Teaching Map Concepts in Social Science Education; an Evaluation with Undergraduate Students

Ilkay Bugdayci 1, H. Zahit Selvi 1

1 Necmettin Erbakan University, Engineering and Architecture Faculty, Geomatic Engineering, Turkey
ibugdayci@konya.edu.tr

Abstract. One of the most important aim of the geography and social science courses is to gain the ability of reading, analysing and understanding maps. There are a lot of themes related with maps and map concepts in social studies education. Geographical location is one of the most important theme. Geographical location is specified by geographical coordinates called latitude and longitude. The geographical coordinate system is the primary spatial reference system of the earth. It is always used in cartography, in geography, in basic location calculations such as navigation and surveying. It’s important to support teacher candidates, to teach maps and related concepts. Cartographers also have important missions and responsibilities in this context. The purpose of this study is to evaluate the knowledge of undergraduate students, about the geographical location. For this purpose, a research has been carried out on questions and activities related to geographical location and related concepts. The details and results of the research conducted by the students in the study are explained.

1. Introduction

Today, maps can be found nearly anywhere and they are used in very different areas. Therefore, it is important to know how well the educational systems succeed in teaching and learning map-reading skills. Establishing map awareness during the first years of education will enable pupils to become effective map users in later times. For this reason, it is very important to disseminate children maps, designing better maps for children in the field of education. In addition to this, training of teacher candidates on map also crucial. The effective use of maps depends firstly on the adequacy of teachers' map knowledge and their experience. In addition to the quality of existing maps, teachers should be conscious and willing about the use and teaching of maps in their lessons. Effective use of maps should be taken from the first years of basic education. For this reason, it is especially important that the geography and social sciences education departments of universities are successful in teaching map reading and perception skills. The students who will graduate from these departments have an important role in teaching map concepts since they will be teachers of the future. At the same time Cartographers have an important mission and responsibilities in this context. Cartographers or map maker must promote the use and enjoyment of maps by children and young people, must increase understanding of children and young people's engagement with maps and must raise the standard of maps and atlases produced for children and young people.

In recent years as a result of the need on the maps in the field of social studies and geography, there has been numerous research about map use, map user, teaching map concepts and etc. Studies on maps have generally been done with primary and secondary school students and also teachers. A project had been completed name of "Resuming an international project: Map use in Argentine and Hungarian schools” carried out by experts, cartographers, teachers and students between Argentina and Hungary and the
experimental work done by students in the 12-14 age group within the scope of the Project [1]. The project, which was carried out for two years between 2004 and 2005, stated that in 2004, maps were used in lessons in primary and secondary education and in 2005, studies on reading and perception of maps were presented by different methods. The curriculum of the 4-7th grade social studies were analyzed in terms of map use, and current maps were analyzed in terms of general cartographic design and maps use by children, in Turkey, within the scope of PhD [2]. As a result of the thesis, some suggestions about children map design depending on the curriculum of social studies courses on 4-7th grade pupils were given. To analyze current situation and map use in social studies courses, qualitative and quantitative researches had been done with social study course teachers and 6th grade pupils. Additionally, an algorithm that involves the cognitive development of a child about map use had been proposed. "Learning and Teaching with Maps" is one of the most important studies on designing child maps and teaching map information to child-age users [3]. Researchers examined in detail how cartographic issues and map information should be taught to children. Children were classified according to Piaget's cognitive development theory, and map-related activities were included according to these age group. Another study conducted a survey with teachers in order to determine the level of comprehension of maps, graphics and forms used in the 7th grade primary school classes [4]. When the research was completed, it was stated that the teachers found that the maps used in large scale were insufficient, the teacher had an important role in increasing the students' interest in the map and that the course duration was not enough for the map use. The other study had done about a method for teaching topographic map interpretation. Students learned how to read and interpret topographic maps by using a set of simplified map exercise cards. Students learned in the field as opposed to a traditional classroom. Map symbols, distance, direction, form, and relief are among the map interpretation topics taught with this method [5]. A research had conducted on the determination of map and sphere use skills of 6th grade primary school students. As a result of the research, it was concluded that the students did not acquire the skill of using maps sufficiently [6].

It is seen that map studies started at very early ages in studies conducted in different countries. Map use is the second grade in Hungary (7 years), the second grade in Portugal [7], the first grade (6 years) in Bulgaria [8] (9 years) [9], it is almost in the curriculum at the beginning of school years. A user study was conducted during which pupils (aged 11–18 years) and geography students (>18 years) had to solve a number of cartography questions using topographic maps. The results show a rising trend in the pupils' scores with increasing age, which can be explained by education in cartography at school [10]. Teachers are required to develop some skills that require technical abilities such as GIS (geographic information systems) and fieldwork skills. There are many studies that achieved with both students and teachers, in this context [11], [12], [13], [14], [15].

