World Journal on Educational Technology: Current Issues

Volume 10, Issue 3, (2018) 186-196

www.wj-et.eu

Use of geographic information systems (GIS) in geography lessons according to teachers' opinion

Yavuz Degirmenci*, Faculty of Education, Bayburt University, Bayburt 69000, Turkey.

Suggested Citation:
Degirmenci, Y. (2018). Use of geographic information systems (GIS) in geography lessons according to teacher' opinions. *World Journal on Educational Technology: Current Issues*. *10*(3), 186-196.

April 08, 2018; revised date May 11, 2018; accepted date June 19, 2018.
Selection and peer review under responsibility of Prof. Dr. Servet Bayram, Yeditepe University, Turkey.

Abstract
The purpose of the present study is to determine geography teachers' opinions about how often, for what reasons and for what subjects the geographic information systems (GIS) are used in geography lessons. This qualitative study was carried out based on phenomenological design. The study was conducted with 15 geography teachers servicing at different schools in a city of Turkey. The teachers' opinions were obtained via the semi-structured interview form developed by the researcher and the series of obtained data were analysed via the content analysis method. The study results showed that a great majority of the teachers did not use the GIS in their lessons and the reason for this was that they are not having sufficient knowledge about how to use them. Also, the teachers emphasised the insufficiency of possibilities, infrastructure, software and hardware. However, it was observed that all the teachers agreed on the necessity of using the GIS in geography lessons.

Keywords: Geography education, geographic information systems (GIS), teacher opinions.

* ADDRESS FOR CORRESPONDENCE: **Yavuz Degirmenci***, Faculty of Education, Bayburt University, Bayburt 69000, Turkey.
E-mail address: ydegirmenci@bayburt.edu.tr / Tel.: +0458-211-11-53

"This paper was presented as an oral presentation in the International Symposium on Social Studies Education VI (May 04-06, 2017) in Eskisehir, TURKEY."

1. Introduction

Today, as it is the case in every field, there is a rapid change and renovation movement in the field of education too. This change observed in educational environments especially brings along the renovation in teaching environments as well and teaching environments are becoming more modernised with every passing day. This process has changed not only the structure of education but also the view of individuals and information. Today, instead of individuals accepting information without questioning information and being inactive in learning environments, raising individuals with questioning skills and the ability to adapt to new situations has come into prominence. In order to achieve this prominence, it is necessary to benefit from possibilities provided by information and technology. At this point, teachers and educators should assume important responsibilities (Degirmenci, 2015). The use of technological tools in the educational process helps education to reach its aim within a short period of time and increases the quality of education (Daban, 2001; Sari, 2005). The technological developments observed in the field of education fundamentally seek an answer to the question of how to teach. However, teachers should assume more responsibilities in order to create a modern classroom environment and benefit from technology (Aktepe, 2011). For this reason, it is clear that teachers need to have skills of using tools-equipment and technology, which are suited for subjects and lessons, in different lessons and subjects in modern classroom environments.

In recent years, rapid changes have been observed in the field of education. In order to realise effective learning in classroom environments, new methods, techniques and materials are being developed and used. The development and use of new technologies in the educational process increase the quality of educational services (Zaman, Coskun, Sever, Turkez & Zaman, 2009). However, increasing the efficiency and effectiveness in education does not only depend on the existence of technological materials in schools. Here, what is important is the effective use of the existing tools and materials. For there are many benefits to the use of these tools and materials used in the teaching process. Shortly, materials used in teaching enhance attention in the learning process, arouse interest, make learning subjects more clear and understandable, facilitate learning, prevent memorisation and provide learners with rich learning experiences (Sari, 2005).

Today it is possible to use technology in many areas of the education process. One of these areas is geography education. For, both with its subjects and its structure, geography is a scientific area where technology can be applied successfully. Today one of the most important novelties which technology has brought to the science of geography is the Geographic information systems (GIS) (Degerliyurt & Cabuk, 2015). GIS is a computer-based information system performing the functions of visualisation of spatial data obtained through position-based procedures, data collection, analysis, storage and presenting to users in an integrated way (Broda & Baxter, 2003; Kinniburgh, 2010; Liu & Zhu, 2008; Madsen & Rump, 2012; Swanson, 2008; Yomralioglu, 2009). Moreover, with the help of GIS, answers can be found quickly and easily to such questions as what, where and how which the discipline of geography tries to answer (Fitzpatrick, 2001).

