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# Geographical Information Systems as Learning Resources for Social Studies: A Literature Review

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**Abstract:** The use of innovative and advanced resources like those of Geographical Information Systems (GIS) for social studies can aid the actualization of the aims and objectives of social studies education in Nigeria. This theoretical paper pointed out the fact that Geographical Information Systems can be used to achieve quality social studies education in Nigeria through exploring available literature to provide a good understanding of the topic under review. The paper adopted an analytical approach through an extensive review of literature around the major variables which are Geographical Information Systems and social studies. It further discussed the relationship between social studies and Geographical Information Systems as well as the benefits which will be accrued to both learners and educators of social studies by using them as instructional references for social studies lessons. The paper concluded by explaining the benefits of applying Geographical Information Systems resources to social studies. These benefits include providing students with visual learning of social studies; studying the major themes of social studies through a spatial perspective; using stored information for education and applying GIS technology to educational processes as it concerns learning in social studies.

**Keywords:** Geographic Information Systems, Learning Resources, Social Studies, Exploring, Benefits and Literature Review

## INTRODUCTION

The environmental landscape is of utmost importance to social studies learners and educators, this is because social studies encompasses the actions and experiences of man living in an environment and help us to bridge the difference between the known and the unknown. Akinlaye (2003) described social studies as a study of man in his environments, these environments can be physical, social, cultural, economic, political and scientific. The subject involves the dealings and interactions of man with these environments. Social studies also involve the reciprocal relationship between man and these environments. Thus, in social studies we study the physical and geographic space, cultural and information systems, social political, economic and all aspects of environments that have to do with man.

Sofadekan (2012) explained that the physical environment to a large extent affects the type, content and system of education, for example children who grow up in riverine areas learn how to fish and those brought up in grassland environments learn grain cultivation and cattle rearing. The child obtains knowledge and learns through observing the physical environments such as roads, rivers, vegetation, climate, relief, animals and so on. This educational process continues to adulthood and it determines the child's behaviour towards the physical and cultural environments. The point being is that Geographical Information Systems (GIS) are digital representation of the physical environment, hence they can be important resources for learning about the physical environment in social studies.

Innovative learning and reference resources for teaching and learning social studies concepts are necessary because according to Golam (2018), they assist the learners to put their full potentials into use. It is based on this premise that this paper advocated for the use of Geographical Information Systems (GIS) digital resources and how it can be introduced and infused into the teaching and learning of social studies. Geographic Information System (GIS) is a type of technology that is used to capture, analyse and store data. Data which are related to natural, human and physical environments, settings and relationships in computer settings (Aytac, 2014). The premise for the application of GIS to social studies is based on the fact that they enable visual learning, promote knowledge retention, make learning fun and easier, aid access to numerical data, stimulate readers interest, improve creativity, help in comparison, develop critical thinking and enable spatial analysis.

Ughamadu (2012) noted that for instructions in school subjects to be effective there is need to apply educational and digital technology as a means of automating the act of studying with resources that have the ability to amplify, transmit, reproduce and stimulate learning. Applying GIS technology to studying social studies is a systematic approach to instructional design, combining alternative methodologies, use of media aids in relation to learning objectives, together with the content of learning the subject matter. Hence components of GIS like Aerial Photographs and Google Earth will give a more comprehensive conceptualization to social studies. The relevant and latest technological advancement of Geographic Information Systems can be harnessed as learning resources which could be used to inculcate social studies knowledge into learners.

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2010) submitted that the aims and objectives of social studies include the comprehension of the physical environment by children; this environment has a lot to do with the immediate surroundings and locations of phenomenon and the effect of the physical environment on man. The implication of the UNESCO statement shows that social studies is "a study of the total experience and understanding that a child acquires having been exposed to a course of study based on the child's problems in his or her environment" (Olatunde, 2006). The specific aim of social studies knowledge is relevant to the relationship between man and all spheres of environment. That is why social studies help's man to acquire the needed basic skills to solve environmental and societal problems. Therefore, GIS resources should be used to learn the subject as they are resources that elucidate about the environment and will help actualize the aims and objectives of social studies education in Nigeria.

