

Geosciences Education in Primary and Secondary Schools in Turkey

Nizamettin Kazancı, Alper Gürbüz, Mübeccel Kazancı

Abstract

Turkey is geographically positioned as a bridge between the continents of Asia, Europe and Africa. The country has very rich and complex geology and geomorphology characterized by the presence of various rock exposures, landscapes, active and inactive volcanic centers, mountain belts, active fault zones, etc. However, geoscience education in a country with such a geological and geographical heritage has become crucial, particularly in the last two decades, after the two devastating earthquakes in the most populated region of Turkey in 1999. From an educational point of view, three periods are identified in the modern educational history of Turkey: a) 1924-1974 – geology courses were compulsory, b) 1975-1998 – geology was elective, c) 1999 to present – geography courses include basic geological topics. Extensive teaching of geological subjects is included within the geography courses, which is compulsory for all classes and branches of all high schools presently, but this is insufficient. Today, the main problem in geoscience education seems to be related to the curricula and the backgrounds of educators in primary and secondary schools.

Keywords: Earth sciences education, geology, geography, primary and secondary schools, Republic of Turkey.

25.1 Introduction

Humans learned early on that the Earth was the only home for living things, and they tried to adapt to it in order to survive. Over time, particularly due to the increasing population, new problems appeared, so they deduced that adaptation to nature was not enough to be safe both

as individuals and as societies. For example, increasing impacts of natural hazards (from earthquakes, tsunamis, floods, avalanches, landslides), climate change, pollution and deteriorating environments, shortage of clean water, food and energy, deforestation, desertification, sea-level rise, and greenhouse effects are significant recent problems caused mostly by rapid urbanization. Furthermore, raw materials, typically provided from nature, are vital for urban dwellers but finite. Therefore, humankind had to learn about the Earth and its nature, natural resources, hazards, and particularly sustainability. Fortunately, people have known the significance of such education for a long time, and schools were opened to teach about the Earth. Now, learning about nature is essential for education programs everywhere.

Education in Turkey is governed by a national system, which was established mainly with the 'Integration of Education (*Tevhid-i Tedrisat Kanunu*)' law in 1924. Details of the law greatly changed over time (Özeli, 1974; Akyüz, 1982). It is a government-supervised system designed to produce skillful professionals for society. Private and free public schools work in parallel, however, the majority are public. Presently, compulsory education extends to 12 years. Primary and secondary education is financed by the state and is free of charge in public schools; private schools are also supported by the state. Presently, enrolment of children between the ages of 6 and 18 is nearly 100 percent (Table 1).

Agerange	0-14	15-24	25-65	>65
%ofpopulation	25.2	16.5	50.3	8

	Pre-Primary	Primary	Secondary	Highschool	University
Schoolingratio%	53	96	94	79	39
Personnel	33,183	267,171	259,315	249,601	155,000

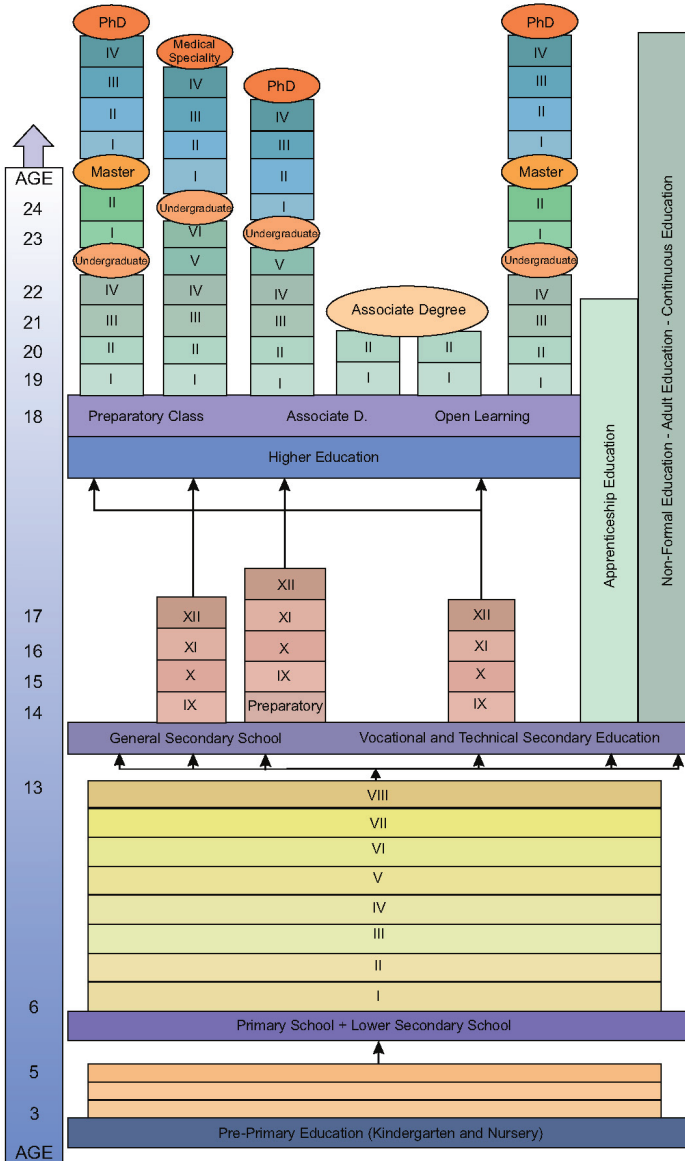
Stillneededinprimaryandhighschools:121,763

