Questions to Facilitate the Use of Maps As Primary Sources in the Classroom

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Maps can be important primary sources of information for middle and high school students. This article discusses the kinds of questions that teachers and students can ask about maps to have a deeper understanding of the maps. These questions can be selectively used and overlap to some extent so that teachers can choose as needed for their classroom situation.

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In 1854, a horrific outbreak of cholera struck the Soho District of London. In the course of just a few weeks, over ten percent of the residents living around the Broad Street water pump were dead. The death toll exceeded 600 people. According to the dominant paradigm of the day, bad air or miasma was blamed for the outbreak by London health authorities. The physician John Snow thought otherwise and began gathering information about those affected by the outbreak. On the basis of the information he gathered he was able to convince the health authorities to remove the pump handle on the Broad Street pump to stop the epidemic, although it appeared to be on the decline already. Eventually, through the evidence Snow presented, the clergyman Henry Whitehead joined him in his efforts to understand the origins of the outbreak. They did an ethnographic and spatial analysis of the cholera outbreak. Even though they did not know the exact causes of the epidemic, they were able to demonstrate a spatial correlation between drinking Broad Street pump water and cholera. Subsequently, Snow produced a map that became famous, a map that represented the distribution of deaths around the pump. This map was the representation of the spatial thinking that he and Whitehead had used, and it has gained a great deal of notoriety over time (Johnson 2006).

It took many more years before the bacteria that causes cholera was definitively identified, but Snow and Whitehead’s systematic approach to the epidemic is as much a demonstration of the importance of examining all the facts and then presenting them logically as a triumph in epidemiology. Today, researchers continue in the footsteps of Snow and Whitehead by thinking spatially, measuring the variables, and logically representing the findings on maps. This is the underpinning of Geographic Information Sciences (GIS), which has taken the power of computers and applied it to the kinds of questions that are important in efforts to solve problems today. Many times the results of this analysis are in the form of a map. For this reason it is important for middle and high school students to unlock the meaning of maps. This article is designed to help all middle and high school teachers—not just those in the social studies classroom—develop their students’ ability to understand and analyze maps in the context of the social studies. Even in the primary grades, maps that illustrate simple relationships are of value in the classroom. At higher grades the maps can be more complex and related to complex concepts and ideas. As with Snow’s cholera map, many maps throughout history can be used to powerfully illustrate ideas that have played an important role in society’s development.

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The use of primary sources is important in understanding the past. These records of events as described by those who lived through them are important in engaging students in their understanding of history. The value of primary sources in the classroom is widely recognized. Luckily, there is a breadth of recorded evidence (National Archives and Records Administration 1989; Veccia 2004; Williams 2007). Commonly, written records are used to reconstruct past events, but other forms of evidence, such as photographs and maps, are valuable in the process of understanding past
events and the intersection of geography and history. The emphasis in middle and high school social studies classrooms has traditionally been on the written word, most commonly the textbook (Hawkins et al. 1998). In this article I emphasize the value of maps in the classroom. Clearly, a map is composed in a different “language” from that of the written word.

Certainly, there are words on a map, but much of the information is represented by symbols, which to a trained eye reveal characteristics of the Earth’s surface (Wood 1992; Wood 2010). A map reading class is just that, an exercise in learning the language of the map. Why is it important for a student in the social studies to learn the language of the map? First, the importance of the map is growing. Today, one can generate a custom map on the Internet or electronically access a variety of maps that in the past would have been sequestered away in a museum or library. Second, not all maps represent the Earth’s features in the same way. Therefore, it is important that a competent citizen of our world society should understand the differences between cartographic representations and what implications those differences have on the individual and the entire society (McCall 2011). Given these two points, I discuss the classroom analysis of maps as primary sources by suggesting a list of questions that can be asked about maps. Important to using maps as a primary source is the understanding that maps of historical events, like twentieth-century maps of the Gettysburg Battlefield, do not fit this category. A map that was drawn at the time of the Civil War does fit this category. Primary source maps are the focus of this article. Questions described in this article are in many cases unique to maps. These questions are designed to engage students in thoughtful investigation of maps.