## LITERATURE REVIEW

Alibrandi and Palmer-Moloney (2001) introduced GIS as a digital technology with positive implications for teacher trainee program. This is because GIS presents a new view in the representation and analysis of data that can transform the teaching and learning of school subjects including social studies. This paper is very timely because presently, government agencies and private industries with networks make use of GIS for their businesses such as real estate, physical planning, health awareness, travelling and many more. Krogman (2015) used GIS to give a geo spatial perspective of historical statistics to social studies students, this is innovative and worthy of emulation by the social studies learners in Nigeria.

Karabas and Sahin (2007) explained that GIS is a significant tool for helping students to acquire geographical knowledge, which can help in organising, protecting and conserving the natural resources that belongs to humans. Reed and Bodzin (2016) investigated how geospatial analysis thinking and reasoning skills of GIS can be used to improve understanding of lesson contents. The findings discovered significant effect of GIS on reasoning and deduction. In addition, digital GIS when properly designed alongside subjects' curriculum can improve learning outcomes in health education. If this can be obtainable in health education, then surely it can do better for social studies.

Jarosievitz, (2011) and Obro (2021) prompted teachers and lecturers in faculty of education of universities to make the benefits of information and communication technology, multimedia

resources (maps, videos, images, graphics and interactive) and new technological advancements like those offered by GIS known to undergraduate trainee teachers. This will give them enough knowledge and capable skills before graduating from universities. With this kind of development, it will be possible and easy for the trained social studies teachers to make use of digital resources like GIS to teach students at the appropriate time. Malik and Agarwal (2012) similarly supported Jarosievitiz (2011) by claiming that a multimedia-based learning atmosphere of digital GIS, provide students the capability of finding solutions to problems through self-exploration, cooperation and active participation. GIS visual media can be ample study materials, when incorporated in an organised way to increase the acquisition of knowledge that is novel, heighten peer learning, boost personal creativity and invention.

Aytac (2014) opined that any technology and information that can be used for educational development and imparting knowledge, should be in a stored digital system like GIS. Most importantly, GIS is an avenue to apply stored information to education. In Turkey's Social studies curriculum objectives, it is clearly stated that GIS data such as maps, graph, sphere, tables, diagrams that are time band should be developed and used in their schools (Aytac, 2014). This has become a national law in Turkey, for geography concept and teaching of social studies so that the students can learn topics on physical environment that are in social studies with ease. This means that GIS give credence to social studies lessons that are geographical in nature. GIS quicken the understanding of geography in a classroom setting and therefore it is the opinion of this paper that social studies teachers and students need to be aware of the benefits of GIS and use them in the study of geography related topics in social studies.

Aladag (2014) also advocated the application of GIS through the use of Arc GIS 9.2 to social studies lessons, in line with this aim 14 Social studies teachers in Ayden Turkey, received 6-hour training course about GIS, the training included theoretical data on GIS, a practical presentation of Arc GIS 9.2 a GIS software used worldwide and researcher's prepared GIS teaching materials in line with the Turkish National social studies curriculum for primary schools. The study discovered that Social studies teachers in Turkey found GIS immensely useful in primary social studies education considering the fact that it helps students with visual learning, improved their map learning and enhanced their retention level.

Mccloughlin (2015) reviewed a series of research relating to the importance and application of GIS in school subjects and the methods that were applied for better understanding of these processes. The review raised the argument that GIS and geography education is deficient in constructive research. Efforts made at closing the gap between the integration of GIS in primary and secondary schools and the applications of these research is very slow, hence there is a need to develop more studies in these areas. Similarly, Bednarz and Ludwig (1997) examined the inculcation of GIS into US K-12 social studies and established a positive connection between them.