NumberofDepartmentsofGeographyandGeographyTeachinginUniversities	33
NumberofDepartmentofGeologicalEngineeringinUniversities	30
NumberofFacultyofEducationalSciencesinUniversities	87

Table1.Populationdistribution(total77.6million)andschoolingratiosinTurkey(SGB,2015)

Although secondary and/or high school education is not mandatory, it is required to progress to university education (Figure 25.1). In 2015, there were 197 universities (state and private) in Turkey. Entrance is regulated by

a national examination, after which, high school graduates are assigned to a university according to their performance. Overall, the present Turkish education system (Figure 25.1) highly resembles that of Western countries, as expected from a member of the European Union. The main difference seems to be in the number of students in vocational schools; however, the indicators have rapidly changed (OECD, 2013a, b).



The Republic of Turkey, which was constructed by a hard war for independence (1919–1922) against the winners of the First World War, needed some new regulations not only in education but in all areas, as the precedent Ottoman Empire had a different state system due to its extremely large area and multi-national structure. One of the basic reforms in the early Republic of Turkey was the integration of laicized education and the establishment of five years compulsory education by a law in 1924 (Akyüz, 1982; MEB, 2015). This law declared that no school could open in Turkey without the permission and agreement of the Ministry of National Education, and all school curricula should be prepared by the ministry. The vocational-technical education institutions that were formerly directed by local governments were put under the responsibility of the ministry. Four years later, in 1928, the alphabet was changed from Arabic to Latin letters. Such a reform was a real necessity for the fresh Republic, as education was very weak and far from building a modern Turkey (Özelli, 1974). For example, in 1923–24, the number of secondary school students was slightly more than 7000, while the population of Turkey was around 13.5 million.

This education reform was successful and helped build modern Turkey. The main structure of the Law in 1924 is still valid, however, before 1997, compulsory primary education was only five years, for ages 7–12, and the rest was optional as secondary schools (middle schools), lasting three years for ages 12–15, and three-year high schools (lyceums) for ages 15–18. Compulsory education increased to eight years in 1997 and to twelve years in 2012. Presently, the schooling ratio within the population of 6–18 year olds is very high, close to 100 percent, and the number of personnel working in the education system is nearly one million (Table 25.1).

The aim of this article is to present the Earth sciences component of Turkey's compulsory education system curriculum. To achieve this goal, some information about formal education is needed first.

25.2 The current formal education system in Turkey

Three institutions, the National Educational Council (NEC), the Ministry of National Education (MNE), and the National Board of Education (NBE), are significant actors in Turkey's formal education system according to the constitution. The NEC is an advisory institution for the ministry that meets whenever the government needs new policy and suggestions. Its members are experts and representatives of different parts of

society. The decisions of the 20 NEC meetings since 1921 have strongly affected the Turkish education system. The MNE is the main authority on education, while the NBE is responsible for the curriculum.

