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Jerry Green*[1]*, *Associate Professor*
e-mail: greenje@miamioh.edu
Liza Skryzhevska*[2]*, *Associate Professor*
e-mail: skryzhy@miamioh.edu
Stanley Toops*[1]*, *Associate Professor*
e-mail: toopssw@miamioh.edu
[1]*Miami University in Oxford, Ohio, USA*
[2]*Miami University in Hamilton, Ohio, USA*

ATLAS USE IN TEACHING GEOGRAPHY IN HIGHER EDUCATION IN THE U.S. AND CANADA

Skills in map use and interpretation are important in geography education. Atlases represent special collections of maps that can be beneficial for developing map use and interpretation and spatial analysis skills in geography students. In this study, we examine the utilization of atlases in geographic coursework. We surveyed 295 geography instructors in the U.S. and Canada about their usage of both print and digital atlases in geography courses of different level. The survey generated 54 responses. The findings indicated that about 39 percent of instructors use atlases in instruction, most of those use print atlases rather than digital atlases. It was found that most of the instructors who use atlases in their instruction teach upper-level Human Geography courses. Some other general courses, in which atlases were used are: Introduction to GIS, Remote Sensing, World Regional Geography, and Introduction to Physical Geography. As indicated by the survey responses, atlases are widely used in special topic courses such as World Forests, Geography of North America, Research Methods in Geography, Natural Hazards, Geography of Europe, History and Theory of Geography, Current World Affairs, Geography of Pennsylvania, Political Geography, Geography of Russia, North American House Types, and Geography of Consumption. In addition to analyzing the survey responses, we also provide examples of atlas use in a variety of courses. We conclude that atlases are useful for studies of spatial associations and geographic patterns, as a background information or context resource, as a source that helps to learn geographic locations, and to learn cartographic methods and map design.

Key words: geography education; map understanding; print atlases; digital atlases; geographic map skills.

Джеррі Грін, Ліза Скрижевська, Стенлі Тупс. ВИКОРИСТАННЯ АТЛАСІВ У ВИКЛАДАННІ ГЕОГРАФІЇ У ВИЩИХ НАВЧАЛЬНИХ ЗАКЛАДАХ США І КАНАДИ

У статті представлені результати опитування, проведеного серед викладачів університетів США і Канади, метою якого було визначення інтенсивності використання географічних атласів у курсах географії різного рівня. Як показали результати опитування, 39% відсотків опитаних використовують атласи у викладанні курсів географії різного рівня. Більшість опитаних використовують атласи в курсах соціальної географії. Менша кількість викладачів використовують атласи в таких курсах як «Вступ до ГІС», «Регіональна географія», «Вступ до фізичної географії». У статті також представлені методичні розробки уроків з використанням друкованих та електронних атласів, які можуть представляти цінність при розробці нових курсів або тематичних блоків у курсах географії вищих навчальних закладів.

Ключові слова: географія освіти, розуміння карти, друковані атласи, цифрові атласи, навички роботи з географічною картою.

Джерри Грин, Лиза Скрижевская, Стэнли Тупс. ИСПОЛЬЗОВАНИЕ АТЛАСОВ В ПРЕПОДАВАНИИ ГЕОГРАФИИ В ВЫСШИХ УЧЕБНЫХ ЗАВЕДЕНИЯХ США И КАНАДЫ

В статье представлены результаты опроса, проведенного среди преподавателей университетов США и Канады, целью которого было определение интенсивности использования географических атласов в курсах географии различного уровня. Как показали результаты опроса, 39% процентов опрошенных используют атласы в преподавании курсов географии различного уровня. Большинство опрошенных используют атласы в курсах социальной географии. Меньшее число преподавателей используют атласы в таких курсах, как «Введение в ГИС», «Региональная география», «Введение в физическую географию». В статье также представлены методические разработки уроков с использованием печатных и электронных атласов, которые могут представлять ценность при разработке новых курсов или тематических блоков в курсах географии высших учебных заведений.