According to Bennett (2019), students are now conversant with GIS through "Pokémon Go" a kind of computer game which has a combination of real and abstract environments. This game app was introduced by GIS specialists in 2016 and has already recorded over 500 million downloads. The video game help students to be conversant with urban environments that have already been produced by the GIS software called "*city engine*". In a similar vein, students that have been driven in a car with GPS or a mobile app with synergistic application maps from apple, goggle or bing must have gotten a first-hand knowledge of how GIS data can combine real life with technology. These students' first-hand knowledge can help give a background of GIS to Social studies students and will find it easier understanding GIS digital resources.

## Geographical Information Systems and Social studies

Geographical Information Systems (GIS) evolved over twenty years ago since the 1990s, in Canada and the United States. It started as web GIS, the application ran on personal computers and were powerful tools for map making (Genapati, 2010). GIS has grown and still growing since the 1990s. Later on, the technology was integrated into the internet and became accessible to anybody with computers and internet coverage. The final stage of its development saw GIS being

used as overlay of spatial data on maps through programming. Hence GIS technology are technologies that show spatial/visual data. These data are collected, stored, analyse and disseminate spatial data.

The growth of GIS has provided opportunities for enhancing social studies education, as GIS and social studies are intertwined and blended together, this is so because social studies is multidisciplinary in nature just like GIS (Kerski, 2015). GIS makes use of data and maps from various disciplines, thus teachers and students who make use of GIS data are taking advantage of information from a wide range of disciplines and content. Secondly, making use of GIS for social studies is holding fast to the major themes in social studies (National Council for the social studies, 2010). The study of culture and globalization are better understood from a spatial perspective which can be provided for with GIS in terms of the theme "time, continuity and change". GIS makes it easier for space and time to be studied together. It is easier to study science and technology when learners and teachers can identify the source and time of data creation. Science and technology is one of the major themes of social studies and using GIS can help to know data source, therefore the class can make decisions on the suitability of the data for the study.

In the same vein, Vander Schee (2003) and Kerski (2004) also demonstrated that GIS is good in boosting social and citizenship studies, this is in line with citizenship education a major theme in social studies. Most significantly are the major phenomenon of climate change, environmental protection, political unbalance and beyond, all these are major aspects of Social studies which can also be analysed from the perspective of GIS. Furthermore, understanding geographic situations helps in understanding Social studies and GIS gives a robust picture of geographic phenomenon as social problems can be studied in many dimensions. For instance, the participation of voters in an election can be represented as lines and shades on the map of a state or country. Statistical characteristics can be presented with charts and maps, the same can be done with a "social problems".

Kerski (2015), while exploring GIS for social studies education posited that the analysis of populations,' phenomena, distribution and its implications are major components of social studies and they are some of the many Social studies components that is heightened by the use of spatial analysis from GIS resources.