Performing geography lessons with the help of GIS ensures active learning and makes geography lessons more enjoyable (Artvinli, 2010). When the geography teaching programme put into practice in Turkey in 2005 and renewed by making updates in the following years is examined, it is observed that the student-centred approaches making individuals active were adopted. However, the programme emphasises the necessity of using new technologies like GIS in geography lessons and suggests the use of GIS in different acquisitions, too. Moreover, McClurg and Buss (2007), too, refer to the importance of using GIS in educational environments. GIS is a powerful tool which can be used to make detailed studies on local conditions and analyse changing environmental conditions. In classroom environments, it can draw students' interest and increase their inclination to technology.

GIS, which is commonly used in many areas today (Turoglu, 2011; Yomralioglu, 2009), is becoming widespread in the field of education as well. In fact, according to Ozdemir and Karadogan (2003), the GIS technology has an important potential for geography lessons and should be used in geography

lessons. Geography, which is fundamentally an earth science whose focal point is human and space, is mentioned together with GIS abroad (Doganay, 2011) and GIS forms an important part of geography education (Turoglu, 2003). According to Favier and Schee (2012), in the last 10 years, an increasing number of teachers started to be interested in the use of GIS in educational environments. Today, one of the biggest developments observed in the science of geography and education is GIS. With its wide area of use, power of analysing every kind of data and effective methodology, GIS is gaining more importance in geography education with every passing day (Aydin & Cepni, 2016). The use of GIS, whose background goes back to pre-1960's (Uygucgil, 2011) and which started to be used commonly in the world after the 1960's, in Turkey especially in educational environments is relatively new (Kapluhan, 2014; Olgen, 2005; Ugurlu, 2008). However, it is clear that there is a need for more study results related to the use of GIS in educational environments (Patterson, Reeve & Page, 2003).

When the related literature is examined, it is observed that there are many studies on the use of GIS in educational environments, particularly in geography lessons (Aladag, 2007; Altas & Degirmenci, 2015; Artvinli, 2010; Aydin & Kilcan, 2016; Baker & White, 2003; Cepni, 2013; Degirmenci & Altas, 2016; Favier & Schee, 2012; Lee & Bednarz, 2009; Linn, Kerski & Wither, 2005; McClurg & Buss, 2007; Simsek, 2007; Ugurlu, 2007; Zaman et al., 2009). However, according to Kinniburgh (2010), the potential of GIS in the fields of social science education is not yet fully known. When the contents of the above-mentioned studies are examined, it is seen that some of these studies were carried out with students and preservice teachers. However, since the use of GIS in educational environments is new in Turkey, it is important to determine the current situation in relation to the practice of GIS, reveal the difficulties encountered in the process, propose possible solutions to problems and emphasise the need for the use of GIS in educational environments with study findings. This study was carried out with the teachers who were at every stage of educational process by considering all these mentioned reasons. Moreover, in the direction of this general purpose stated in the study, answers were sought to the following sub-questions as well:

- Did the participant geography teachers receive a post-graduate degree?
- Did the participant geography teachers receive any training related to GIS?
- Are the participant geography teachers using GIS in their geography lessons?
- Why are the participant geography teachers using GIS in their geography lessons?
- Why aren't the participant geography teachers using GIS in their geography lessons?
- What geographical skills can GIS have students to acquire, according to the participant geography teachers?

2. Method

In this study, the phenomenological design, one of the qualitative research methods, was used. This approach lays an appropriate groundwork for focusing on phenomena of which we are aware in daily life but about which we do not have a deep and detailed understanding. However, it may appear before us in different forms such as phenomena, events, experiences, perceptions, concepts and situations (Yildirim & Simsek, 2011). The phenomenological approach is the investigation of individual universe. That is to say, individual experiences underlie this approach. The researcher is interested in participants' personal experiences (Bas & Akturan, 2008; Smith & Eatough, 2007). Moreover, Smith and Eatough (2007) suggest that, for detailed analyses in a phenomenological study, attention should be paid to such stages as selection of small sample groups, holding interviews with participants, grouping data obtained from participants' opinions under certain themes and categories and finally interpreting and reporting participants' opinions (Smith & Eatough, 2007). In this context, in the study, the geography teachers were asked for their opinions with the aim of determining whether they are using GIS in their lessons, the reasons why they are using GIS, the reasons why GIS should be used and what difficulties they have when they are using GIS and the series of data obtained from their experiences were analysed via the content analysis method and then interpreted.