There are fewer studies conducted at undergraduate students or teacher candidates in our country, there was no study conducted to measure the sufficiency of map information of today's teachers. However, a study was conducted on the use of map concepts and maps with teacher candidates who read in social studies [16]. Since the results are quietly poor in terms of map information and map use, researchers have come to the conclusion that there is no mapping consciousness from primary education to higher education, and studies have to be done in this regard. The deficiencies of mapping conception at the end of primary and secondary education, will affect the geography courses in high school education and accordingly the success in social studies and geography in higher education.

Research with undergraduate students in education departments will also provide significant contributions to the development and dissemination of map use. The main aim of this study is to assess the geographic locational skills of undergraduate students of social studies teacher department. In primary and secondary education in Turkey, maps and map concepts teaching are responsible with social studies teachers. When social studies curriculum in basic education is examined, it is often seen that map and map themes are included in curriculum. On the contrary when the curriculum of Social Studies
Education Departments of Universities are examined in general, mostly it is seen that both basic map concepts and cartography are not included in. It is not expected that teacher candidates who have graduated without sufficient education on map can benefit from the maps effectively in their lessons and educate students well in this subject. The students of social studies, geography and history departments, will be teachers of near future. For this reason, it’s very important to determine if these students gain map concepts before graduation or not. The place where the map concepts is first taught is basic education. The better the map concepts are taught in basic education, the more common the use of maps, the acquisition of map-using consciousness and the effective use of maps will be realized. All of these reasons maps and related themes should be taught at the universities in the best way.

2. Cartographic education in Turkey
Basic education in Turkey, continues with primary and secondary education, high school and university. Primary education 1, 2, 3, 4th grade (6-10 years), middle education 5th, 6th, 7th and 8th (11-15 years) grade and high school 9th, 10th, 11th, 12th grade. Map concepts in the education system, takes place in 4 (10 years) and 5, 6 and 7 classes in social studies classes and 9th and 10th classes in geography and history courses. Cartographic materials (maps, sphere, atlas, wall maps, relief maps, drawings and etc.) are used beside the textbooks to support teaching and learning. 4, 5, 6, 7th grade social studies curriculum includes units, expected benefits, examples of activities related to the topics covered in the unit, and explanations about these benefits and activities. Within the scope of these courses, the geographical, physical characteristics and economical features of our country, scale, geographical location, climate, geographical features of the places where the Turkish states live, world countries and geographical features are related with maps. Besides, maps and map-related topics commonly seem in the curriculum in geography and history courses in high school. In education system there is no course named map learning or map concepts and etc. Teaching of all subjects related to maps throughout basic education is the responsibility of teachers of social studies, history and geography. Teachers have a huge role in the learning and teaching process. Teachers should effort for expected benefits with activities and various materials in class. The effective use of maps depends firstly on the adequacy of teachers' map knowledge and their experience. For this reason, it is very important to teach the concepts of map in the field of social studies, history and geography teacher department at universities as required.

3. Study design, participants and questionnaire documents
The students of social studies, geography and history departments, will be teachers of near future. For this reason, it’s very important to determine if these students gain map concepts before graduation or not. The place where the map concepts is first taught is basic education. The better the map concepts are taught in basic education, the more common the use of maps, the acquisition of map-using consciousness and the effective use of maps will be realized. All of these reasons maps and related themes should be taught at the universities in the best way.

Measuring the qualifications of prospective teachers for all map topics, increasing their proficiency if necessary, will contribute significantly to the use of maps in education and the existence of maps in the future. It is often seen that, map and map concepts are included in social studies curriculum in basic education. Geographical location is one of the most important theme of the curriculum of social studies courses. Geographical location is not only determining or influences the physical conditions such as climate, vegetation, water resources, soil types, but also plays an important role in determining social and economic structure of the country and its strategic importance. The geographical coordinate system is the primary spatial reference system of the earth. It is always used in cartography, in geography, in basic location calculations such as navigation and surveying [17]. Geographic location is defined in two ways. One of them is called absolute location which is specified by geographical coordinates called latitude and longitude. The other is relative location of a city or destination on the earth is its relationship to another place or nearby landmarks.
In this study, it was aimed to measure the proficiency of the teacher candidates in social science education department, about the geographical coordinates before graduation. This study was conducted with 60 students of Social Science Education Department of Necmettin Erbakan University. A questionnaire related with absolute location was prepared (Figure 1). It contains, some questions about definitions about latitude, longitude, parallel, meridian, absolute location and also contains some activities about absolute location of some places on Turkey.