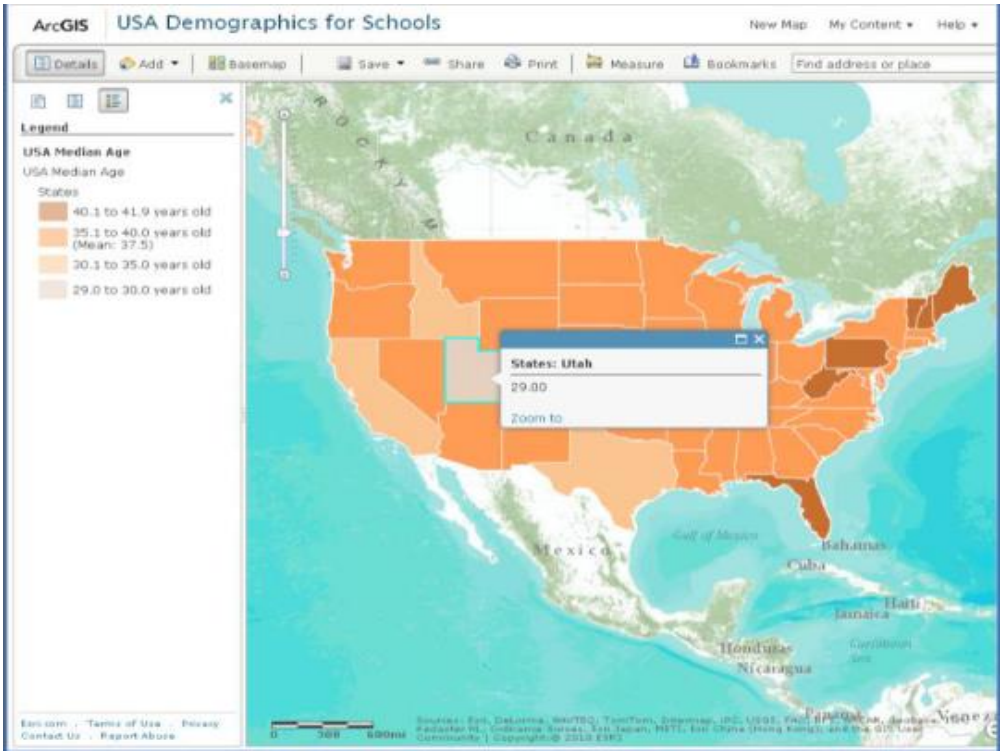


Figure 1. A Map produced with Arc GIS showing median age of a population (Kerski, (2015).

The map above shows the median age of a population and it was produced within seconds using Arc GIS (online www.arcgis.com). Kerski (2015) maintained that the use of GIS for social studies will enhance the grounding of social studies students in their physical and cultural environment, real-world settings to social issues, geography, and help develop their critical thinking skills. It will also help to connect social problems to global issues, as social problems have a major impact on the daily lives of people on planet earth. GIS as a technology gives the ability of collecting information that are physical in nature, information can be used in the development and enhancement of all human activities in the environment.

Goodchild (2009) pointed out that GIS is all about space and space is critical to locations, but very many social scientists do not understand the importance of the study of space. It is worthy to note that the course that leads to crime, deprivation, family disharmony, war, conflicts and crisis in the world today are the same everywhere. But in the thinking of many social scientists today, education, unemployment and the economy are far more important than geographic space. Geographers seem to be alone in their study or concern for space in the past. Anthropologists, economists, sociologists, political scientists and demographers have been unconcerned about the concept of space. But recently, the narrative is changing, many social scientists have come to the realisation that man does not exist in a vacuum but in space. Therefore, the spatial analysis that is presented by GIS will be of utmost benefit to social studies learners. Interest in GIS is increasing as well as spatial model analysis that has been made possible by GIS.

Sousa et al. (2017), is of the opinion that multimedia resources like GIS makes it possible to incorporate maps, graphics, text and other communication technology as one collection in social studies. This gives a comprehensive information to students in achieving specified learning objectives. Besides, it allows the presentation of very difficult task into a highly synergistic, expressive manner so that teaching materials can be interconnected with congruent topics in an innate and intuitive manner.

GIS can be a drive for exploration, integration, analysis, questioning, interpretation and evaluation of information. GIS software in CD ROM, Google Earth, Google Maps, satellite images, aerial photos and many others applications are means and ways of integrating GIS into social studies (Alibrandi, 2003).

## Benefits of Exploring GIS as Library Resources for Social Studies

Environmental Systems Research Institute (ESRI), (2017) claimed that structuring GIS into geography and history studies in the form of social studies will be beneficial to Colombian students. According to Luz Angela Rocha, a university professor in Colombia,

> "It provides the students with the geographic context of where events happened, which may have had an influence on why a particular event happened. However too often, our social studies teachers have strong educational background in history and limited knowledge of geography so they naturally emphasize history in their classes" (ESRI, 2017)

From the quote above, it can be deducted that GIS will broaden the geographical horizon of social studies students but most especially that of teachers. GIS will influence the geographic knowledge of social studies teachers, by helping them in explaining the physical environment to learners. Social studies teachers in Nigeria can borrow a leaf from the ESRI study in Colombia to begin an evaluation of how we can apply the rich knowledge provided by GIS and use it to enrich Social studies knowledge. Many of the Colombian students and teachers interviewed after preliminary usage of GIS software to teach social studies revealed that GIS is a good learning tool to explore things, places and events in depth and to have a better understanding of our environments (ESRI, 2017).

