



ANALYSIS OF QUANTITATIVE AND QUALITATIVE APPROACHES IN GEOGRAPHY AND ENVIRONMENTAL EDUCATION IN NIGERIA TERTIARY INSTITUTIONS

BY

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Abstract

One of the key factors in the success of Environmental Education and Geographic research is not just the applicability of both quantitative and qualitative methods, but the manner and techniques of incorporating the approaches in geography and environmental education. It entails careful planning to ensure that the approaches are well thought out and applied in Geographic studies. The approach considered for any geographic research must be thoroughly selected for use, and it must be appropriate for the overall purpose, learning objectives and research intent in which it is to be integrated. The integration of quantitative and qualitative approaches is crucial for creating immersive and personalized experiences in Geography and Environmental Education. They have the potential to revolutionize environmental education and geographic research through adaptive learning, intelligent interactions and realistic data gathering. This paper analyzes the quantitative and qualitative approaches in geography and environmental education. It sought to examine the key aspects and techniques the approaches follow in data gathering and generalization, bearing in mind the components of statistical analysis, spatial analysis, statistical modeling, GIS, remote sensing, and the application of oral history, participatory mapping, as well as observation techniques. The study further contends that integrating the approaches enhances research skills, promotes critical thinking as well as preparing students for diverse career opportunities. The paper concludes by underscoring the immense potentials of quantitative and qualitative approach, even as they offer distinct, yet complementary perspectives to Geography and Environmental Education.

Keywords: Analysis, Qualitative, Quantitative, Geography Education, Tertiary Institutions.

Introduction

As Geography is a multidisciplinary science, it is quite natural that students and teachers tend to perceive and describe geography with different perspectives, which appears to have something to do with the fact that geography has a structure that can be positioned in accordance with academic field and various viewpoints. Due to their differing perceptions of, and approaches to geography, many geographers have defined it in a different way. For instance, whilst Uzgen (2021) perceives geography as man's effort to govern the environment, Cresswell (2018) took geography as strategic information required for political and military applications. Still, other Geographers as Gregg and Leinhardt (2024) observed Geography as a combination of knowledge and opinions on the distribution of topographic features, their historical developments, and their formation in time.

Geographers who have called attention to the interaction between man and environment have defined geography as a scientific field that explains the mutual interactions between man and natural environment as well as their spatial patterns (Uzgen, and Bindak, 2019; Lambert & Morgan, 2020). In fact, this kind of definition may well be considered as a reflection of the perceptions regarding the concept. Furthermore, as was mentioned by Bennetts in (2022), this approach has been adopted by a growing number of Geographers. According to this approach, geography is essentially the discipline concerned with the study of physical and human environments and processes; relationships between people and environments; the character of places and landscapes; the significance of location and of spatial patterns,

interactions and interrelationships on the Earth's surface; and the relevance of place, space and environments for human welfare.

The skills, techniques, and methods in quantitative and qualitative approach to the teaching of Geography is vital in higher institutions for improved academic performance among students (Gomez, 2020). Appreciation of quantitative and qualitative methods does not begin and end with advanced institutions of learning. For this purpose, quantitative methods were defined by Flowerdew, (2022) to broadly mean data collection, analysis and presentation (which includes GIS and Remote Sensing). A better descriptor would be quantitative skills and processes, which Geographers take to include the learning of computer and data handling skills to process, combine, analyse and present data, and also the ability to think critically (not merely negatively) about quantitative approaches - to take informed and professional judgements regarding statistical analysis and modelling. It is this wider view that Geographers have in mind as the target for learning among geography students.

Quantitative Approach to the Teaching of Geography and Environmental Education

According to Cloke, (2024), Quantitative geography is a subfield and methodological approach to geography that develops, tests, and uses scientific, mathematical, and statistical methods to analyze and model geographic phenomena and patterns. It aims to explain and predict the distribution and dynamics of human and physical geography through the collection and analysis of quantifiable data. The approach quantitative geographers take is generally in line with the scientific

method, where a falsifiable hypothesis is generated, and then tested through observational studies (Clope, 2024). This has received criticism, and in recent years, quantitative geography has moved to include systematic model creation and understanding the limits of their models.

This approach is used to study a wide range of topics, including population demographics, urbanization, environmental patterns, and the spatial distribution of economic activity (Delyser, 2020). The methods of quantitative geography are often contrasted by those employed by qualitative geography, which is more focused on observing and recording characteristics of geographic place. However, there is increasing interest in using combinations of both qualitative and quantitative methods through mixed-methods research to better understand and contextualize geographic phenomena.

Quantitative approach in Geographic knowledge refers to the systematic scientific investigation of quantitative properties and phenomena and their relationships, by using statistical methods (Hay, 2023). It includes the analysis of numerical spatial data, the development of spatial theory, the construction and testing of mathematical models of spatial processes. Since the early 1990s the interest in georeferenced data and the need to understand, it has led to an enormous field of spatial analysis. By the late 1990s, the field of spatial analysis had matured to the point where the methods of spatial analysis served as fundamental research techniques in a variety of disciplines, including geography, ecology, environmental studies, epidemiology, regional science, sociology, and urban planning. The quantitative methods of yesteryear have given way to a complex field of spatial analysis that serves as a unifying methodology for social science in general.

