions of geography teachers about the use of technology in geography education. Incekara 2011a.

The research results also indicated that public school teachers tend to support the notion that the 2005 teaching program supports more use of technology more than private school

and private course (these are the private educational institutions preparing students for different exams, including university and high school entrance exams) teachers. Moreover, public school teachers are more positive than private course teachers about the idea that "technology must be used" for ideal geography teaching. Additionally, public and private course teachers suffer the most from the lack of infrastructure in using technology, compared with private school teachers. According to the further analyses, the belief of geography teachers in the importance of technology use is increasing as the teachers' English level increases (Incekara, 2011a).

Incekara (2011b) also studied the most and least used technologies in geography education and to what extent (frequency) these technologies are being used. Research results indicated that the educational technologies used in geography teaching have been diversified and have changed in the last few decades. Maps, atlases, and globes are among the most popular technologies used in geography education. The moderate use of Google Earth, various models, Internet, and computer animations shows that geography teachers make an effort to visualize their courses. However, spatial technologies including satellite images, air photos, global positioning systems (GPS), and GIS are among the most rarely used technologies in geography courses.

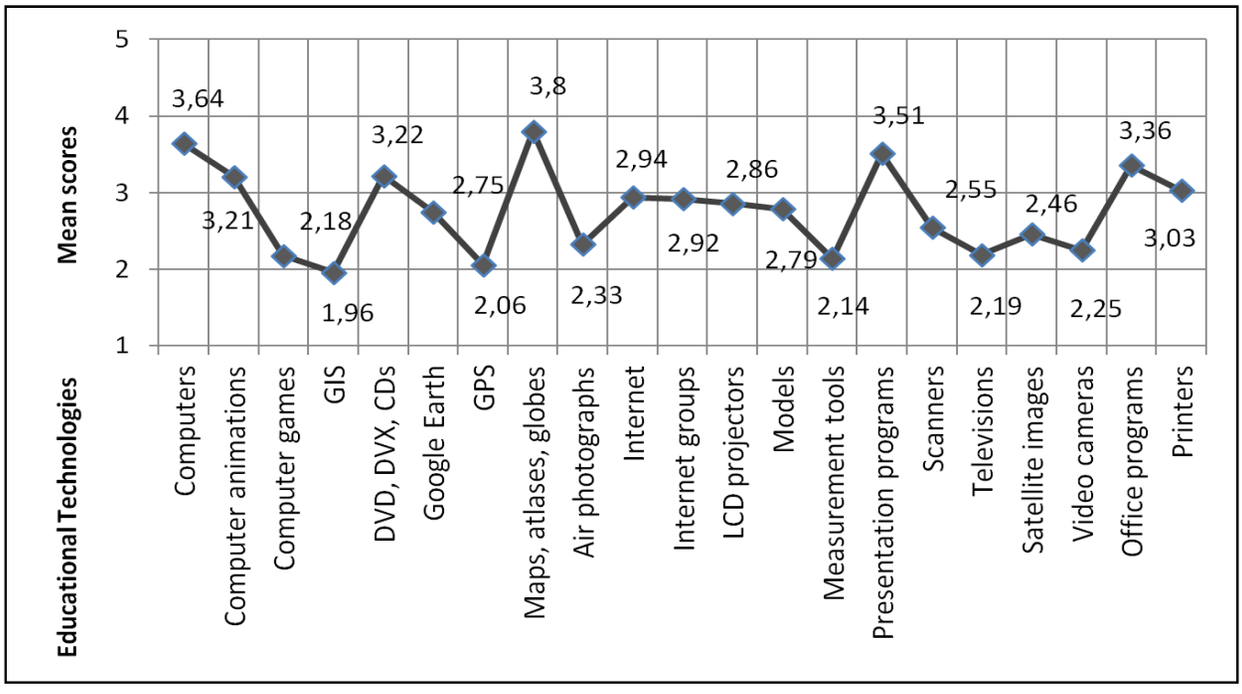

Figure 1. The mean scores of geography teachers in using educational technologies. Incekara, 2011b.