As Susan Schulten stated, “[I]t is useful to think of maps as brokers of information that both shaped and were shaped by history. They show us what people knew, what they thought they knew, what they hoped for, and sometimes what they feared. In each case, maps had the unique ability to translate a three-dimensional reality onto a two-dimensional plane” (Schulten 2007, 160). While maps in many ways parallel written records, they are also a unique way of representing past events (Monmonier 1993; Robinson 1965; Wood 1992; Wood 2010). The conversion of the three-dimensional Earth’s surface onto a two-dimensional surface is not just a geometry exercise; it involves the simplification and classification of the complexity found on Earth (Kaiser and Wood 2001). Of course, any primary source is a product of its time, and the way that the Earth is represented changes. The meaning of words and statements change; mores and conventions are different, but with teacher-led guidance in these differences a student should be able to make sense and meaning out of primary sources. Anyone who studies historic maps must understand the cultural context of the cartographer’s time. Maps can reflect the hegemony of certain groups, such as European colonial powers, over less powerful indigenous peoples (Monmonier 2004). In many cases, maps made in the Cold War reflected the cartographer’s political outlook. Governmental agencies may have a different agenda than private sector cartographers (Monmonier 1996). Maps need to fit into a larger context so that meaning can be derived from them. It may even be possible to compare maps from the same time period and see that the emphasis is different, depending on the cartographer. In the context of changing meaning, I propose this set of questions that will guide a student and teacher in the exploration of maps as primary sources.

Not only are maps an expression of ideas and hopes but they are also a reflection of changing technology. The representation of the features of the Earth’s surface on maps dates back at least 5,000 years when clay tablets were inscribed with lines that were probably representations of property lines in Mesopotamia (Crone 1978; Sobel 1995). Since then, the history of cartography is inseparably linked to a wide variety of technological advances that have directly or indirectly affected the accuracy, content, and appearance of maps. For example, the exploration of the Western Hemisphere and beyond by Europeans was in part facilitated by technological advancements in seafaring vessels and a nascent understanding of the causes of diseases such as scurvy. Technological advances during the Age of Discovery necessitated the creation of new and better navigational maps, and the invention of the marine chronometer by John Harrison in the first half of the eighteenth century allowed for more accurate navigation (Brown 1979; Sobel 1995). The invention of the printing press, which generally corresponded with the voyages of Columbus, greatly expanded the impact of maps, as evidenced by the naming of the newly-discovered continents after the explorer Amerigo Vespucci, rather than Columbus, which is credited to a clergyman turned cartographer, Martin Waldseemüller, who first placed the name America on a map (Brown 1979; Crone 1978; Galloway and Ridgway 2011; Lester 2009). Today, the advent of computer mapping, GPS, and satellite imagery allows for very accurate maps where selected features can be represented in a variety of media.

Map Questions for Students

My goal is to set forward a broad set of questions that help to knit together the map characteristics that relate to understanding the historical and cultural context of these maps. What follows is a set of questions that teachers and students can ask about maps as way to put those maps into context. I have organized the questions to progress from appreciation of cartographic style to more difficult questions that deal with motives and messages in the maps. In many cases the maps also are part of a related set of texts and photographs. The historical context of course is larger than just what is shown on the map, but the use of maps is helpful in visualizing the time in which it was created and
the context of the time to history. Maps may be especially helpful for students who are visual learners.

The questions that follow are a basic approach to understanding the context of maps. These basic questions can open discussion about the ideas and technology behind maps. Initially, a student should be able to analyze the cartographic conventions of a map. These are questions that can be asked about any map. By thinking about and understanding some of the general attributes of maps, students will become comfortable with maps and be able to move on to more complex analysis.

The first question is one that engages the student and asks them to critically examine the map. Is this map easy to read and understand? This is a question that only can be answered after a close examination of the map. As one would expect, all cartographers do not have the same skills for producing maps. Some maps are hard to read for a variety of reasons. The symbols selected for a map may be hard to read. Sometimes the map becomes so complicated that it is difficult to understand the map. Older maps may use symbols that are no longer in use. Understanding the connection between cartography and art may be facilitated by an interaction between art teachers and social studies teachers (Sobel 1998).

Once the students have been drawn into the map, they should be able answer if the map is a general purpose map or a thematic map. A general purpose map has lots of information on it. The United States Geologic Survey topographic maps of the United States are general purpose maps. A large number of questions can be answered by using this type of map. For example, students can measure the area of a town, the amount of change in elevation from a valley to a mountain top, or the distance from one location to another using a general purpose map. As demonstrated from this list of activities, general purpose maps are especially helpful for teachers who wish to integrate math and geography lessons. Activities are not just math-based. Students can look at place names to determine the ethnicity of a region’s settlers or trace out the pattern of streams and make inferences about how that pattern developed. Thematic maps have specific themes and commonly have information on them that is not represented on general purpose maps. Thematic maps offer insights into very specific sets of data. A map of the distribution of young children is an example of a thematic map. In many cases the use of two thematic maps may help students think about the correlation of variables. For example, a map of the distribution of young children might be compared to a map of the same area and scale that shows the distribution of playgrounds. There should be a good correlation between these two variables. If there isn’t, students can begin to investigate the reasons for this.