Ключевые слова: география образования, понимание карты, печатные атласы, цифровые атласы, навыки работы с географической картой.

1. Introduction. Maps are such an integral part of geography that for many geographers, the framing of a problem in a mappable context is essential for the conduct of research in the discipline. In 1965, Robinson, writing for the Association of American Geographers, advanced the idea that map reading and appreciation should be '…in par with such things as algebra, laboratory experiment… and probably a good share of what actually is done in English composition courses" (Robinson, 1965). This perspective places the importance of maps and their understanding firmly in the context of an

important liberal arts component of undergraduate education.

Muehrcke (1981) stated that these comments rested on earlier statements by Hartshorne (1939), Ullman (1951), and Sauer (1956), and are reinforced later by Borchert (1987), and Perkins (2004) all of whom made clear the centrality of maps to the framing of geographic problems, their solution and the presentation of geographic discourse to the world at large. Those positions emphasized that maps are essential to geography and that an understanding and use of maps is likewise essential to a geographic education. This understanding has continued to be a part of the geographic context. Writing in 1990, Peter Haggett noted that "geography is the art of the mappable" (Haggett, 1990).

The importance of geography as being the "art of the mappable" has not diminished. Indeed, the proliferation of maps in both print and digital form make map understanding (and concomitantly geographic understanding) an important part of contemporary perception.

Since the 1990s, however, there has developed a sense that specific training in the skills of map understanding is facing both diminished opportunity and a changing contextual setting in contemporary geographic education. Such change has been reviewed in a series of related articles. Green, Burns, and Green (2008) explored the national decline in map interpretation enrollments. Gillen and others (2010) considered the use of introductory texts as a source of materials that could be used to support map interpretation while Green and others (2012) analyzed course syllabi to determine the extent to which map interpretation instruction was actually included in introductory courses. Concurrently with these investigations, Skryzhevska, Green, and Abbitt (2013) considered the nature of map interpretation skills development that was supported by GIS text content.

These changing circumstances suggest the need to strengthen the skills development of map users and renew the sense that geography "is the art of the mappable." A convenient and well established form of maps with which to do this is available in the traditional print atlases which, when joined with electronic/interactive atlases, provides instructors with a wide array of materials to develop geographic map skills while providing the cartographic support necessary to fully understand the geographic complexities of the global community.

In the context of this study, we define an atlas as a collection of maps, whether it is in traditional print or digital form.

The idea to bind maps together in a book originated during the Renaissance. Ever since then, the collections of maps have influenced contemporary knowledge and encouraged further advancements in cartography and mapmaking. The first modern atlas, entitled *Theatrum Orbis Terrarum*, was created by Flemish cartographer Abraham Ortelius in 1584. His work was encouraged and guided by Gerardus Mercator, who, in turn, created maps for his own collection, but never finished it. His atlas was published a year after his death in 1595. Gerardus Mercator, however, is considered to be the first to coin the term *atlas* (Harwood, 2006).

Although the topic of atlas use in teaching geography hasn't been widely reflected in the recent literature, throughout the course of the past two decades, scholarly findings in the area of geography education indicated that atlases represent an important instructor's recourse that helps to develop spatial perspective and to form spatial analysis skills in students. Wiegand (1998; 2006) pointed out that atlases are essential reference tools that require continuing development of skills in their use. Klein (2003) suggested that atlas-based activities foster development of spatial thinking through frequent analysis and interpretation of spatial data. Increasingly, as a result of rapid development of geospatial technologies, maps and atlases are becoming digital and interactive (Wiegand, 2006). These technologies bring countless opportunities to geography education by allowing students to work with spatial data and visualizations and, by doing so, deeper understand the content of geographic knowledge (Bodzin, 2011; Songer, 2010; Lee and Bednarz, 2009). Geospatial technologies also help students to develop geospatial thinking needed for spatial problem-solving (Bednarz, Heffron, and Hunyh, 2013). As indicated in the report from the Geography Education Research Committee of the Road Map for 21st Century Geography Education Project (Bednarz, Heffron, and Hunyh, 2013), high caliber research about geospatial technologies and learning is needed.

