Chapter 26
South Korea: GIS Implementation Profiles Among Secondary Geography Teachers

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26.1 Introduction

Recently, there has been dramatic development in Geographic Information Systems (GIS) and increasing applications of GIS to geography education. Researchers have considered GIS as a teaching tool because of its reported benefits in students' learning (e.g., Baker & White, 2003; Bednarz and van der Schee, 2006; Patterson, Reeve, & Page, 2003). Educators in South Korea also have become interested in incorporating GIS in education (e.g., Jung & Kim, 2006; Kim, 2007; Lee, Kim, & Ban, 2008). Since GIS-related content is discussed in geography textbooks and GIS in Korean society is becoming widespread, geography educators accordingly have turned their attention to GIS. However, the incorporation of GIS in education, especially at the secondary level, is at an incipient stage in South Korea. Only a few innovative teachers are beginning to consider the use of GIS in the classroom.

This chapter consists of three parts. First, contexts of education in South Korea are described through three aspects: (1) the position of geography in secondary education and the portion of GIS content in the geography curriculum, (2) geography teacher certification procedures, and (3) research trends associated with GIS in secondary education. Second, the preparedness of South Korean schools to use GIS in their classrooms is explored. Finally, opportunities and challenges in implementing GIS into secondary education are discussed.

26.2 Educational Contexts of South Korea

26.2.1 The Position of Geography in Secondary Education and GIS Content in the Geography Curriculum

The educational system in South Korea consists of pre-school, primary, secondary, and higher education. This section introduces the geography portions taught in

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the secondary education curriculum: middle school (Grades 7–9) and high school (Grades 10–12), and discusses the GIS content in the geography curriculum. For the social studies curriculum, of which geography is a part, South Korea has a centralized compulsory national curriculum until Grade 10, and all textbooks are based on that curriculum. During Grades 11 and 12, students select subjects from among several electives. Even though students choose a few subjects, each elective must follow the nationally imposed curriculum. Before the current curriculum was introduced, social studies consisted of geography, history, and civics. However, in the current curriculum, history is an independent subject, and geography and civics constitute the subjects of social studies. Table 26.1 presents the sequence of history and social studies in the middle school curriculum. Geography is taught in Grades 7 and 9. A variety of geographic content is taught in the middle school, but there is no specific attention to GIS. There is a recommendation to use ICT (Information & Communication Technology), but the middle school curriculum does not explicitly guide teachers to incorporate GIS in the classroom. Table 26.2 provides the curriculum of high school. Students in Grade 10 learn the mandatory subject, social studies, while higher grade level students select from among seven elective subjects. Three geography electives – Korean geography, world geography, and economic geography – are included. In terms of GIS content, the social studies curriculum in Grade

Table 26.1 Sequence of history and social studies in the middle school curriculum (Ministry of Education, Science and Technology, 2008)

Classification	Grade 7	Grade 8	Grade 9
History		Korean History World History	Korean History World History
Social Studies	Social Studies (Geography + Civics)		Social Studies (Geography + Civics)

Table 26.2 Sequence of history and social studies in the high school curriculum (Ministry of Education, Science and Technology, 2009b)

Classification	Grade 10	Grades 11–12
History	History (Korean History + World History)	History of Korean Culture Understanding of World History History of Eastern Asia
Social Studies	Social Studies (Geography + Civics)	Korean Geography World Geography Economic Geography Law and Society Politics Economics Society and Culture

10 does not include GIS. However, most textbooks briefly introduce what GIS is and how GIS can be used. Among the three electives of geography, the world geography curriculum requires teaching GIS. However, close scrutiny of world geography textbooks reveals that the GIS content in them is almost the same as the social studies textbooks even though the world geography curriculum asks for the incorporation of GIS. Therefore, students in South Korea do not learn about GIS in high school in depth. Also, activities or exercises using GIS software are not required.

The description above reflects the currently publicized geography curriculum for South Korea known as the "2007 Revised Curriculum." However, the Ministry of Education, Science and Technology in South Korea (2009a) recently announced that a new curriculum called "2009 Revised Curriculum" will begin to be partially implemented in 2011. A detailed description of the 2009 curriculum goes beyond the scope of this chapter. While the specific content of the curriculum has not been decided yet, it is known that among the three geography electives, economic geography will be dropped. However, we do not expect that the content of Korean geography and world geography will change dramatically.