A corollary to the question about a general purpose map or a thematic map is the question whether the map shows primarily the distribution of humanly created features or the distribution of natural features. Maps of the same area may not all show the same information. It is important to understand the general categories of data represented. Humanly created features are more generally changeable through time. A map from the last century that shows the distribution of buildings in a city is probably much different from a current map of the same city. The comparison of maps from different times that show humanly created features can be quite illustrative of the changes that have occurred. Maps of natural features tend to be more static, but they still can show changes over time. A map of landforms may show changes as a result of some geomorphic event. A map of Mount St. Helens before 1980 is going to be quite different from a map of the same volcano after its eruption (Tilling, Topinka, and Swanson 1993).

Once a student is able to determine if a map represents humanly created features or natural features, they can be asked does this map represent ideas and not concrete features? Rather than representing objects that are visible on the Earth’s surface, maps can represent opinions or concepts that are primarily ideas rather than objects, which is a good question to ask of a map so that you understand if these are visible features. A map could show the number and types of places of worship in an area. These places of worship are concrete features, and in some ways they are the embodiment of the religious beliefs of the people who go to those buildings. A map that shows ideas would be one that shows the distribution of the people who hold different religious beliefs. Because religious belief is ideological, it is not necessarily observable, yet it still can be put on a map.

By now the students are probably seeing symbols that are unique to cartography on the map. They can be asked what they see and what they think is the meaning of these symbols. Cartographers have a symbology or “language” that is unique to cartography. An understanding of this language is important because a student who is not able to read a map may misinterpret the map and draw wrong conclusions. Prior to the middle of the nineteenth century, changes in hillslope were represented by hachures. Hachures are lines that were drawn up and down the slope and were more closely spaced if the slope was steeper. Today, the use of contours is more common. Contour lines connect points of equal elevation and are drawn across a hillslope (National Archives and Records Administration 1989; Wood 2010). An understanding of these two types of symbols is important in interpreting two different maps of landforms that show the same thing.

Maps can range from a map of the entire Earth to a small part of a neighborhood, so it is important that the students understand what is the scale of a map is. Scale is the relationship between the dimensions of a map and distance on the Earth’s surface. Small-scale maps (the fraction that represents the relationship between the map dimensions and the Earth’s dimensions is very small, e.g., 1/500,000) represent a large portion of the Earth’s surface; therefore, the detail is lacking. Large-scale maps (the fraction which represents the relationship between the map dimensions
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and the Earth's dimensions is larger, e.g., 1/24,000) show a
greater amount of detail because much less of the Earth's
surface is represented (Monmonier 1993; Monmonier and
Schnell 1988). The amount of information and the detail
of information vary with scale, so a discussion about scale
helps students to understand the amount of information
that can be gained from a map of the western United States
compared to a map of the city of Denver, Colorado.

Which direction is north on this map? Today, almost all
maps are made with north at the top of the map, so this
would seem to be a silly question. Map readers are condi-
tioned to this convention, which became standard with the
use of the compass. Prior to the wide use of the compass
in Europe, maps in the Middle Ages had east at the top.
Maps of the Middle Ages generally were allegorical and
represented ecclesiastical ideas; therefore, east was at the
top of the map because that was where the Garden of Eden
was located (Bagrow 1966; Cosgrove 2007). We still orient,
meaning east, a map when we line the map up so that it is
laid out with north on the map aligned with the compass ar-
row. Each map should be carefully examined to see if north
is truly at the top to avoid confusion because some maps
are not oriented with north at the top. Sometimes, the area
represented on the map is better suited to be represented
with other directions at the top. There are world maps on
which south is at the top of the map. Sometimes, maps
have been drawn by Southern Hemisphere residents as a
protest to a perceived Northern Hemisphere bias (Kaiser
and Wood 2001).

Once students have examined the map itself, broader
questions begin to arise. One important question is what
kind of technology was used to produce this map? A wide
variety of technologies have been used in map production.
The ways in which maps have been produced include hand
drawing, engraving, lithography, and computer generation.
Just as the technology that has been used to directly produce
a map has changed, the technology used to gather informa-
tion to put on a map has also changed. Remote sensing (the
gathering of information about the Earth's surface from a
platform above the Earth) has progressed from the use of
hot air balloons to airplanes to satellites (Jensen 2007). GPS
is quickly replacing conventional surveying techniques. The
more detailed information cartographers are able to gather
via a variety of technologies the more accurate maps are.
The kinds of technologies used in map construction are
important to know so that one can understand how in-
formation is gathered and turned into a map. One of the
fastest growing job sectors in the United States is geospatial
technology (United States Department of Labor 2010). To
introduce students to maps can give them an opportunity
to learn about the potential career opportunities in the field
of cartography and geospatial technology.