Research results also revealed that the measuring tools which are subjected to use both in laboratories and field trips and computer games are among the most rarely used technologies in geography education. This shows that field trips, laboratories, and computer games haven't become and integral part of geography education. Statistical test results suggested that younger geography teachers tend to use computer games more than older ones, and public and private school teachers are using educational technologies more than

private course teachers. However, public school teachers use educational technology in their courses as much as private course teachers as a result of the fast expansion of computers, Internet and Internet-based technologies, and Internet groups based on geography profession (Incekara, 2011b).

Another important result that the statistical results proved was that as the diploma level (undergraduate, graduate) and foreign language competencies of teachers increase, the success of integrating the technologies into education also increases. As a final assessment of technology use in geography courses we can say that the mean score of geography teachers regarding the use of technology is 2.73 out of 5 which corresponds to "sometimes" on a 5-point Likert scale, which means the geography teachers are using educational technologies sometimes in their courses. This frequency is not enough if the status of geography and the geography education level on global scale is considered (Incekara 2011b). The use of GIS technologies in Turkish secondary schools can't be isolated from the general state of technology use in geography courses which is very low if we consider that geography is a suitable course to integrate all kinds of educational technologies. Even worse, GIS is being used more rarely than any kind of educational technologies in spite of the existence of a big consensus among the geography teachers that GIS is a beneficial tool for geography courses and must have more place in teaching and in-service training programs.

For example Demirci (2008) reported that almost all geography teachers that attended his questionnaire study replied that they haven't attended any GIS education program, and they didn't know how to use GIS software or how to use GIS in their courses. 93% stated that they haven't had a computer laboratory in their schools; however, all of them supported the use of GIS in geography education. The situation is better in his 2009 study, where 66% of teachers surveyed didn't know what GIS was, 82% of them didn't know how to use it in their courses, and 80% of them had never attended a training course about GIS. However, 84% of the geography teachers stated that they hadn't used GIS software before while only 16% they used it on a basic level (Demirci, 2009). Artvinli (2009) underlined advantages and disadvantages of using GIS from a teacher's perspective and concluded that while most of the teachers appreciated the advantages of using GIS, they mostly complained about technical insufficiencies, time limitations, lack of in-service training, and over class-sizes as the most expressed limitations in using GIS in their courses.

3. Methodology

3.1. Content analysis of related studies

To provide a comprehensive understanding about GIS in Turkey's geography education, we provided an extensive review of literature in the previous parts of the chapter including the definition of GIS and benefits of using it in education, the advent of GIS and its diffusion in Turkey's education and other sectors, GIS in the secondary school curriculum, and use of technology and GIS in geography courses in Turkey. In the first part, the definition of GIS and the benefits of using GIS in geography learning and teaching processes was explored from an international perspective. In addition to its benefits, some controversial issues were

underlined regarding whether education with GIS is certainly beneficial or best in every case or enhancing the spatial skills of students. In the second part, a detailed process of GIS adoption to education sectors along with other private and public sectors in Turkey and a table entitled "milestones of GIS in Turkey" was given a place. In this chapter, the difficulties and limitations in front of an effective integration of GIS into education sector were discussed item by item. Then, the GIS in the Turkish secondary school curriculum were underlined in order to reveal the relationships between the use of GIS in Turkish secondary education level and curriculum priorities. In this part, the distribution of GIS activities by subjects was also given to understand the irregularity of distribution.

There is a strong relationship between the overall use of educational technologies and GIS use in geography education. In other words, as the teachers' tendency to use technology increases, their tendency to use GIS also increases. So, we think that it is appropriate to look at the attitudes of geography teachers in Turkey towards technology use in geography education under the light of previous studies realized on this subject. In the following part, the literature on GIS in geography education in Turkey was reviewed to give the chance to compare the previous studies and this study in terms of teachers' attitudes towards using GIS technology in their schools.