26.2.2 Procedures to Become a Geography Teacher

The pathways to become a geography teacher in public schools in South Korea can be explained in two steps: obtaining eligibility and passing an exam. First, to be eligible for a teacher certificate exam, in principle, it is necessary to graduate from a department of geography education. In South Korea, the departments of geography education specialize in educating preservice teachers. The graduates of geography education departments are eligible for teacher certification. There is an alternative way to be eligible for the exam. If an undergraduate or a graduate student fulfills requirements by attending courses offered by a department of geography education, those students can also take the teacher certification exam. However, this alternative route is restricted and very competitive. Once a person is eligible for the teacher certification exam, the person can take the exam, which is administered only once a year. It is very difficult to pass the exam because the teaching profession is popular in South Korea and only a limited number are allowed to pass.

26.2.3 Research Trends in GIS Education

Up until now, GIS has not been widely implemented in classrooms in South Korea. Nonetheless, geography educators are becoming more interested in GIS for education. This trend is reflected in the number of published articles in geography education journals. Kim (2007) categorized the research trends into three types: introduction of the status of GIS education, lessons learned from foreign countries' GIS education, and concrete teaching plans using GIS.

First, the status of GIS education in South Korea has been the subject of research. For example, Hwang and Lee (1996) analyzed the GIS component of geography

textbooks and reported how geography teachers understood GIS. According to Hwang and Lee, most teachers did not have a concrete idea of what GIS is. Jung (1997) investigated the development of GIS and discussed what aspects of GIS could be applied to geography education. Oh and Seong (2003) postulated that GIS had not been implemented effectively into the classroom even though interest in and demands for GIS education had been increasing.

Second, some researchers have explored GIS education in other countries and sought to learn lessons. Kim (2002) investigated how GIS was incorporated into education in the UK to gain insight into how to effectively incorporate it into secondary education in South Korea. Similarly, GIS implementation in the USA was benchmarked. For instance, Kim (2005) discussed how GIS was used in geography education in the USA as a basis to explore its potential in the South Korean context. Jung (2005) examined GIS curricula for undergraduates in the USA. Based on that exploration, he suggested establishing an intensive GIS course and a certificate program for South Korea.

Third, research on concrete lesson plans using GIS is increasing. Hwang (1998) emphasized that the overlay function in GIS is one of the most appropriate strategies that can be used at the secondary level because the function can show the relationships between and among regions even without complicated procedures. Shin, Jeong, and Joo (2002) devised a GIS courseware that aims to enhance students' visual and spatial learning. Yang (2004) developed a GIS learning module using the Internet and demonstrated the effectiveness of the module. Kwon (2004) provided an example application of GIS in education. Kwon claimed that his study can be a model for geography teachers because the study is based on basic geographic concepts and GIS functions that are understandable to students. Jung and Kim (2006) suggested a lesson plan using GIS. Grounded in teachers' opinions, Jung and Kim exemplified how diverse spatial topics, such as plate tectonics, earthquakes, and the relationship between annual precipitation and agriculture, can be taught using GIS to high school students. Lee, Kim, Lee, and Jo (2006) analyzed geography textbooks and developed learning materials regarding geomorphology. These publications suggest that researchers in South Korea are broadening their interest in GIS education at the secondary level.

26.3 GIS Implementation Profiles

This section investigates how prepared schools are in South Korea to use GIS in the classroom. To determine preparedness, we modified and expanded the GIS implementation model suggested by Audet and Paris (1997). Nine high schools in South Korea were recruited for this study, and their GIS implementation profiles were constructed, including GIS software acquisition, hardware/equipment acquisition, data development, professional development activity, and educational context for GIS education. This exploration of nine schools provides an informative picture of the current status of GIS education at the secondary level in South

Table 26.3 A survey questionnaire for constructing GIS implementation profiles (Modified from Audet & Paris, 1997)

Please select one response for each item below	Comments				
GIS software acquisition					
I have GIS software available if I want to incorporate GIS in my teaching	SD	D	U	A	SA
I have sufficient funds to acquire GIS software	SD	D	U	A	SA
Hardware/equipment acquisition					
I have a sufficient number of computers to be used for GIS education	SD	D	U	A	SA
Computers in my school are adequate (e.g., CPU, RAM, memory) for supporting GIS applications	SD	D	U	A	SA
I have sufficient funds to acquire hardware and equipment for GIS education	SD	D	U	A	SA
Data acquisition					
GIS data is readily available	SD	D	U	A	SA
I know where to access sources of GIS (digital) data	SD	D	U	A	SA
I have sufficient funds to acquire digital data	SD	D	U	A	SA
Professional development activity					
My school and/or district provide staff development support for GIS education	SD	D	U	A	SA
I take advantage of professional development opportunities related to GIS education	SD	D	U	A	SA
I believe that professional development should be an ongoing process	SD	D	U	A	SA
School administration support for GIS in-service education is easy to obtain	SD	D	U	A	SA
I have time to learn GIS-related skills	SD	D	U	A	SA
Educational context development					
I see how GIS can be used to enhance my curriculum	SD	D	U	A	SA
GIS is an educational tool for exploring spatial concepts	SD	D	U	A	SA
I can think of interdisciplinary applications of GIS	SD	D	U	A	SA
GIS can enhance students' problem-solving ability	SD	D	U	A	SA
Project-based activities are a good way for students to apply GIS	SD	D	U	A	SA
I can envision real world applications of GIS technology	SD	D	U	A	SA