Now the focus turns from the map itself to particulars of
the map's construction. For example, a student could ask
when this map was made. The date that a map was made
has direct bearing on understanding the map. Fundamen-
tally, a map reflects the technology available at the time
of the creation of the map. The accuracy of older maps is
usually lower than today's maps because of the tech-
nological differences. Beyond these technologically driven
differences, the older the map, the less relationship there is
to the present distribution of features on the Earth's sur-
face (especially cultural features). This is good and bad.
In some cases it is hard to interpret older maps because
the information on those maps is hard to put into con-
text. Yet in many cases older maps put into context the
development of the geography of the location represented
on the map by showing past distributions. Ancient Greek
maps of the inhabited world obviously represent a much
different world than today (Monmonier 1995). Perhaps the
most intriguing information on a map is that maps reflect
the world view of the culture that the cartographer lived in.
For many groups of people, such as the pre-Columbian Na-
tive Americans of the Southwest, their maps represent not
the geographic position of locations but the relationship of
those people with their environment and the supernatural
(Cosgrove 2007). To try to use these kinds of maps to locate
places would be a folly, yet these maps tell us much about
the people who created them. With this question students
are beginning to think beyond the borders of the map and
start thinking about the broader context represented by the
map. Students should be encouraged to think about and in-
vestigate the source of the information used to construct
this map. The information that is represented on a map may
be limited by the amount of data available. In some cases
a cartographer may choose not to use a certain data set
because of a personal decision or lack of confidence in the
data. In other cases the available data may be limited and
the information on the map is less accurate than desired by
the cartographer and the map user. A map reader needs to
recognize the shortcomings of any map and to see where
the information represented on the map may be weak. In
some cases the cartographer may deliberately falsify infor-
mation as the result of security concerns or government
manipulation of the facts. Of course, knowing who made
a specific map would be an important thing. A person or
group may have a particular point of view that will show
up on the map. In some cases the point of view will be
political; in others it will be based on a particular data
set. Sometimes, the cartographer is motivated by financial
gain; in other words, how many maps can be sold. Govern-
ment agencies produce maps as part of informing citizens
about the country they live in. Understanding who made
the map helps students to understand the content of the
map (Monmonier 1996).

One result of knowing the author is that we may be led
to ask why this map was made. Maps are made for all kinds
of reasons. Many maps are a collection of information about
the Earth's surface. Topographic maps show a variety of
features, including elevation, vegetation, roads, buildings,
rivers and streams, and railroads among the extensive list
of things that can be represented. Other maps are very
specific. The maps that adorn television studio walls during national election coverage are very focused in their content. This representation has entered the language in the form of “red states vs. blue states.” Behind each map is a reason for its production, which in some cases is very specific. For students to think about what is on a map is important. What kind of information was available and what was left out? Does that unmapped information change how someone might understand the spatial distribution?

One would hope that this map is or was useful to someone, but who specifically is the targeted audience? One of the reasons that maps are made is that there is an audience who needs the information from the map. In many cases there is a specific set of people who will benefit from a map. For example, travelers welcome maps that show their route. During the westward expansion of the United States there was a brisk business in guidebooks that described the best routes to good agricultural land or gold fields (Redpath and Hinton 1859; Schulten 2007). Today, we have user-defined map creation through websites that will generate a map of a traveler’s route complete with detailed directions. No matter what time period, there has been a demand for maps because they are an important way to convey spatial characteristics in an easily useable form.

Maps can represent a great deal of information, but, in many cases, a map is based on some other data that is contained in written or tabular form. What supporting documents would be helpful in understanding this map? Are there other documents that can be used to understand the context of a map or the changes that have happened between the production of maps from two time periods? Usually, the answer is yes. The map that John Snow made of cholera deaths is just one piece of data that he presented (Johnson 2006). Texts or photographs may be available that explain the information on the map or the historical background of the map. Maps can be tied to the bigger historical picture and are great illustrations of what has happened in the past.