2.1. Data collection tool

The purpose of this research was to determine the geographical teachers use of GIS in teaching geography subjects, why they should be used, which subjects they usually use in their teaching and their opinions and thoughts on the use of GIS, the interview technique, one of the qualitative research methods, was used (Yildirim & Simsek, 2011). The data of the study were collected via the semi-structured interview form developed by the researcher. The aim of qualitative interviews is to achieve the understanding of things which cannot be observed directly such as participants' feelings, thoughts, ideas and behaviours (Patton, 1990). For this purpose, interviews were held with the participant teachers separately and data were collected in relation to the research questions.

2.2. Study group

This study was carried out with 15 geography teachers selected by using the purposeful sampling method and working at secondary educational institutions in a city centre of Turkey during the spring semester of the 2016–2017 educational year. The interviews held with each of the participant teachers lasted 15–20 minutes on the average. The data belonging to the study group were given in Table 1.

Table 1. Characteristics of the study group

Professional experience	Female	Male	Total
Between 1and 4 years	2	4	6
Between 5 and 9 years	1	3	4
Between 10 and 14 years	1	-	1
15 years and over	-	4	4
Total	4	11	15

The participant geography teachers' professional experience varied between 1 and 32 years. When Table 1 is examined, it is observed that the study group was composed of a total of 15 teachers, 4 females and 11 males. In the study, it is observed that while six teachers had a teaching experience of 1–4 years, four teachers had a teaching experience of 5–9 years, one teacher had a teaching experience of 10–14 years and finally, four teachers had a teaching experience of 15 years and over.

2.3. Data analysis

The data obtained in the study were analysed via the content analysis technique. The purpose of the content analysis is to gather obtained sets of data under certain concepts and themes and arrange and interpret them in a way that readers can understand them (Yildirim & Simsek, 2011). The reached data were presented in the tables in the form of percentages (%) and frequencies (f) and then interpreted. Moreover, in order to ensure the reliability of the data, the formula of [Consensus / (Consensus + Dissidence) x 100] suggested by Miles and Huberman (1994) was based on and 96% agreement was found.

3. Findings

In this section of the study, the findings obtained from the interviews held with the geography teachers were given in order, in tables, in company with the questions formed in relation to the purpose of the study. In Table 2, the participant geography teachers' post-graduate educational statuses were given.

Table 2. The participant geography teachers' post-graduate educational statuses

Category	(*f*)	(%)
I have a post-graduate degree	2	13.3
I don't have a post-graduate degree	13	86.6

When Table 2 is examined, it is observed that while very few of the participant teachers (*n* = 2), (13.3%) continued post-graduate education following undergraduate education in their field, a great majority of the study group (*n* = 13), (86.6%) did not receive any kind of post-graduate education following undergraduate education. In Table 3, information was given about whether they had any education (lesson, seminar, private course, etc.) on GIS.

Table 3. If the participant geography teachers received an education on GIS

Category	(*f*)	(%)
Yes, I received an education on GIS	9	60.0
No, I did not receive an education on GIS	6	40.0

When Table 3 is examined, it is observed that while (*n* = 9) (60.0%) of the participant teachers had a previous experience in relation to GIS, the others (*n* = 6) (40.0%) did not have any experience in relation to GIS. In fact, during the interview process, six participant geography teachers stated not having received any private course, training or undergraduate course on GIS. While only two of the teachers stated having received private training on GIS, one teacher stated having met GIS in the in-service training process. However, the other six teachers stated having received only one undergraduate course on GIS. Table 4 includes the teachers' opinions about the use of GIS in geography lessons.

Table 4. Do you think that the GIS should be used in geography lessons?

Category	(*f*)	(%)
Yes	15	100.0
No	-	-

When Table 4 is examined, it is observed that all the participant teachers (100%) agreed on the necessity of using GIS in the teaching process in geography lessons. Table 5 includes information about whether the participant teachers are using GIS or not.