In the first part of the questionnaire, following questions were asked.

1. What is latitude and longitude?
2. What is parallel and meridian?
3. What is absolute location?
4. What is absolute location of Turkey?

These questions were prepared to determine whether these students know the basic concepts associated with geographical location. It is very important to learn these concepts as needed to teach youngsters correctly. In the second part, firstly it is required to write the locations of the triangles marked belonging to 10 districts on the given map (Figure 1). Afterwards, some of the districts circle marked with their given absolute locations are requested to be placed on the map. Such activities are often seen in social studies textbooks. The design of these activities for children is also one of the topics to be investigated. It will be much more useful to teach the topics with activities and maps that are designed according to the levels of the children, and it will make it easier for the teachers.

4. Results and discussions

In the first part of the questionnaire, some basic definitions; latitude, longitude, parallel, meridian, were asked. Location is usually considered more precise than "place." A locality is a human settlement: city, town, village or even archaeological site. A place's absolute location is its exact place on earth, often given in terms of latitude and longitude. Specifying a location on the earth requires determining latitude, the north-south angular distance from the equator, and the longitude, the east-west angular distance from a prime meridian. All points on the earth having the same latitude form a line called a parallel; all points of the same longitude form a meridian line. While latitudes and longitudes express angular distances, parallels and meridians represent imaginary lines. The obtained results of the first part of the questionnaire are summarized in Table 1. It’s seen that only 11.6% of students express latitudes and longitudes correctly. 81.6% of students replied that latitudes are the same with parallels, and longitudes are the same with meridians. While the majority of the students were not aware of the difference, 6.7% of students didn’t reply. When the question was about meridians and parallels 45% of students explain properly this time. The other questions were about absolute location. 55% of students were expressed
absolute location correctly, which is determined by the latitude and longitude grades on earth. 66.7% of students expressed the absolute location of Turkey accurately.

Table 1. Obtained results of the first part of the questionnaire

| Question                                      | Right Answers | Wrong Answers | No Answer |
|-----------------------------------------------|---------------|---------------|-----------|
| 1. What is latitude and longitude?            | 7             | 49            | 4         |
| 2. What is parallel and meridian?             | 27            | 30            | 3         |
| 3. What is absolute location?                 | 33            | 26            | 1         |
| 4. What is absolute location of Turkey?       | 40            | 19            | 1         |

According to these results, it could be said that general information of students about geographical coordinates, is not sufficient. This is the main reason why students do not have basic map concepts in their university curriculum unfortunately. In this case, it is understood that the students replied the questions, from their knowledge in previous educations. Social studies education department is located in 61 universities in Turkey. When the course curriculum in these departments are examined, no specific course on map and cartography has been seen. In some universities cartography and map concepts are explained within the scope of the only "General Physical Geography" course just one week throughout the whole semester. Cartography and map concepts, in some universities do not even take part in the content of this course, and in some departments are in the curriculum as an elective course. Cartography and map concepts are quite important themes for both social science and geography-history education in universities. Because there are a lot of themes related with maps in primary and secondary education in social science, geography and history courses. Unfortunately, teachers educating students are not given sufficient training on maps and cartography. As a result, maps cannot be used effectively in these courses. This is one of the main reasons why map use is not sufficient. In addition to this, within the PhD thesis of Bugdayci [2] in the research done with the teachers about the use of maps in the social studies lessons, it was concluded that the maps could not be used properly. Reasons for this include the deficiencies of quality maps for students, deficiency of map information in the curriculum, the limited duration of the course for map use, the lack of information on teachers' use of maps, and so on.

Table 2. Obtained results of the second part of the questionnaire

| Question | 10-9 right answers | 8-7 right answers | 6-5 right answers | 1-4 right answers | Answers with one or more unmarked |
|----------|--------------------|-------------------|-------------------|-------------------|----------------------------------|
| 5. Write the absolute locations of the triangles marked belonging to 10 districts on the given map | 11 | 9 | 2 | 7 | 31 |
| 6. Mark some of the districts circle with their given absolute locations are requested to be placed on the map | 25 | 3 | 10 | 16 | 6 |

The results of the second part of the questionnaire are summarized in Table 2. The students were more forced in reading the absolute locations of the districts, than matched districts with given geographic coordinates. The answers were accepted at about ± 30° accuracy. But it cannot be said that both results are good. It can be said only 33.3% of students in the 5th question, 46.7% of students in the 6th question answered correctly (7-10 right answer).