3.2. Research questions and objectives

The chapter will seek the insights into what changes were made by the GIS applications which were integrated into new high school geography curricula from geography teachers' perspective and to what extent the GIS have been an integral part of geography education in Turkish high schools. The study aims at determining whether high schools have the required physical infrastructure for sufficient adoption of GIS into geography courses, whether the geography teachers have enough knowledge and skills to incorporate GIS in their courses, how often the geography teachers use GIS in their teaching process, and their beliefs and attitudes towards using GIS in geography education.

3.3. Statistical analysis

The "Teachers' attitudes towards using GIS" questionnaire constitutes the main method of the study. A 29-item questionnaire was prepared and distributed to the 183 geography teachers who voluntarily accepted to fill out the form from almost 50 different provinces in Turkey. The questionnaire was prepared as 4 parts, including demographic questions which were prepared to investigate gender, age, professional experience, education level, English level, the school type, etc. The second part consists of questions to determine the infrastructure of the schools in which the teachers are employed in terms of effective use of GIS in geography courses. The third part is developed an understanding of whether the geography teachers have enough skills to apply GIS applications in their courses. The fourth part aims at measuring the tendency of teachers to use GIS in their courses. The last part was allocated to determine the attitudes of geography teachers towards using GIS in their courses including the benefits of using GIS, fundamental factors preventing them from

using GIS, etc. For the descriptive analysis, frequencies and crosstabs are used throughout the study.

4. Findings

4.1. Demographic features of respondents

Demographic features of 183 geography teachers who responded to the questionnaire from almost 50 different provinces of Turkey (nearly half of them were employed in Istanbul and Ankara) revealed that most of the teachers were male (n= 128). The number of female teachers was 55. As the statistics revealed, almost half of the teachers were between the ages of 33 and 40, more than half of the respondents were employed in public schools, and 123 teachers out of 183 had more than 10 years of professional experience. It was found that the big majority of respondents (n= 130) knows a beginner level of English, while 46 of them announced that they had intermediate level of English and just 7 of them expressed that they know English at advanced level. With regard to the educational level of teachers, we can say that more than two thirds (n= 134) of them had an undergraduate diploma while 47 of them had a graduate diploma including master and doctoral education. 138 teachers out of 183 reported that class-size that the respondents teach changes between 16 and 30.