As summarized in Figure 25.1, the Turkish formal education system consists of pre-primary education, primary education, secondary education and higher education. The system is bipartite as it is compulsory for primary and secondary schools and optional for pre-primary and higher education. Compulsory education lasts 12 years, divided into three four-year components, providing options to transfer between general and vocational schools. The first eight years (4+4), called first level education (= primary school), are conducted in the same school building, while the last four years (secondary or high school) is taught in separate, stand-alone buildings to avoid problems due to student age differences.

The curricula of all primary and secondary schools are organized by the NBE, a half-independent unit in the MNE. It decides and announces the programs, courses and also the contents of courses regularly. Textbooks are provided to students free of charge by the government in all public schools.

The higher education and/or university system has not been under the direct control of the MNE since 1960. It is now coordinated by the Board of Higher Education, members of which are nominated by the head of the Turkish Republic. The following paragraphs briefly introduce the different school levels, except for higher education.

25.2.1 Pre-primary education

Pre-primary schools in Turkey are an optional system for education of children between 36–72-months old who are under the age of compulsory primary education. Although it is optional, participation is rapidly increasing due to urbanization. The relevant schools are generally independent nurseries, some of which are opened as nursery classes and practical classes within formal schools, when suitable physical capacity is available. Services related to pre-primary education are given by nurseries and kindergartens in practical classes operated first and foremost by the MNE. Additionally, schools for this level of education are encouraged by MNE as day-centers, nursery schools, day care houses, child care houses, and child care institutions. Presently, the schooling ratio in this level of education is about 53 percent (Table 25.1). The goal is to reach 100 percent for children of this age before the 100th anniversary of the republic in 2023 (SGB, 2015).

25.2.2 Primary education

In Turkey's formal merit system, primary education is 4+4 years, covering the education of children between 6-14 years old. It is compulsory for all citizens, boys and girls, and provided free of charge in public schools. Private schools are present and even encouraged by the state.

Core courses of the first, second and third grades are mainly Turkish, mathematics, life science, and foreign language, however the latter can change from school to school. The course 'life science' is replaced by the course 'science and social studies' in fourth grade. Foreign language teaching is relatively strong in private schools, with English most commonly taught, while some schools teach German, French or Spanish instead of English. Some private schools teach two foreign languages at the same time.

In the sixth, seventh and eighth grades, Turkish, math, foreign language, sciences, and social sciences are the five main courses, however 'social sciences' is replaced by the courses history and citizenship in eighth grade.

As mentioned above, primary education institutions are schools that provide eight years of uninterrupted education. Daily lessons are provided all day in some schools; however, two education sessions (morning and afternoon) are conducted each day in some schools, due to capacity shortages. There are typically six classes per day, lasting 45 minutes, with 10-minute breaks. The places and units of the schools are under the control of the MNE. At the end of the eight years, graduates receive a primary education diploma.

25.2.3 Secondary education

Turkish secondary education includes all general, vocational and technical schools that provide four years of education. The last year (12th grade), however, is generally preparatory for university and/or working life. Some schools and also types of schools in secondary education are preferred (Tables 25.2, 25.3). Therefore, a relative level of success is needed to enter a preferred school. To evaluate student success, the MNE organizes a common, national exam in the second semester of 8th grade. Sometimes private schools have different exams, and other times they only look at school grades. Secondary education aims to give students a good level of common knowledge and prepare them for higher education, a vocation, life, and business, in line with their interests, skills and abilities.

Secondary schools cover the education of youth between 15–18 years old for at least four years after primary education. General secondary education includes high schools, foreign language teaching high schools, Anatolian high schools, science high schools, Anatolian teacher training high schools, and Anatolian fine arts high schools (Table 25.2). In Anatolian high schools and private high schools, the daily programs are typically longer, up to eight classes each day, than those of public high schools.

Type of high school	Number of Compulsory (C) courses	Number of Elective (E) courses	Weekly hours of Geography and all courses							
			9 th grade		10 th grade		11 th grade		12 th grade	
			C	E	C	E	C	E	C	E
General	17	16	2 (30)	- (7)	2 (20)	- (15)	- (20)	2 (15)	- (17)	2 (18)
Anatolian	18	16	2 (35)	-	2 (19)	- (16)	- (20)	2 (15)	- (17)	2 (18)
Science	18	7	2 (39)	-	2 (37)	-	- (36)	-	- (17)	- (18)
Social sciences	26	-	2 (40)	-	4 (40)	-	3 (40)	-	4 (40)	-
Arts	28	4	2 (40)	-	2 (35)	-	- (35)	-	- (35)	-
Sport	34	8	2 (40)	-	2 (35)	-	- (35)	-	- (35)	-
Music	32	4	2 (40)	-	2 (35)	-	- (35)	-	- (35)	-
Teacher's training	23	15	2 (34)	- (5)	2 (23)	- (15)	- (22)	- (16)	- (19)	- (19)

Table 2. Types of secondary schools and hours of geography course in their programs (SGB, 2015).