2. Purpose and scope of the study. The purpose of this study is to get a better understanding of atlas use in geography education in the U.S. and Canadian universities by determining the nature and extent of atlas use in contemporary geographic instruction. To achieve this goal, we conducted a survey that involved geography instructors in the U.S. and Canada. In order for the study to be truly contemporary, our investigation allowed for responses that covered both traditional print atlases and digital forms.

3. Method and data. In this study, we used an electronic survey that was sent by email to two hundred and ninety-five geography instructors in the U.S. and Canada. We used divisions of the Association of American Geographers (AAG) as a basic geographic unit of analysis. To compile a sample of surveyed individuals, we used the following criteria:

1. Twenty-five percent of all geography programs in each AAG division were selected;
2. Bachelor's, Master's, and Doctoral programs were included;
3. Twenty percent of instructors in each selected program were surveyed;
4. Instructors were picked randomly within each geography program.

The survey consisted of ten questions that aimed at better understanding of atlas use in geography education. A list of the survey questions is presented in Appendix 1.

4. Results. The survey was sent to the surveyed group twice, with a two-week interval, and generated 18.3 percent response rate (fifty-four responses out of two hundred and ninety-five surveys sent). Below, we present our results summarized under five broad topics. In addition, Table 1 summarizes the responses to the selected survey question and indicates their geographic distribution.

4.1. Are atlases used in geography instruction?

Nearly thirty-nine percent of respondents indicated that they use atlases in their instruction.

As indicated in Table 1, the majority of instructors who use atlases, prefer print copies rather than digital atlases. This result is rather surprising, given the speed with which technological change has been affecting our access to information and teaching styles and methods.

Table 1

Selected responses to the survey questions and their geographic distribution

AAG Division	**Responses**	**Use atlases in their instruction,** responses	**Use atlases in their instruction,** % of the total within a division	**Use print atlases,** responses	**Use print atlases**, % of those who use atlases within a division	**Use digital atlases,** responses	**Use digital atlases,** % of those who use atlases within a division
1	2	3	4	5	6	7	8
East Lakes	9	4	44.4	1	25	3	75
Great Plains/ Rocky Mountains	8	3	37.5	3	100.0	0	0.0
Mid Atlantic	2	0	0.0	0	0.0	0	0.0
Middle States	3	1	33.3	1	100.0	0	0.0
New England/ St Laurence	2	1	50.0	1	50.0	1	50.0
Pacific Coast	12	4	33.3	3	75	2	50
Southeast	7	1	14.3	1	100.0	0	0.0
Southwest	7	5	71.4	5	100.0	1	20.0
West Lakes	4	2	50.0	2	100.0	0	0.0
Total	**54**	**21**	**38.9**	**17**	**80.9**	**7**	**33.4**

Note: Respondents were allowed to specify that they used both print and digital atlases.
Source: Compiled by authors using survey results.

4.2. In what courses are atlases used?

Thirty-nine percent of the instructors who responded to the survey teach upper-level Human Geography courses, sixteen percent teach introductory Human Geography, fifteen percent teach GIS, fourteen percent teach World Regional Geography, eleven percent teach introductory Physical Geography, and eight percent teach upper-level Physical Geography. In addition, atlases are used in a wide variety of courses, such as World Forests, Geography of Honolulu and North America, Research Methods in Geography, Remote Sensing, Natural Hazards, Geography of Europe, History and Theory of Geography, Geographic Background to Current World Affairs, Geography of Pennsylvania, Geographic Writing, Geographical Statistics, Political Geography, Geography of Russia, Field Methods, Environmental Geography, Water Resources, Biogeography, North American House Types, Rural Landscapes of North America, Geography of Indiana, Oceanography, Political Ecology, Geography of Urbanization, Social Geography, Cultural Geography, and Geography of Consumption.