It is necessary to design more activities and apply these activities frequently in order to learn the issues related to the maps and map concepts. It is also important that designed activities should be supported by experts in the field of cartography and maps, and that the right resources are used.
5. Conclusions
After examining the investigations on map use in education in the field of social studies and geography in our country, it’s seen that there are significant deficiencies about general map concepts. It is seen that the less and incorrect definitions are made for the map, the different definition of the layout elements and the properties of the signs that represent the objects are expressed incorrectly. It is also seen that in the doctoral and master thesis and studies related with maps. The basic themes of map design, cartography and map concept need to be carefully observed at universities. In addition, in order to enable the creation of map-using consciousness and effective use of maps, it is necessary to first eliminate the deficiencies seen in the curriculum in the education system, and teacher and teacher candidates should also be trained in cartography map use and map concepts in higher education. It seems that the role of teachers in the development and dissemination of map and map use is very important. It’s important to do more investigations related with map, map use and map user. It’s also important teaching and learning with maps.

Acknowledgment
The author wishes to acknowledge the financial cooperation and assistance given by to Scientific Research Found (BAP) of Necmettin Erbakan University

References
[1] Reyes, N. J. J., Juliarena, M., Cristina, E., Gallé, E., Garra, A. M., Rey, C. A., Alves C., Maria V., Dibiase, A. S., “Resuming an international project: Map use in Argentinean Hungarian schools”, Second International Conference on Cartography & GIS, Borovets, Bulgaria, 113-122, 2008.
[2] I., Bugdayci, “An Evaluation About Map Use In Elementary Schools”, PhD thesis, Konya: Selcuk University, Natural Science Institute, 2012.
[3] P., Wiegand, “Learning and Teaching with Maps”, Taylor & Francis, London: Routledge, 180s, 2006.
[4] L., Yildiz, “The Perception Level of Maps, Graphics and Shapes in the Social Studies Lessons of Primary Education 7th Class, the example of the city of Aksaray”, MSc thesis, Gazi University, Educational Science Institute, Ankara, 2006.
[5] W., Schuit, “A Method for Teaching Topographic Map Interpretation”, Journal of Geography, 110:5, 209-216, DOI: 10.1080/00221341.2011.549497, 2011.
[6] Z., Ertugrul, “The Determination of 6th Grade Primary School Students? map and globe usage skills”, MSc thesis, Gazi University, Educational Science Institute, Ankara, 2008.
[7] N. J. J., Reyes, “Teaching Maps in Portuguese and Hungarian Elementary Schools A Study Douša”, Cartography and Children Comission and the Cartographia para Escolares Woking group, Diamantina, Brazil, 2002.
[8] T., Bandrova, C., Dinev, “The New Cartographic Products in Bulgaria -Modern School Atlases”, 22. International Cartographic Conference, poster presentation, CD, A Coruna, Spain, 2005.
[9] R. Windiastuti, L. Munajati, D. K. Kresnavati, “Cartography Education For Children in Indonesia”, 24. International Cartographic Conference, Chile, 2009.
[10] K., Ooms, P. D. Maeyer, L. Dupont, N. V. D. Veken, N. V. Weghe, S. Verplaetse, “Education in cartography: what is the status of young people’s map-reading skills?”, Cartography and Geographic Information Science, 43:2, 134-153, DOI: 10.1080/15230406.2015.1021713, 2016.
[11] T. A. Keiper, “GIS for Elementary Students: An Inquiry into a New Approach to Learning Geography”, Journal of Geography, 98:2, 47-59, DOI:10.1080/00221349908978860, 1999.
[12] E. K. Shin, “Using Geographic Information System (GIS) to Improve Fourth Graders' Geographic Content Knowledge and Map Skills”, Journal of Geography, 105:3, 109-120, DOI: 10.1080/00221340608978672, 2006.
[13] J. J. Kerski, A. Demirci, A. J. Milson, “The Global Landscape of GIS in Secondary Education”,
[14] Yao-Hui Wang & Che-Ming Chen (2013) GIS Education in Taiwanese Senior High Schools: A National Survey Among Geography Teachers, Journal of Geography, 112:2, 75-84, DOI: 10.1080/00221341.2011.637227

[15] J. E. Hong, “Promoting Teacher Adoption of GIS Using Teacher-Centered and Teacher-Friendly Design”, Journal of Geography, 113:4, 139-150, DOI: 10.1080/00221341.2013.872171, 2014

[16] S. Incekara, G. Kanturk, “Sosyal Bilgiler Öğretmen Adaylarının Haritalarla İlgili Temel Görüşleri ve Harita Kullanımına Yönelik Yaklaşımları”, Marmara Coğrafya Dergisi, 21, 240-257, İstanbul, 2010

[17] A. H. Robinson, J. L. Morrison, P. C. Muehrcke, “Elements of Cartography”, John Willey & Sons, USA, 674s, 1995