Table 5. Information about whether the teachers are using GIS in their geography lessons

Category	(*f*)	(%)
Yes, I'm using	2	13.3
No, I'm not using	13	86.6

When Table 5 is examined, it is observed that although all the teachers stated opinions in relation to the necessity of using GIS in geography lessons, very few of them were currently using this technology in their lessons. In fact, according to Table 5, while (13.3%) of the teachers were using GIS in their lessons, a great majority of them (86.6%) were not using GIS in their lessons. In Table 6, the reasons why the teachers were using this technology in their lessons were given. However, here, each teacher drew attention to more than one reason.

Table 6. The teachers' opinions about the reasons why they are using GIS in their geography lessons

Category	(*f*)
Visualisation of geographical data	2
GIS ensures permanent learning	2
GIS allows for the comparison of geographical data	1
GIS allows for the analysis of geographical data	1
Harmony between GIS and geographical subjects	1
GIS addresses more sensory organs	1

The teachers using the GIS technology in their lessons expressed more than one reason why they are using it. According to Table 6, the two reasons which were attached more importance were GIS's visualising geographical data (*n* = 2) and making learning permanent (*n* = 2). However, its allowing for the comparison and analysis of geographical data, addressing more than one sensory organs and harmony with geography subjects are the other reasons why GIS is used. Table 7 includes the distribution of the reasons expressed by the teachers who are not using GIS in their geography lesson in relation to why they are not using it.

Table 7. The teachers' opinions about why they are not using GIS in their geography lessons

Category	(*f*)
Teachers' not being competent at using GIS	9
Lack of sufficient hardware and software	6
Lack of classroom environments which are suitable for the use of GIS	1

The teachers not using the GIS technology in their lessons stated more than one reasons for their not using it. According to Table 7, of these reasons, the most emphasised reason for not using GIS (*n* = 9) was their not being competent at using GIS. In fact, one of the most important reasons of this was the teachers' not having received any training on the use of GIS in the classroom. Again when Table 7 is examined, it is also observed that as a reason for not using GIS in the classroom, the teachers (*n* = 6) mentioned the lack of sufficient hardwares and softwares at their schools. However, another reason was the inappropriate classroom environments. In Table 8, all the geography teachers (those who were using (*n* = 2) and not using (*n* = 13) GIS in their lessons) were asked why GIS should be used in geography lessons and the received answers were shared.

Table 8. Why GIS should be used in geography lessons?

Category	(*f*)
GIS facilitates the collection and analysis of geographic data	5
GIS visualises and concretises geographical data	5
GIS can be used in many geography subjects	2
GIS is effective on the solution of complicated issues	1
GIS is effective on making a decision in relation to a space	1
GIS allows for experiential learning	1
GIS facilitates the answering of geographical questions	1
GIS allows for student-centred teaching	1

In the study, when the teachers using and not using GIS in their geography lessons were asked why you think GIS should be used in geography lessons, they uttered more than one reasons for this. When Table 8 is examined, some teachers are observed to think that GIS facilitate the collection and analysis of geographical data (*n* = 5), others are observed to think that GIS visualise and concretise geographical data (*n* = 5) and yet others are observed to think that GIS can be used in many subjects of geography (*n* = 2). However, among the other reasons were GIS's being effective on the solution of

complicated matters and making decisions on space, allowing for experiential learning, facilitating the answering of geographical questions and finally allowing for the student-centred teaching. In Table 9, information was given about the geographical skills which GIS might have students acquire.

Table 9. The teachers' opinions about the geographical skills which the use of GIS in geography lessons might have students acquire

Category	(*f*)
Skills of reading maps, tables and graphs	6
Skill of questioning	4

The participant teachers were asked if there were any geographical skills which students might be made to acquire through using GIS in geography lessons, the teachers generally stated that GIS had an effect on having students acquire the skill of reading maps, tables and graphs (*n* = 6) and also developed students' questioning skills (*n* = 4).

4. Conclusion and discussion

In the present study, a total of 15 currently servicing geography teachers' opinions were collected in relation to the use of GIS in geography lessons and the results were evaluated.