Students can be asked to decide if a map represents different times on the same map. Some maps combine times through combining sets of maps or using different symbols on the same map. Maps that show different times are particularly helpful in determining the changes that have occurred in an area. In some cases a series of maps might be available for the same place. Sanborn insurance maps are a good example of maps that form a series through time. Sanborn insurance maps were drawn for a large number of United States cities starting in the late nineteenth century. This was a practical solution for the underwriting of insurance policies because it was difficult for insurance companies with offices in distant locations to know what the conditions were in urban areas. Sanborn insurance maps represented the building construction materials, the location of fire hydrants, and the storage of potentially flammable materials. These maps were updated on a regular basis, so comparisons can be made over a period of time (Monmonier and Schnell 1988). By using these maps, changes of urban use can be analyzed by students and comparisons can be made between time periods.

Do maps have an ideologically distinct point of view? In many cases the maker of a map may have an ideology that they want to represent. The result is a map where the representation of information may display some kind of bias. Maps that display a political viewpoint have been produced from a broad spectrum of organizations from Nazi Germany to the modern Israeli state (Herb 1997; Monmonier 1995). Maps of Middle Ages Europe show an ecclesiastical orientation. Knowledge of the broader ideological context of time during which a map is helpful in understanding the map and the map itself can illustrate how some groups perceive the world around them. Maps are helpful adjuncts to other publications that explain a particular point of view.

Of primary interest in any map study is the broad reaching question, is this map relevant for solving problems today? By understanding the past we might be able to project changes into the future. An understanding of how present distribution came to be is very helpful in solving problems. The British, in conjunction with other European powers like France, divided up the Middle East after World War I in a way that disenfranchised many groups. The story of the creation of the political boundaries of the Middle East is one of secret maps, a confusing maze of ethnic and religious groups and efforts to bring stability to this region. Through a series of expeditious, but usually problematic decisions, boundaries were drawn, leaders were installed, and the region was divided into countries and spheres of influence. If the colonial powers would have had a better understanding of the history and distribution of these groups or even better maps, some of the problems that are occurring in the Middle East today might have been averted (Naiden 2007).

Today, students are used to Poland being an independent country, but if they look back at the history of Eastern Europe, they will find that Poland has not always had the autonomy that it has today. Between 1795 and 1918, the region that had been and is Poland was partitioned between Germans, Austrians, and Russians. It was only as World War I was winding down that the Poles were able to declare their independence. This independence was short-lived. On August 23, 1939, the foreign ministers of Germany and the Soviet Union met to secretly determine the fates of the Baltic countries. The resulting Molotov-Ribbentop Pact drew a line, dividing the German and Soviet spheres of influence to the north of Poland. On September 1, 1939, the Germans invaded Poland. On September 22, 1939, the agreement between the Germans and the Soviets was expanded to include Poland. Both the Soviet Union and Germany already had troops on Polish soil, and a mutually agreed upon line defining the territory occupied by each army was determined. This agreement was far from secret. On September 23, 1939, a map appeared in the New York Times that showed not only the position of the line of
demarcation but the territory originally held by Germany, Austria, and Russia in 1914 at the beginning of World War I (Knauth 1939) (Figure 1). The map in the *New York Times* is a great example of a map that shows changes over time. One can wonder what a reader of this newspaper may have been thinking as they looked at this map. If they were concerned about the escalating war in Europe, they had good reason. This map of Poland shows the dangers of being situated between two heavily militarized countries that would eventually go to war against each other. Ideological struggles, territorial aspirations, and human suffering can all be inferred from this map.

Finally, it is time to challenge students to become active cartographers themselves. Ask them how they would make this map better. This is a discussion question that has no definitive answer, but it will help develop a critical eye. After looking at a variety of maps, a discerning map user should be able to think of ways that a map can be improved. In some cases the presentation of a map is not aesthetically pleasing. In other cases the map information is not easy to figure out. This exercise helps a map reader to develop a critical eye.

**Conclusions**

The questions presented in this article are designed to engage students, to help them think about the context of
Maps as related to texts, and to understand how maps work. The examples given in this article merely touch on the vast amount of material available. The literature is full of lessons that can be adapted for a variety of classroom situations and grade levels (e.g., Beaufre 1992; Comenetz 2005; Galloway and Ridgway 2011; Hawkins 2003; Sobel 1998). Many maps can be found in digital form on the Web, and numerous books with maps and map commentary are available. The use of maps in the classroom can be a colorful addition to the classroom environment and can engage students in ways that are different. The result of using maps as primary resources will pay dividends in the classroom and in an educated citizenry in the future (Dunn 2010; Gershmehl 2008; Halverson 2009; McCall 2011).

References