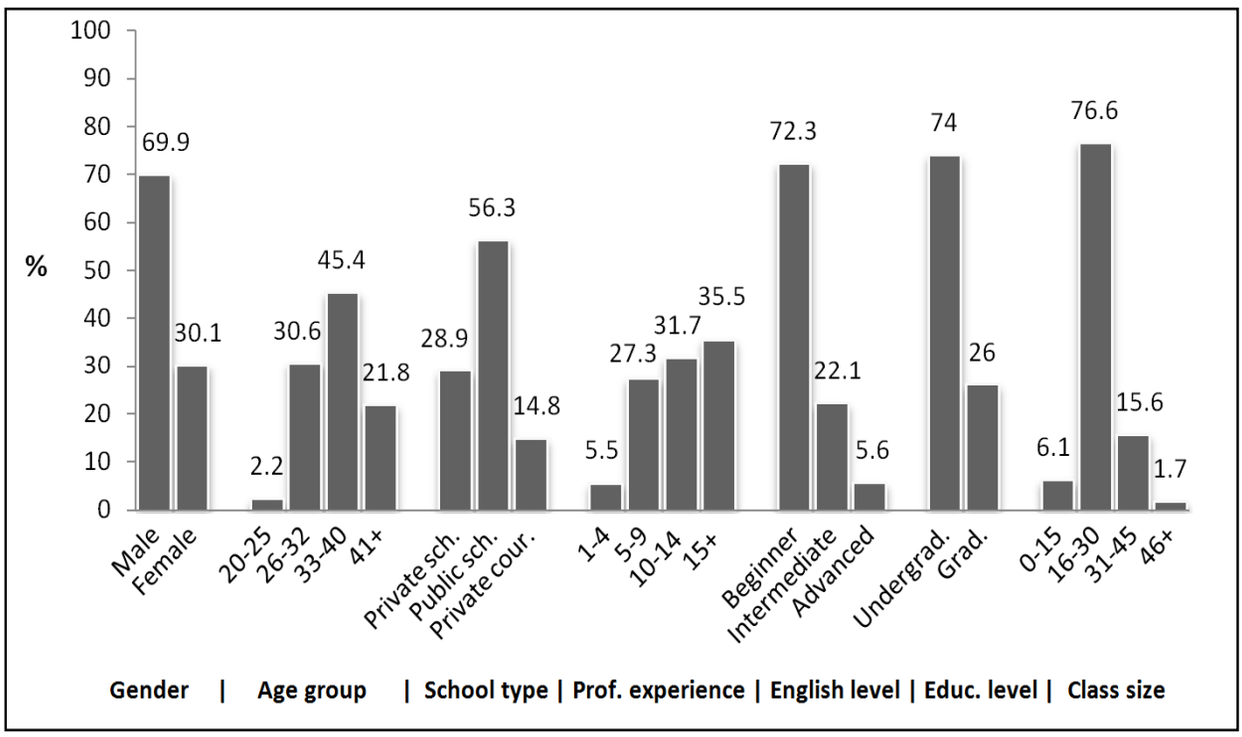

Figure 2. Demographic features of respondents.

4.2. The opinions of geography teachers regarding the importance and limitations of GIS

By assessing the composition of Table 5, the following inferences may be drawn:

- The big majority of teachers seem to appreciate the importance and necessity of using GIS in geography education, as almost 82% of them agreed or strongly agreed that GIS is an important tool in geography education and slightly more than 60% of them thought that a geography course without using GIS is missing.
- Almost half of the teachers think that limited time, insufficient infrastructure of schools and weak background of teachers are significant restraints in terms of an efficient use of GIS in their courses.
- More than two thirds of respondents complained about insufficient support from the ministry of education in terms of GIS programs and GIS training (Table 6).

Statements		Level of agreement				
			Strongly disagree/ Disagree 1/2*	Neutral 3*	Agree/ Strongly agree 4/5*	Total
1	GIS is an important tool for geography courses	*n*	9	24	148	183
		%	4.9	13.3	81.8	100
2	A geography course without using GIS is missing	*n*	29	43	109	181
		%	16.1	23.8	60.1	100
3	I don't have enough time to learn and teach with GIS	*n*	68	37	76	181
		%	37.6	20.4	42	100
4	It is impossible to use GIS in geography courses with the present insufficient infrastructure of schools and background of teachers	*n*	44	37	100	181
		%	23.3	20.4	55.3	100
5	Ministry doesn't support the teachers enough in providing software and training	*n*	24	28	129	181
		%	13.3	15.5	71.2	100
*1: Strongly disagree 2: Disagree 3: Neutral 4: Agree 5: Strongly agree						

Table 6. Opinions of geography teachers about the importance and limitations of GIS.

4.3. Attitudes of geography teachers towards using GIS in their courses:

The answers of the teachers to the related questions and their agreement level to the given statements provide us with very little reasons to be optimistic regarding the use of GIS in geography education in Turkey. This is because 75% of teachers or more stated that:

- They didn't have GIS software,
- Their schools didn't have GIS software,
- They didn't know how to use GIS software,

- They didn't have required GIS documents in order to develop a course activity,
- They couldn't develop a GIS course activity,
- They didn't use GIS in their courses,
- Their students didn't use GIS in their projects and assignments,
- They didn't attend a GIS training program, and 51.4% of them reported that they didn't have a computer laboratory to use in the courses developed by the help of GIS (Table 7).