In this study, it was observed that only (*n* = 2) of the participant teachers had a post-graduate degree and the others (*n* = 13) did not have a post-graduate degree in relation to their field. However, when it was examined if the teachers had any GIS experience, it was found that only two teachers stated having received private training on GIS and one teacher stated having met GIS during the in-service training process. Moreover, the other six teachers stated having received training related to GIS only at the undergraduate level. It was determined that the remaining six teachers did not have any experience in relation to GIS. All the participant teachers (100%) stated an opinion in relation to the necessity of using GIS in geography lessons. Again, this result shows similarity to the results of the study by Akinyemi (2015). In the mentioned study made with teachers, all the participants (100%) agreed on the necessity of using GIS in geography lessons. Similarly, Aladag (2014) found in a study that the teachers held the opinion that GIS required to be used in lessons and had many advantages to education and teaching. Again, Aydin and Kilcan (2016) determined as a result of a study in which they examined the teachers' opinions about GIS that an important part of the participant teachers held the opinion that GIS could be used at all class levels but it would be more appropriate to use it in the 11th and 12th grades. Moreover, in the study, the geography teachers were found to emphasise the GIS technology's providing some advantages such as facilitating the collection, analysis and updating of geographic data as one of the reasons for using GIS in geography lessons. Rickles, Ellul and Haklay (2017) determined in their interdisciplinary study on the use of GIS that the interdisciplinary researchers stated their desire to use GIS to obtain, analyse and visualise data.

In the study, it was emphasised that the teachers were not competent enough to use the GIS technology. This result is supported by those which were obtained from the studies by Aydin and Cepni (2016), Aydin and Kaya (2010), Bednarz (2004), Karademir (2013) and Shin (2006). In fact, although Bednarz (2004) emphasises the importance of teacher training and competence in the use of GIS, Karademir (2013) found in a study on the field knowledge competence of the preservice geography teachers that the preservice teachers were not competent enough to use GIS. Moreover, Shin (2006) emphasised the fact that the use of GIS not only depend on the developmental levels of students, but it also depended on teachers' technological competence levels. About this matter, while Aydin and Cepni (2016) found in their study examining the teachers' opinions about the use of GIS that 73.3% of the participants stated not having received any GIS training before, 80% of them stated not having sufficient knowledge about GIS, Aydin and Kaya (2010) determined in a similar study that 70% of the teachers did not know about GIS.

In the study, the teachers gave different answers to the question 'Why do GIS need to be used in geography lessons?' Of these answers, the GIS technology's visualising and concretising geographic data and thus achieving permanent learning were the ones having been attached more importance. According to the results of the study by Artvinli (2009), when mentioning the advantages of the use of GIS, the teachers generally stated that GIS facilitated learning and supported active learning. Again, Aydin and Kilcan (2016) determined in their study that the participant teachers stated that it was useful to use GIS for many subjects of geography mainly map information and population. In Aladag (2014) study, when the teachers mentioned the advantages of GIS, they emphasised its increasing visuality, developing map information, contributing to permanency and making learning enjoyable as well as usability in the teaching of many subjects of geography.

In the study, the obstacles before the use of GIS in lessons were examined and some limitations were found in relation to this matter. The main limitation are teachers' having to be competent at using GIS (n = 9), lack of software and hardware (n = 6) and lack of classrooms which are suitable for GIS (n = 1). This finding shows similarity to those reached by Aladag (2014). In the same study, such difficulties as the teachers' having insufficient computer knowledge, being incompetent at using GIS, time problem, insufficiency of software and technical substructure CBS were reported to be obstacles before the use of GIS. Kerski, Demirci and Andrew (2013) drew attention to these difficulties and emphasised that educators continuously uttered problems related to the CBS software and hardware. Moreover, Cukur (2005) mentioned the costliness of the tools and equipment which were necessary to perform the main function of GIS and the insufficient number of teachers being able to use GIS and develop materials in relation to this matter as the most important limitations about this matter. Again, Akinyemi (2015) found in a study with teachers that only 32% of the participant teachers stated using GIS in their lessons and 68% of them stated not using this technology in their lessons. Among the reasons why they did not use it were the lack of GIS software (41%), the insufficient number of computers (19%) and some teachers' being incompetent at using GIS. Similar limitations were mentioned by Patterson, Reeve and Page (2003), too. According to Ugurlu (2008), one of the most important obstacles before the use of GIS in teaching environments was teachers who had insufficient knowledge about and time to use GIS. Again, Aydin and Kilcan (2016) emphasised in their studies that such reasons as lack of hardware at schools, insufficient number of geography lesson hours, intensiveness of the curriculum, teachers' having insufficient knowledge of GIS, software problem, lack of data, crowded classrooms and students' low levels limited the use of GIS in lessons. Similarly, Artvinli (2009) mentioned the lack of hardware and insufficient geography lesson hours as the main limitations to the use of GIS. In a study with teachers, Kerski (2001) listed such difficulties as the lack of education in this field, the insufficiency of software and hardware and the length of preparation time among the reasons for teachers' not using GIS. However, Favier and Schee (2012) emphasised the fact that although the use of GIS had increased in recent years, teachers still had insufficient knowledge about the best way of using GIS in lessons. Moreover, Bevainis (2008) determined after the interviews with five geography teachers that some of the teachers used GIS in their lessons but there were problems at schools in relation to the use of this technology. These problems were generally related to software and practice, costliness of GIS software and some students' having low computer using skills.