4.3. What atlases are used in geography instruction?

The most frequently used print atlases in ranked order were: Goode's World Atlas, Rand McNally Road Atlas, Readers Digest Atlas of America, Perthes World Atlas, U.S. National Atlas (USGS), Climate Atlas of Texas, Texas Agro-Climatic Atlas, Atlas of Landforms, Texas Water Atlas, Rand McNally Atlas of the World, and Cambridge World Atlas.

Digital atlases used by the survey respondents were the following: Atlas of Canada, U.S. Census Bureau Atlas, and USGS National Atlas.

4.4. How are atlases used in geography instruction?

Use of atlases in geography instruction, as specified by the respondents, can be summarized in the following categories: Homework assignments (answers can be found in atlases); as a background information or context resource; as a source that helps to learn geographic locations; to learn cartographic methods and map design; map interpretation; to teach geographic patterns. Additionally, twenty percent of the respondents use atlases for quizzes and exams.

4.5. Are atlases important in geography education?

This survey question generated a set of forty-eight responses that revealed the undoubted importance of atlases, both print and digital, in geography education. A vast majority (ninety-two percent) of respondents stated that atlases are important tools for geography instructors. Several respondents referred to atlases as "essential tools," "sources that provide a spatial context to enrich reading, "great way to convey information and have students think spatially," and "sources that along with text and statistics provide a rich geographic description." Interestingly, even the instructors, who do not use atlases in their teaching, admitted their importance and critical role in introducing the concept of scale.

By contrast to those who value atlases as essential tools in geography, others suggested that, affected by advancements of technology, atlases are becoming obsolete. We assume that these respondents referred to print

atlases only. Several responses indicated that Google Earth replaces maps and other cartographic materials used in class prior to the introduction of this popular (and free) digital program. As an argument against use of print atlases, the cost of an atlas was mentioned. When added to the cost of a textbook, it might become burdensome for students.

Additionally, two useful suggestions were made by the respondents. One suggestion is to publish a basic atlas specific for physical geography. Another one is to develop teaching methods that would help incorporate atlas-based exercises in a large-lecture-class setting.

5. Discussion.

5.1. Use of atlases

As previously mentioned about thirty-nine percent of the respondents indicated that atlases are used in geography instruction. Given the variety of options for classes, thirty-nine percent is a solid showing. Many instructors are going away from standard textbooks to a compilation of readings. An atlas may be a useful supplementary text. Several introductory textbook publishers can add an atlas to a textbook package. In other cases many introductory texts have a large number of thematic maps so that the textbook is sufficient without the addition of an atlas. Some introductory textbooks also have publisher's websites with maps beyond those included in the textbooks.

A variety of atlases are available for classroom use. Appendix 2 presents a list of atlases recommended for classroom use by the authors of this paper. Some atlases such as Goode'*s* and Perthes are general atlases that are useful for introductory classes. Goode's is produced by Rand McNally and can be bundled with introductory geography textbooks from Pearson. Upper level course generally use more specialized atlases of a particular topic, e.g. politics or GIS, or region, e.g. Asia or Texas. Rand McNally has the North American Road Atlas. The USGS produces the National Map in digital format that includes capabilities to utilize GIS to produce maps. There was a National Atlas of the United States in print and then online, but that has been discontinued. The Rand McNally World Atlas also in digital format has a useful teaching tutorial website, http://www.randmcnally.com/support/category/world-atlas. The online Census Atlas of the United States, provides pdfs of a number of social and economic maps of the data from the U.S. Census as well as a print version.

5.2. Examples of atlas usage

The methods of instructions vary from homework assignments, enhancement of geographic location capabilities, to map design and interpretation. Instructors also use the atlases for quizzes and tests. As a text in the classroom, the instructor can lead the students in a topical discussion over sections of an atlas. A directed discussion would identify certain maps and allow student time in class to discover the geographic information portrayed in the maps. Either the students would bring their atlas to class, or the instructor needs to have sufficient atlases on hand. Further, we introduce several examples of class activities used by the authors of this paper.