Numbers inside parenthesis show total hours for all courses per week and numbers out of parenthesis show hours of geography course for each week.

Vocational and technical secondary education involves schools that train students for careers in business and other professional areas (MEB, 2015, SGB, 2015). It includes specified technical education schools for boys and girls, *i.e.* trade and tourism schools, religious education schools, multi-program high schools, special education schools, private education schools, and health education schools (SGB, 2015).

The 9th-grade course program is similar more or less in all secondary schools. Courses are about 36–37 hours per week, including some electives (Tables 25.2, 25.3). The core classes are the Turkish language, Turkish litera-

ture, mathematics, physics, chemistry, biology, geometry, history, geography, religion and ethics, physical education, and foreign language (Table 25.3).

From 10th grade on, programs are highly differentiated in secondary schools. Students of general schools choose one of four branches: *Turkish language—mathematics, science, social sciences, or foreign languages*. In vocational high schools, there are no branches, while only the *science* branch is offered in science high schools. On the other hand, some schools offer elective courses instead of branches. For 10th, 11th and 12th grades, the compulsory courses are: Turkish language, Turkish literature, History of the Republic, and religion and ethics. In addition to these courses, students attend classes in mathematics, geometry, statistics, physics, biology, chemistry, geography, philosophy, psychology, sociology, economics, logic, arts and music, traffic and health, computer science, physical education, and first and second foreign language, depending on the chosen branch and/or the high school. The number and weekly hours of elective courses also changes in different schools (Tables 25.2, 25.3). Branches help and provide advantages to students preparing for university in a variety of fields, *i.e.* international relations, law, education, psychology, economics, business management, and similar fields require high marks in Turkish language and mathematics, while medicine, computer science and other science-related professions require good marks in science. However, geography has always remained in the social sciences branch of the Turkish education system (Şahin, 2001).

Course category	Courses	9 th grade	10 th grade	11 th grade	12 th grade
C O M M O N and C O M P U L S O R Y	Turkish and composition	2	2	2	2
	Turkish literature	3	3	3	3
	Religious culture and ethics	1	1	1	1
	History	2	2	-	-
	History of Turkish Republic	-	-	2	-
	Geography	2	2	-	-
	Mathematics	4	-	-	-
	Geometry	2	-	-	-
	Physics	2	-	-	-
	Chemistry	2	-	-	-
	Biology	2	-	-	-
	Introduction to Health	1	-	-	-
	Philosophy	-	-	2	-
	Foreign language	3	2	2	2
	Physical education	2	2	2	2
	Visual arts /music	1	1	1	1
	Traffics and first aid	-	-	-	1
	Total compulsory courses hours	29	15	15	12

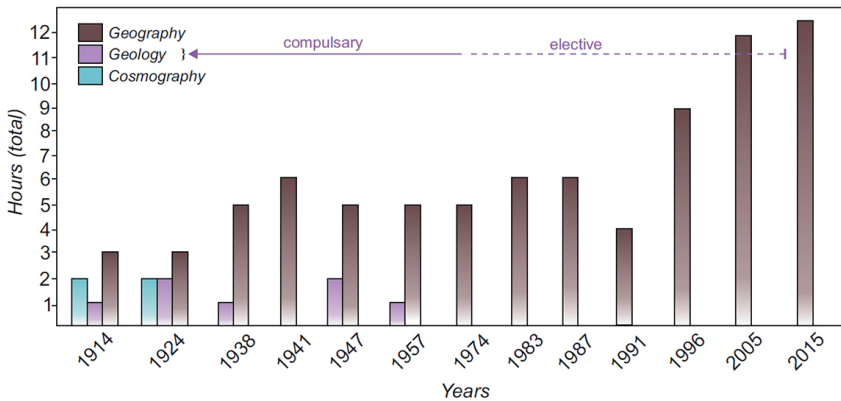
Course category	Courses	9 th grade	10 th grade	11 th grade	12 th grade
E L E C T I V E S	Turkish and composition	-	2	2/3	2/3
	Turkish literature	-	1	1	1
	Mathematics	-	2/4	2/4	2/4
	Geometry	-	1/2	2/3	1/2
	Physics	-	2/3	2/4	2/3
	Chemistry	-	2/3	2/4	2/4
	Biology	-	2/3	2/4	2/3
	History	-	2	2/4	-
	Modern Turkish and	-	-	-	2/4
	World history				
	Geography	-	2	2/4	2/4
	Psychology	-	2	-	-
	Sociology	-	-	2	-
	Logic	-	-	-	2
	Foreign language	-	2/4	2/4	2/4
	Second foreign language	-	2/4	2/4	2/4
	Other elective courses	7	2	1	2
Total elective courses hours		7	14	14	17
Consultancy and Guiding		1	1	1	1
Total weekly hours		37	30	30	30