Moreover, one of the remarkable findings obtained following the interviews held with the teachers in the study was that the use of GIS in geography lessons contributed to the development of map reading and questioning skills in the students. Degirmenci (2015) found in a study with students that the use of GIS in geography lessons helped to develop many geographic skills in the students; it particularly enhanced the students' map and questioning skills in a positive way. Likewise, Kinniburgh (2010) determined in a study that GIS had an important potential in making contribution especially to the development of map skills in individuals. When the results of the studies carried out by Aladag (2014), Artvinli (2009, 2010), Aydin and Kilcan (2016) Baker (2002), Bevainis (2008), Cepni (2013), Hagevik (2003) and Shin (2006) and in this field are examined, it is observed that GIS makes important contributions to the development of students' geographic skills.

5. Suggestions

When the sets of data obtained as a result of the study are evaluated, the following suggestions can be made:

- In the study, although all the teachers agreed to the necessity of using GIS in geography lessons, it was determined that they did not use this technology sufficiently. Necessary works should be carried out to make teachers use this technology in their lessons more effectively and efficiently.
- In the study, it was found that although the teachers wanted to use this technology, they could not use it for various reasons. It is necessary to eliminate difficulties and obstacles before the use of GIS in lessons.
- At schools, GIS laboratories should be established and necessary infrastructure should be provided.
- Softwares, hardwares and other tools which are necessary for this technology should be provided.
- Geography lesson hours and the teaching programme should be revised, so as to allow for more opportunity to do GIS practices.
- The teachers should be provided with the skill of using this technology by starting from undergraduate semesters and the number of applied courses related to GIS should be increased at universities.
- The teachers not having acquired the skill of using GIS fully in the undergraduate period should be convinced about the fact that in-service training periods are an important opportunity and they should be made to acquire these skills through seminars or courses in this period.
- In order to increase the number of GIS practices in geography lessons, a platform where different GIS practicing examples from all over the world and Turkey are brought together should be established and teachers can be given an opportunity to see and get acquainted with novelties and different examples in the field.

References

Akinyemi, F. O. (2015). An assessment of gis use for teaching in Rwandan secondary schools. *The Geography Teacher, 12*(1), 27–40.

Aktepe, V. (2011). The classroom teachers' views on computer use in their courses. *Ahi Evran University Faculty of Education Journal, 12*(3), 75–92.

Aladag, E. (2007). *The effect of geographic information system (GIS) in teaching social studies to the academic achievements and motivation of 7th grade students of primary education* (Unpublished doctoral dissertation). Gazi University Educational Sciences Institute, Ankara, Turkey.

Aladag, E. (2014). An evaluation of geographic information systems in social studies lessons: teachers' views. *Educational Sciences: Theory & Practice*, *14*(4).

Altas, N. T. & Degirmenci, Y. (2015). Evaluation of using of GIS (Geographic Information System) in teaching of geography in higher education in terms of the student opinions. *The Black Sea Journal of Social Siciences, 7*(3), 1–14.

Artvinli, E. (2009). Approaches of geography teachers to geographical information systems (GIS). *BAU-SBED, 12*(22), 40–57.

Artvinli, E. (2010). The contribution of geographic information systems (GIS) to geography education and secondary school students' attitudes related to GIS. *Educational Sciences: Theory & Practice, 10*(3), 1255–1292.