5.2.1. Goode's World Atlas in introductory World Regional Geography course

One of the authors uses the Goode's World Atlas in an introductory World Regional Geography Course. Students purchase the atlas along with the text. On certain class days marked in the syllabus, the students bring the atlas to class and answer questions referring to certain sections of the atlas. For example, for the unit about East Asia, sample questions include: What cultures (languages and religions) are in East Asia? Where are the natural hazards? What is the precipitation pattern? Where are the natural resources? Compare the population distribution of China, Japan, and the Koreas. What are the distances from Pyongyang, North Korea to Seoul, South Korea, Japan, China, Russia? Questions are provided in class and then students proceed to examine the appropriate maps. Questions could also be provided as homework. Questions sample cultural, environmental, economic, population and political geography. Not all students may bring the atlas, so the instructor can use a document camera to project the maps.

5.2.2. McGraw Hill Student Atlas of World Geography

One of the authors uses the McGraw Hill Student Atlas of World Geography in a global affairs course. In this, questions on certain topics are provided to the students as homework. Students also bring the atlas to class and then we discuss the results. A document camera is also useful. Topics include population, geopolitics, economic development, culture and environmental issues. Questions on population include

1. What are the largest cities in the World (Map A)?
2. Where are the 10 most populous countries (Table A)?
3. How does the developed world compare with the developing world in terms of population size?
4. What counties have the highest population growth rates (Map B)?
5. What countries have the lowest population growth rates (Map C)?

Compare the locations of these countries.

7. What countries have regions of high population density (Map D)? Low density?
8. How does population density correlate with population growth rate (Map E)?
9. What countries have serious population problems?
10. What are some indicators of population problems?

5.2.3. The Routledge Atlas of Central Eurasian Affairs

One of the authors uses The Routledge Atlas of Central Eurasian Affairs in an upper level Asia course. The atlas is organized topically and includes maps on history, population, environment, economy, culture and politics as well as maps of countries and provinces. In this case for each section of the course, the appropriate section maps in the atlas are assigned. Students write a weekly response to the readings as well as the atlas maps. The students bring the atlas to class and discuss the maps along with the readings for the class session.

5.2.4. Atlas of Canada

Another author uses the Atlas of Canada. The atlas, first published in 1906 by the Canadian government, is now available online at http://www.nrcan.gc.ca/earth-

sciences/geography/atlas-canada. It is a great source of historical and contemporary geographic information on economic, social, and environmental situation in Canada, as well as a convenient interactive mapping tool for construction of topographic maps. The atlas contains a myriad of downloadable maps that can be used in geography courses to illustrate spatial patterns and phenomena. This example illustrates an assignment on linguistic culture regions and bilingualism in introductory Human Geography course. Students are asked to download maps of linguistic regions for two official languages in Canada: English and French, and the maps of population density and educational attainment. Further, they are asked to explore spatial distributions of Anglophone and Francophone populations and answer a series of questions:

1. Is there a core-periphery pattern in distribution of Anglophone population?

2. Is there a core-periphery pattern in distribution of Francophone population?

3. How is the English-French bilingualism spatially distributed?

4. Is there a correlation between the areas with high percentage of bilingual population and high population density?

5. Is there a correlation between the areas with high degree of educational attainment and high percentage of bilingual population?

5.2.5. Goode's World Atlas in introductory physical geography course

Another author uses Goode's World Atlas to expand on linkages with elements of physical geography in an introductory physical geography class. In addition to offering exposure to additional resources, the atlas is used in exercises related to:

1. Energy at the earth surface in which maps of frost-free periods, percent possible sunshine and the surface temperature regions maps are used.

2. Weather maps in which a series of Goode's maps are used to relate natural hazards to geographic place, the Average Track of Highs and Lows and precipitation maps are used in an eco-region context with the world eco-regions map.