Table 3. Weekly course program of a general high school in 2015 (<http://ttkb.meb.gov.tr/>). Note nearly all courses are compulsory for 9th grade. Hours of geography course may reach to 14 if it is desired.

25.3 Earth Sciences Education in Primary and Secondary Schools

The Turkish curricula for students 6–18 years old includes a good deal of basic information about the environment, nature, ecology, climate, wild-life, and the formation and evolution of the Earth, rocks, minerals, fossils, etc. This information has been distributed in courses of ‘Life science’ for

2nd and 3th grades, ‘Science and social studies’ for 4th–8th and Geography for 9th–12th grades. In fact, information about the solid Earth and cosmos was taught in the Turkish education system since the Ottomans, with courses called ‘*Arziyat*’ (Earth science) and ‘*Kozmografya*’ (Cosmography), although they were not well designed for students’ abilities (Taş, 2005; İncekara, 2007; Figure 25.2). After introducing the new law in 1924, ‘*Arziyat*’ and ‘*Kozmografya*’ were replaced by ‘*Geology*’ and ‘*Astronomy*’, respectively, which continued as two main courses in secondary schools until 1974 (archive of the bulletin ‘*Tebliğler Dergisi*’; <http://tebligler.meb.gov.tr/>). From then until 2012, the Geology course remained as an elective in the science branch of secondary schools when it was removed completely from the curriculum (Figure 25.2). However, Geology course content was partly added into Geography from 9th to 12th grades (TTKB, 2011). According to a recent announcement on the NBE website (<http://ttkb.meb.gov.tr/>; last access March 18, 2016), Earth sciences lectures in the current Geography program will decrease significantly after 2016 to allow more time for regions, cultures and population, based on the NEC’s advice.



In the meantime, there is no doubt that teachers and teacher-training are always primary factors in education quality. In Turkey, the teacher training conducted by the MNE according to employment-based policy was completely left to the universities in 1982. The Council of Higher Education re-established the teacher training system for education faculties in the 1998-1999 academic year. As a result, primary and secondary school teachers started to be trained only in university Educational Sciences faculty programs, whereas high school (branch) teachers started to be trained to the

Master's degree level (Bilir, 2011). This reestablishment was not a positive development for teaching Earth sciences because geology was an engineering program within Science or Engineering faculties. The solution was to enlarge geography education within the Educational Sciences faculties programs, including some Earth science topics. Presently, while all the Earth science topics are taught by geography teachers in secondary schools, similar content in 3th–8th grades are taught by general classroom teachers.

25.3.1 Earth Science Topics in the Curricula

Here, we summarize the general Earth science topics in the programs of different grades. It is however, sometimes difficult to determine which topics belong to geography, ecology or geology. It is noteworthy that the topic's teaching times determined by the NBE are not less than 1–2 hours/week in a semester. The courses and their relevant topics are as follows in the current curricula (TTKB, 2015).