Note: SD: Strongly Disagree, D: Disagree, U: Undecided, A: Agree, SA: Strongly Agree

Korea. However, due to its limited sample size, this description is a preliminary analysis.

The survey was conducted using the questionnaire presented in Table 26.3. All geography teachers in the nine schools provided their opinions of the status of GIS in their schools; a synthesis of their opinions was used to construct each school's profile. The number of teachers in each school varied from 1 to 4, and in total, 23 teachers took part in the survey. The participants indicated their opinions via a Likert scale from 1 to 5 (1 – strongly disagree, 2 – disagree, 3 – undecided,

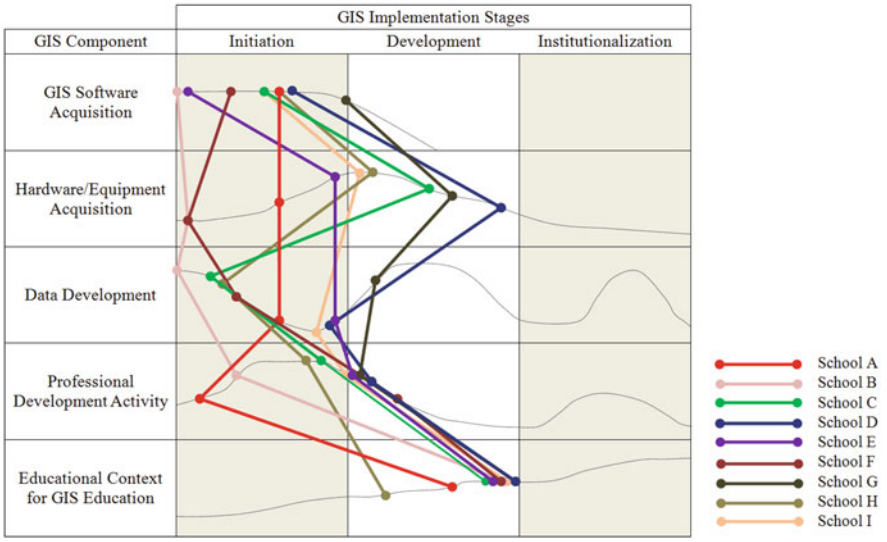

Fig. 26.1 GIS implementation profiles of schools in South Korea (Kim, 2010)

4 – agree, 5 – strongly agree) and mean scores of each school and category were calculated. Based on those mean scores, GIS implementation profiles were constructed as shown in Fig. 26.1. For the purpose of this study, the initiation stage was defined as an incipient phase where GIS sources are lacking, while institutionalization signifies the stage in which GIS sources are commonly shared and GIS practices are regularly exercised. The development stage is located between the two. Considering that the Likert scale of 2 is "disagree," 3 is "undecided," and 4 is "agree," the stages were determined as follows: the range of mean scores of 1.0–2.5 was determined as "initiation," 2.5–4.0 was the development stage, and more than 4.0 was deemed the institutionalization stage. A more detailed description of this survey is found in the article published by one of the current authors (Kim, 2010).

The GIS implementation profiles indicate that schools in South Korea are not well-equipped to implement GIS in the classroom. Hardware, software, and data need to be provided for teachers to incorporate GIS into their teaching, even though there is a relatively wide variation in hardware acquisition. Teachers also do not believe that they have adequate professional development opportunities. Moreover, when given opportunities, teachers do not feel that they take advantage of them effectively. One promising aspect is that the educational context for GIS education has relatively improved; the mean score of the educational context development category was the highest. These results suggest that teachers have positive attitudes about the utility of GIS in educational contexts. In summary, teachers in South Korea seem to believe in the potential of GIS as an educational tool, but a wide range of obstacles prevent teachers from incorporating GIS into the classroom. Further study with wider samples would confirm the results presented here.