Aydin, F. & Cepni, O. (2016, June 2–4). *Cografi bilgi sistemlerine yonelik hizmetici egitim faaliyetlerinin ogretmen goruslerine gore degerlendirilmesi.* ERPA International Congresses, Sarajevo, Bosnia and Herzegovina.

Aydin, F. & Kaya, H. (2010). Geography teachers' views towards vocational geographic information systems (GIS) seminar. *Middle-East Journal of Scientific Research*, *6*(6), 631–636.

Aydin, F. & Kilcan, B. (2016, June 2–4). *Cografya dersinde cografi bilgi sistemleri kullanimina yonelik ogretmen gorusleri.* ERPA International Congresses on Education, Sarajevo, Bosnia and Herzegovina.

Baker, T. R. (2002). *The effects of GIS technologies on students' self-efficies and achievement in middle school science classroom* (Doctoral dissertation). University of Kansas, Lawrence.

Baker, T. R. & White, S. H. (2003). The effects of GIS on students' attitudes, self-efficacy and achievement in middle school science classroom. *Journal of Geography, 102*(6), 243–254.

Bas, T. & Akturan, U. (2008). *Nitel arastirma yontemleri NVivo 7.0 ile nitel veri analizi* (1. baski). Ankara, Turkey: Seckin Yayincilik.

Bednarz, S. W. (2004). Geographic information systems: a tool to support geography and environmental education? *GeoJournal, 60*, 191–199.

Bevainis, L. (2008). Applying the GIS in school education: the experience of Japanese geography teachers. *GEOGRAFIJA, 44*(2), 36–40.

Broda, H. W. & Baxter, R. E. (2003). Using GIS and GPS technology as an instructional tool. *The Social Studies, 94*(4), 158–160.

Cepni, O. (2013). The Use of geographic ınformation systems (GIS) in geography teaching. *World Applied Sciences Journal, 25*(12), 1684–1689.

Cukur, H. (2005). The targets of geography teaching and GIS. Dokuz Eylul University. *The Journal of Buca Faculty of Education, 18*, 87–99.

Daban, S. (2001). *Cografya ogretiminde bilgisayar ve programlarinin kullanimi* (Yayimlanmamis yuksek lisans tezi). Dicle Universitesi Sosyal Bilimler Enstitusu, Diyarbakir, Turkey.

Degerliyurt, M. & Cabuk, S. N. (2015). Defining the geography by geographical information systems. *Eastern Geographical Review, 20*(33).

Degirmenci, Y. (2015). *The effects of GIS (Geographical Information Systems) supported education on academic success and motivation of student candidates* (Unpublished doctoral dissertation). Ataturk University the Institute of Educational Sciences, Erzurum, Turkey.

Degirmenci, Y. & Altas, N. T. (2016). Academic achievement effect in geography course of GIS (geographic informatıon systems) assisted instruction in higher education. *Erzincan University Journal of Social Sciences Institute, 9*(2), 153–166.

Doganay, H. (2011). In terms of its meaning, definition, subject and philosophy some opinions on science of geography. *Eastern Geographical Review, 16* (25).

Favier, T. T. & Schee, J. A. (2012). Exploring the characteristics of an optimal design for inquiry-based geography education with geographic information systems. *Computers & Education*, *58*(1), 666–677.

Fitzpatrick, C. (2001). A trainer's view of GIS in schools. *International Research in Geographical and Environmental Education, 10*(1), 85–87.

Hagevik, R. A. (2003). *The effects of online science instruction using geographic information systems to foster inquiry learning of teachers and middle school science student* (Unpublished doctoral dissertation). North Carolina State University, Raleigh.

Kapluhan, E. (2014). The importance and necessity of the use of geographic ınformation system (GIS) in geography teaching. *Marmara Geographical Review, 29*, 34–59.

Karademir, N. (2013). Competences level of prospective geography teachers for their field. *Eastern Geographical Review, 18*(29).

Kerski, J. J. (2001). A National Assessment of GIS in American High Schools. *International Research in Geographical and Environmental Education, 10*(1), 72–84.

Kerski, J. J., Demirci, A. & Andrew, J. M. (2013). The global landscape of GIS in secondary education. *Journal of Geography, 112*, 232–247.

Kinniburgh, J. (2010). A constructivist approach to using GIS in the New Zealand classroom. *New Zealand Geographer, 66*, 74–84.