Geospatial Cooperation (2019) pointed out that as there is an accelerated change in technological advancement in the world of work today, the educational system should evolve along with it. Geospatial cooperation further reiterates that one key instrument that can help every

subject matter to advance with the pace of technological innovations is GIS. GIS should be embedded into education, environmental science, physical sciences, business studies, and all fields of engineering, geography, history, social studies and other subject areas. Geospatial cooperation explains the ease of bringing GIS to students, since they already use GIS to locate places with their phones like hotels, restaurants and eateries around their campuses. Therefore, it will be better to meet them at their GIS knowledge base and take it from there. it will be proper to surpass their knowledge of GIS by teaching Social studies and other subjects with GIS.

Industry Focus (2015) clearly stated that teaching students to think spatially authorizes them with the ability to comprehend and find solutions to big problems such as climate change, environmental degradation and pandemics facing the earth. They reiterated that from historians and ancient scholars in Greece, China and Rome, geography has been studied for over 2,500 years ago. Therefore, the study of geography to think spatially is more important now than ever, especially with issues of globalization, the economy and climate change, overpopulation, loss of biodiversity, poor quality and quantity of water, environmental hazards. These problems have assumed a global dimension and is threatening our everyday living. To solve these problems, we need a population of people that are grounded in spatial thinking, a population that can view the "wider scenario" and in the same way comprehend how the various patterns and trend of these issues are interconnected, from a universal dimension to their own local environment.

Spatial science, another name for GIS can visualize all major problems we experience today, because these problems have geographical and social dimensions. GIS helps to analyse these issues using maps in quantitative form or framework, instead of abstract lessons, these maps are expressive and can be merge with other maps, multimedia, charts and databases. Industry focus also indicated that GIS is best for an inquiry based and problem-solving methods of learning and teaching. GIS integrates field study and gives a tract for a career that is in high demand. It assists students to think, evaluate and judge critically, it makes use of tangible data and links the students to their own environment which is the major objective of social studies. GIS can be used to achieve all these at the primary, secondary and tertiary level of social studies.

The application of Geographic Information Systems to enhance social studies teaching and learning has been applied to promote Social studies performance in many countries such as Turkey; South Africa and the United States. GIS have proven to play an important role in the promotion of better understanding and teaching of social studies in these countries. This is because GIS is multidisciplinary like social studies, several studies such as (Kayer (2012); (Iran), Musakwa (2017) in South Africa; Aytac (2014) in Turkey; Mzuza & Westhuizen (2019) in South Africa; Mccloughlin, (2015) (Dublin); Kerski (2015) in the USA and Gokce (2015) in Turkey, just to mention a few, have demonstrated the positive impact of GIS on teaching and learning social studies. Therefore, this paper presented an in-depth review and a basis for using Geographic Information Systems as learning resource for social studies instructions.

## CONCLUSION

The contemporary teaching of social studies is only meaningful when citizens participate in the process of learning and not passive recipient. From research evidence reviewed, it is anticipated that this paper will aid quality social studies Education by using GIS resources for its instructional purposes. GIS offers variety of multimedia platforms like Aerial Photographs; Maps; Soft wares; Satellite images and many other that can be meaningfully explore for social studies and provide quality social studies education. The ability of social studies teachers to effectively make use of GIS in the classroom is pertinent to improving quality social studies. GIS will deepen the process and path of social studies education through enhancing geographic context of the subject, heightening visual knowledge; promoting the major themes of social studies, broadening the spatial perspective of students and applying digital technology to the teaching of social studies. Hence, social studies teachers and learners should be encouraged to make use of GIS resources, while school administrators should make them available in their schools.

## CONFLICT OF INTEREST

The authors would like to state categorically that there was no conflict of interest of this paper.

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