26.4 Opportunities and Challenges

Even though GIS has not been widely incorporated into the classrooms of South Korea, we expect that the use of GIS in education can be increased in the future. Most preservice education programs for geography teachers have included GIS-related courses in their curriculum. Telephone interviews were conducted to investigate GIS courses in preservice curriculum (Fig. 26.2). We discovered that, among all eighteen geography education-related departments in South Korea, sixteen departments include GIS courses in their undergraduate curriculum. The two remaining departments offer GIS courses via the form of special lectures or other routes without explicit inclusion of a GIS course in the curriculum. Furthermore, many students actually take GIS courses. In ten out of the sixteen departments that include GIS courses in their curriculum, GIS-related courses are mandatory or most students attend the courses even if they are not mandatory. In five out of the remaining six departments, more than half of the students take the courses, and in one department, one third attend GIS-related courses. In the two departments where GIS-related courses are not explicitly included in the curriculum, whenever there is a special lecture or any other opportunity, most students take advantage of them. Therefore, today, most preservice geography teachers in South Korea are exposed to GIS-related content before they become teachers. Considering that experience with GIS is important in making geography teachers become interested in GIS for their teaching (Bednarz & Audet, 1999; Kim, Bednarz, & Lee, 2009), the current situation is favorable at least at the university level. Moreover, most teachers in South Korea appear to believe in the potential of GIS in geography education (Kim, 2010; Kim et al., 2009). The questionnaire survey of this study also suggests that teachers' awareness of GIS as an educational tool is positive. Even though teachers in South

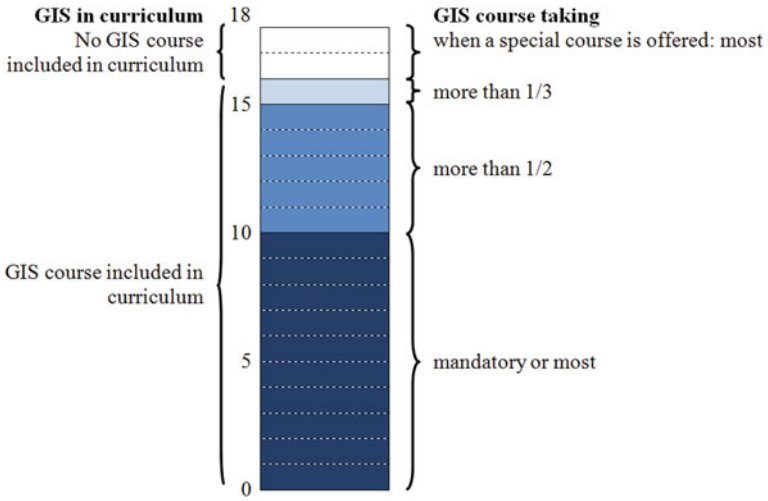

Fig. 26.2 GIS education in preservice programs

Korea think there are considerable obstacles to using GIS in the classroom, they showed positive attitudes about the educational context for GIS education, which is an indicator of teachers' evaluation of GIS as a teaching tool. Therefore, we think GIS has the potential to play a role at the secondary education level if adequate support is offered to teachers.

However, the opportunities given to GIS will be realized only when challenges are overcome. It is encouraging that most preservice teachers have the opportunity to learn about GIS during their preservice education. Nevertheless, educators must pay more attention to improving GIS preservice programs. As was identified by many researchers (e.g., Sui, 1995), teachers should have the ability to teach with GIS as well as to teach about GIS. We do not think teachers are automatically well prepared to teach with GIS without having used it themselves. Thus, teacher educators must develop effective curriculum to provide preservice teachers with experience in teaching with GIS. Moreover, a wide range of problems associated with software, hardware, data, and professional development, as were revealed in the previous section, must be solved. The current situation indicates that, even though teachers want to incorporate GIS in their teaching, obstacles prevent it. Last but not least, GIS content needs to be emphasized in the geography curriculum. In South Korea where the nationalized curriculum is imposed on all geography teachers at the secondary level, teachers have little autonomy in selecting topics and content. High-stakes exams are also based on the national curriculum. Therefore, if GIS is to be used in the classroom, the curriculum explicitly should ask geography teachers to use it.

We believe that GIS education in South Korea is at a critical point. If adequate support is provided, GIS could widen its realm in education. If the previously noted problems are not resolved, GIS may not find its way into secondary education. It is promising that teachers have relatively positive perspectives on the pedagogical role of GIS. However, the positive perspectives can either be heightened further or disappear completely depending on support given to teachers.

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