3. One full exercise uses Goode's Atlas to introduce and expand on scale, use of symbols in legends; atlas map content and atlas tabular content.

4. Goode's Atlas is used to provide material used in world climate classification including the normal range of temperature map and the variability of annual precipitation map.

5. A variety of atlas maps are used in exercises on biogeography and soils including vegetation maps, soils maps and ecoregion maps.

The useful role of atlases in geographic education is appreciated by the respondents who indicate the importance of atlases as materials for geographic instruction. Students can develop a deeper understanding of concepts such as scale and space, a richer feel for map design and interpretation, and can access a wealth of data. Another point of departure for instructors is the choice between using a print atlas, accessing a digital atlas, or using a wide variety of sources on the internet to examine maps and geographic information. One item of concern mentioned is the cost of the atlases. For the atlases used by the respondents, a new Goode's World Atlas has a base price of $33. Perthes World Atlas is $52 and there is also a digital version available for $199. Simpler atlases are cheaper. Google Earth is available for free, so one can access general reference materials. The instructor could access some thematic material on Google Earth as well but not as much as that portrayed in Goode's or Perthes. Pearson has a workbook that utilizes Google Earth and KMZ files suitable for introductory courses. So the cost is certainly manageable.

6. Conclusions. In this paper we discussed use of atlases in teaching geography in higher education in the U.S. and Canada. Originated during the Renaissance, atlases played an important role during the Age of Discovery and contributed valuable knowledge to the progress of cartography and mapmaking. Nowadays, atlases continue to serve as one of the important resources needed for understanding of space and spatial interactions. It is evident from this study that, despite a tremendous increase in availability of new methods and tools for geography instruction, atlases both print and digital remain an integral part of geographic education.

From the survey conducted among the geography instructors in the U.S. and Canadian universities, we conclude that nearly thirty-nine percent of respondents use atlases in their instruction. Nearly eighty-one percent of the abovementioned instructors use print atlases, while thirty-three percent use digital atlases available online.

Atlases are useful for studies of spatial associations and geographic patterns, as a background information or context resource, as a source that helps to learn geographic locations, and to learn cartographic methods and map design. Affected by the advancement of digital technology, GIS-based atlases also allow students to make connections between data used for visualizations and spatial patterns and phenomena that these visualizations reveal. Given a rapid development of geospatial technologies, we expect an increased use of digital and interactive atlases in geography instruction.

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Appendix 1. Survey Questions

1. Which of the following geography courses do you teach?
   - Introductory physical geography
   - Upper level physical geography
   - Introductory human geography
   - Upper level human geography
   - World regional geography
   - Cartography
   - Map Interpretation
   - Geographic Information Systems
2. Other (specify)
3. Where is your university located?
   - USA
   - Canada
4. In which AAG regional division you are located?
   - East Lakes
   - Great Plains/Rocky Mountains
   - Middle Atlantic
   - Middle States
   - New England/St. Lawrence Valley
   - Pacific Coast
   - Southeast
   - Southwest
   - West Lakes
5. Do you use atlas(es) in your instruction?
   - Yes
   - No
6. If you answered "Yes" to Question 4, please list the atlases you use in your instruction.
7. If you answered "Yes" to Question 4, please specify how atlases are used in your instruction.
8. If you answered "Yes" to Question 4, which types of atlases do you prefer to use?
   - Print atlases
   - Digital atlases
9. Do you use atlases for quizzes and/or exams in your classes?

- Yes
- No

10. Do you think atlases are important in geography education? Why or why not?
11. Do you have anything else you would like to add about use of atlases in geography courses?

Appendix 2. List of Atlases Available for Classroom Usage

Print Sources:

Agro-Climatic Atlas of Texas. College Station: Texas A&M University Press, 1984.

Brunn, Stanley, Stanley Toops and Richard Gilbreath. The Routledge Atlas of Central Eurasian Affairs. New York: Routledge, 2012.

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