Questions and statements			Answers		
			Yes	No	Total
1	Do you have a computer laboratory which can be used in geography courses?	*n*	88	93	181
		%	48.6	51.4	100
2	Do you have a GIS software?	*n*	21	159	180
		%	11.7	88.3	100
3	Does your school have a GIS software?	*n*	6	173	179
		%	3.4	96.6	100
4	I heard the term "GIS" first time?	*n*	17	164	181
		%	9.4	90.6	100
5	I know what the GIS is and its area of usage.	*n*	135	46	181
		%	74.6	25.4	100
6	I know how to use a GIS software.	*n*	38	143	181
		%	21	79	100
7	I have required documents such as data, map, and images, etc to develop GIS activities in my courses.	*n*	33	149	182
		%	18.1	81.9	100
8	I can develop a GIS course activity by using GIS.	*n*	39	143	182
		%	21.4	78.6	100
9	I use GIS in my courses.	*n*	24	158	182
		%	13.2	86.8	100
10	My students use GIS in their assignments and projects.	*n*	12	170	182
		%	6.6	93.4	100
11	I know where to get a GIS training.	*n*	89	92	181
		%	49.2	50.8	100
12	I have attended a GIS training program so far including in-service training, course, panel, conference, workshop, etc.	*n*	40	141	181
		%	22.1	77.9	100
13	I want to attend any GIS in-service training program that will be organized by ministry of education	*n*	152	28	182
		%	83.5	15.4	100

Table 7. Attitudes of geography teachers towards using GIS.

However, more than half of the geography teachers stated that they know where to get a GIS education and more than 83% of them expressed that they are willing to attend any GIS training program by the ministry. This shows that they want to develop themselves in GIS and are planning to use it if the negative circumstances are changed by the authorities.

5. Conclusion

The research results revealed that before assessing the use of GIS in geography education, we have to focus on the technology adaptation into geography education. In spite of a common consensus among the educators that technology has innumerable benefits for teachers and students, there are some issues to be taken into account by all stakeholders of education: almost half of the teachers in Turkey suffer from the insufficiency of a technological infrastructure in their schools and at least one third of them have difficulties with how to integrate the technology in their courses, although the 2005 geography program of Turkey suggests more integration of technology in education (Incekara, 2011a, Table 7). It is not realistic to expect GIS to be a widely used technology, as the schools and geography teachers experience many discouraging problems on technological infrastructure and competencies for incorporating technology into education.

With regards to GIS in geography education, the integration of GIS into the geography curriculum of Turkey goes back to the secondary school curriculum reform realized by the ministry of education in 2005. Turkey's geography curriculum of 2005 suggested maximum use of technology and particularly underlined the extensive incorporation of 21 GIS activities into geography courses. Nevertheless, almost 6 years since the ministry of education launched the new program, it is quite clear that GIS has failed to become an integral part of geography education in Turkey: research results indicated that only 13% of geography teachers use GIS in their courses and just 6.6% of students benefit from GIS for their projects and courses. These results unfortunately correspond to the previous studies' outcomes that the usage of GIS in geography education is very limited on international and national levels despite fact that the support for GIS among geography teachers is very high (Kerski, 2003; Korevaar & Schee, 2004; Yap et al., 2008; Demirci, 2008; Artvinli, 2009; Demirci; 2009; Incekara, 2011b).

The research outcomes showed that 74.6% of the respondents stated that they knew what GIS is and its area of usage and almost 79% of them expressed that they didn't know how to develop a GIS activity for their courses. This means that most of them know what GIS is, but they don't have enough knowledge of how to teach geography with GIS. These outcomes exposed the fact that Turkey is placed in between the "awareness" and "understanding" stages based on Bednarz & Ludwig's four stages in the adoption of educational innovation (Bednarz & Ludwig, 1997, Table 1). The research results also revealed that geography teachers will walk alone in the way of using GIS in their courses because they believe that (71.2%) the ministry of education doesn't support them enough in providing software and

training. According to geography teachers, the limited time to teach and learn GIS, the insufficient technological infrastructure of schools, and lack of necessary knowledge of GIS and how to incorporate it into education are among the most critical restraints that prevent an effective use of GIS in courses to be mitigated.

As closing remarks, when we seek the answer to the question "Do Geographic Information Systems (GIS) move high school geography education forward in Turkey?" from a teacher's perspective, we found that the answer is quite clearly "not yet", at least "not in the short-run". However, the research results give us enough evidence to be optimistic in the long-run because:

- More than 80% of the teachers agreed or strongly agreed that GIS is an important tool for geography education,
- More than 60% of them think that a geography course without using GIS is missing, and
- More than 83% of geography teachers expressed that they want to attend any GIS training program if organized by the ministry of education.

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