Lee, J. & Bednarz, R. (2009). Effect of GIS learning on spatial thinking. *Journal of Geography in Higher Education, 33*(2), 183–198.

Linn, S., Kerski, J. & Wither, S. (2005). Development of evaluation tools for GIS: how does GIS affect student learning? *International Research in Geographical and Environmental Education, 14*(3), 217–224.

Liu, S. & Zhu, X. (2008). Designing a structured and ınteractive learning environment based on GIS for secondary geography education. *Journal of Geography, 107*(1), 12–19.

Madsen, L. M. & Rump, C. (2012) Considerations of how to study learning processes when students use GIS as an instrument for developing spatial thinking skills. *Journal of Geography in Higher Education, 36*(1), 97–116.

McClurg, P. A. & Buss, A. (2007). Professional development: teachers use of GIS to enhance student learning. *Journal of Geography, 106*(2), 79–87.

Miles, M. B. & Huberman, A. M. (1994). *Qualitative data analysis: an expanded source book* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Olgen, K. (2005, April 27–29). *GIS Education in Turkey* (K. Olgen, Ed.). Ege GIS Symposium, Izmir, Turkey.

Ozdemir, M. A. & Karadogan, S. (2003). *Cografya egitiminde bilisim teknolojilerinden faydalanma* (Turk Cografya Kurumu. Cografya kurultayi bildiriler kitabi, Gazi universitesi). Ankara, Turkey: Gazi kitabevi.

Patterson, M. W., Reeve, K. & Page, D. (2003). Integrating geographic information systems into the secondary curricula*. Journal of Geography, 102*(6), 275–281.

Patton, M. Q. (1990). *Qualitative evaluation and research methods.* Newsbury, UK: London sage publication.

Rickles, P., Ellul, C. & Haklay, M. (2017). A suggested framework and guidelines for learning GIS in interdisciplinary research. *Geo: Geography and Environment, 4*(2).

Sari, M. (2005, Eylul 21–23). *Fen bilimleri egitiminde teknolojik arac-gereclerin ogretme ogrenme ortamında kullanılmasına yonelik ogretmen gorusleri*. IETC, Sakarya, Turkey.

Shin, E. (2006). Using GIS to improve fourth grades geographic content knowledge and map skills. *The Journal of Geography, 105*(3).

Smith, J. A. & Eatough, V. (2007). *Interpretative phenomenological analysis*. In E. Lyons & A. Coyle (Eds.), *Analysing qualitative data in psychology* (pp. 35–50). Los Angeles, CA: Sage Publications.

Swanson, S. E. (2008). GIS. *Journal of Hospital Librarianship, 1*(3), 83–89.

Simsek, N. (2007). *The influence of applications and activities based on GIS in the teaching of social studies on student's success and attitudes to the social studies* (Unpublished doctoral dissertation). Gazi University Educational Sciences Institute, Ankara, Turkey.

Turoglu, H. (2003). *Cografyacı ve cografya egitimi* (Turk Cografya Kurumu. Cografya Kurultayi Bildiriler Kitabi, Gazi Universitesi). Ankara, Turkey: Gazi Kitabevi.

Turoglu, H. (2011). *Cografi bilgi sistemlerinin temel esaslari*. Istanbul, Turkey: Cantay yayinevi.

Ugurlu, N. B. (2008). A new example for the use of ınformation technologies in education: geographic information systems. *Ankara University, Journal of Faculty of Educational Sciences, 41*(2), 81–95.

Uygucgil, H. (2011). *Cografi Bilgi Sistemlerine Giris* (Yayin No: 1214, A. Cabuk, Ed.). Eskisehir, Turkey: Acik ogretim fakultesi, Anadolu universitesi.

Yildirim, A. & Simsek, H. (2011). *Qualitative research methods in the social sciences*. Ankara, Turkey: Seckin Publications.

Yomralioglu, T. (2009). *Cografi bilgi sistemleri. Temel kavramlar ve uygulamalar*. Trabzon, Turkey: Akademi kitabevi.

Zaman, S., Coskun, O., Sever, R., Turkez, K. & Zaman, N. (2009). *The effects of geographical ınformation systems use on student achievement in geography education.* 1st International Conference on Foreign Language Teaching and Applied Linguistics (FLTAL'11), Sarajevo, Bosnia and Herzegovina.