In 3rd-grade Life Science: description of continents and oceans on the map; hydrological cycle; movements of the Earth

In 4th-grade Social Sciences: atmosphere and atmospheric events; natural disasters and preparedness for hazards

In 5th-grade Social Sciences: relations of natural disasters and regional geographic properties; natural hazards and causes

In 6th-grade Science and Technology: maps and scales; oceans and continents; climate and habitats; climatic zones of Turkey; climate and geomorphology; controlling factors of settlements

In 9th-grade Geography: maps and geomorphology; contour lines; tectonics and tectonism; Geological times and events; control of endogenic forces on morphology; and control of exogenic forces on landforms

In 10th-grade Geography: rocks and their characteristics; relations of rocks and landscapes; groundwater and water sources; soil and soil types; natural disasters and hazards; preparedness for hazards

In 11th-grade Geography: factors on the formation of biodiversity; elements of ecosystems; water and water ecosystem; ore deposits; natural energy sources

In 12th grade Geography: extreme conditions of natural events; interactions of natural and anthropogenic processes; predicting natural transformations; management of natural environments; management of natural resources; conservation of geological heritages.

25.3.2 Assessment and Evaluation

The results of Earth science education and its effects on citizen's daily lives are not very clear in Turkey as there is no reliable assessment to make a satisfying evaluation. The only data could be weekly programs and their coverage (Tables 25.2, 25.3). From the Earth sciences point of view, three terms in Turkey's modern education history are identified; a) 1924–1974, a geology course was compulsory, b) 1975–1998, geology was elective, c) 1999 to present, geography courses include geology topics (Figure 25.2). Surprisingly, we notice geology-related subjects were taught extensively for the last two decades as the geography course was compulsory for all classes and branches of all high schools. As a result, presently students in primary and secondary education are relatively much more familiar with Earth science topics. In this period, the problems are mainly dependent on teacher training and qualification.

Earlier, geology education was good, as teachers were well educated in geology, but the course was only compulsory for the 12th grade science branches. Earth sciences education appeared very weak in 1974–1998 as it was elective only for science branches of a few types of high schools in 12th grade (Tables 25.2, 25.3). This meant that limited students could take the course, even if there were enough teachers. Moreover, the course needed to be elected by at least ten students to be offered, however, the absence of Earth science questions on the joint exam for university entrance negatively effects the elective geology course.

The Scientific and Technological Research Council of Turkey (TÜBİTAK) supports and encourages the attendance of students at the International Science Olympiads. Unfortunately, there is not yet such an organization for the Earth sciences. However, geology and/or Earth sciences topics are favorites among secondary school students in the national project competition of the TÜBİTAK.

25.4 Concluding remarks

Turkey looks like a bridge between the continents of Asia, Europe and Africa. Therefore, it has very complex geology, characterized by the presence of various rocks and fossils belonging to these continents. In addition to its various landforms, active and inactive volcanic centers, mountain belts, and seismic zones, the country has a long-lived cultural heritage. Hence, its spa-

tial position contains immense geoscientific and cultural values for discovery by inhabitants, at least to avoid natural hazards. However, the university geology and geography departments are not now favored by young people due to unemployment. On the other hand, local authorities and municipalities are now slowly becoming aware of the geotourism potential of natural formations. Mountaineering, trekking, alpinism, and cave tourism are increasing rapidly in Turkey. Moreover, society has learned the concepts of geoparks, geoheritage and geoconservation. In conclusion, the authors hope that clear geoscience education curricula will formally support this geological richness and direct social development in the near future.

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Captions

Figures

Fig. 25.1 General structure of the Turkish education system. I–VIII and IX–XII grades are in physically separated schools, even though they are both parts of compulsory education(simplified from SGB, 2015).



Fig. 25.2 Geosciences related courses in Turkey. Geology was an elective course between 1974 and 2012 only for the 12th-grade science branches, while geography was always compulsory for the Anatolian and general high schools. Total hours in the graph represent the maximum hours in the social sciences branches of these schools. For other branches, the compulsory geography course hours are less as 4 hours, but they can be increased to 8 hours with elective courses. Data

are from the formal course programs that were published by the NBE.

Tables

Tab 25.1 Population distribution (total 77.6 million) and schooling ratios in Turkey (SGB, 2015).

Tab. 25.2 Types of secondary schools and hours of geography course in their programs (SGB, 2015). Numbers in parenthesis show total hours for all courses.

Tab. 25.3 Weekly program of a general high school in 2015 (<http://ttkb.meb.gov.tr/>). Note, nearly all of the courses are compulsory for 9th grade. Hours of a geography course may reach up to 14 if desired.

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