Applicable Techniques in Quantitative Geography

The quantitative technique in Geography involves using numerical data, statistical methods, and mathematical models to analyze and understand geographic phenomena, geographical patterns, and relationships. These techniques help geographers to quantify observations, test hypotheses and make predictions about geographical phenomena. Hay, (2023) suggested the various ways it can be applied:

Statistical Analysis: It takes the form of:

- i. **Descriptive Statistics:** It involve using measures such as mean, media, mode and standard deviation to analyze data.
- ii. **Inferential Statistics:** Involves making predictions or inferences about a population based on a sample, using techniques like hypotheses testing and confidence intervals.

Spatial Analysis: According to Cloke (2024), spatial analysis involves using statistical techniques to analyze spatial patterns and relationships in geographic data. It includes:

- i. **Geostatistics** techniques such as kriging to analyze and interpret spatially correlated data.
- ii. **Spatial Autocorrelation** Involves measuring the degree to which a set of spatial features and their values are correlated to each other across space.

Geographic Information Systems (GIS): GIS utilizes software to collect, analyze, and visualize geographic data. It considers:

- i. **Spatial Data Analysis:** Using GIS software to analyze spatial data, including overlay analysis, buffering and spatial querying.
- ii. **Mapping and Visualization:** It implies creating maps that visually represent quantitative data, allowing for easier interpretation of patterns.

Remote Sensing: Remote sensing adopts technologies to collect data on the Earth's surface and analyze environmental changes, without

necessarily coming in contact with objects or phenomena. Cloke, (2024) stated that it adopts techniques as:

- i. **Image Analysis:** Using satellite imagery or aerial photographs to gather quantitative data on land use vegetation cover, and environmental changes.
- ii. **Change Detection:** Analyzing temporal changes in land cover or land use, using quantitative methods.

Statistical Modeling and Simulation: Developing statistical models to understand and predict geographic phenomena. It takes into consideration:

- i. **Regression Analysis:** Hay, (2023) stated that regression analysis explores relationships between variables to predict outcomes (e.g., simple linear or multiple regression to assess factors influencing land use).
- ii. **Spatial Interaction models:** Analyzing flows between locations, such as migration patterns or trade relationships.
- iii. **Time Series Analysis:** It entails examining trends and patterns over time in geographical data, such as climate data or population changes.
- iv. **Multivariate Analysis:** It examines techniques such as cluster analysis and principal component analysis (PCA) to identify patterns and relationship among multiple variables.

Qualitative Approach to the Teaching of Geography and Environmental Education

Cresswell, (2018) opined that Qualitative geography is a subfield and methodological approach to geography focusing on nominal data, descriptive information, and the subjective and interpretive aspects of how humans experience and perceive the world. Often, it is concerned with understanding the lived experiences of individuals and groups and the social, cultural, and political contexts in which those experiences occur. Thus, qualitative geography is traditionally placed under the branch of human geography; however, technical

geographers are increasingly directing their methods toward interpreting, visualizing, and understanding qualitative datasets, and physical geographers employ nominal qualitative data as well as quantitative. Furthermore, there is increased interest in applying approaches and methods that are generally viewed as more qualitative in nature to physical geography, such as in critical physical geography.

While qualitative geography is often viewed as the opposite of quantitative geography, the two sets of techniques are increasingly used to complement each other (Fotheringham, 2015). Qualitative research can be employed in the scientific process to start the observation process, determine variables to include in research, validate results, and contextualize the results of quantitative research through mixed-methods approaches. Pryke (2023) asserted that much of the current qualitative scholarship in geography can be characterized as inductive or descriptive, theory-building work. In understanding human experience, Fisher (2023) reported that qualitative methods aim to be holistic and to articulate actual causes of events or phenomena, thus preserving the context of “data” in collecting and producing evidence. By contrast, quantitative work aims to be deductive or hypothesis-driven, testing data to generalize. But qualitative methods can be designed to test hypotheses, often relying upon approaches of triangulation (correspondence of evidence across contexts or sources) to generalize.

A complaint shared among many social sciences is that qualitative methods are not explicitly taught or well-articulated, compared to quantitative methods. Perhaps, because of geography’s history of “borrowing” methods developed in other disciplines, or because of the complexity of some mixed-method research designs, geographers can be relatively silent about their use of qualitative methods.

But the discipline has contributed to developing these methods in keyways, because of geography's epistemological and ontological commitments to analyze space, place, and scale, and because of its tradition of fieldwork.

During the Age of Exploration and amidst the rise of Enlightenment humanism, early geographers were explorers and natural historians; geography as a discipline evolved in service to the nation-state, cartographically circumscribing territories and describing regions and their resources. Fisher (2023) reported that Geographers articulated a "regional approach" to describe places in the early 20th century, but it was not until the quantitative revolution of the 1960s that geographers more carefully began to articulate qualitative methods in the discipline. "Humanistic" approaches to understanding "sense of place" and "landscape" developed more rigorous methods to analyze qualitative human experience, expanding on a core of fieldwork and interviewing techniques.

The qualitative approach in geography focuses on understanding the meanings, interpretations, and experiences of individuals and groups in relation to geographic phenomena. This approach emphasizes the importance of context, perspective, and narrative in shaping our understanding of the world. According to Shummer-smith (2024), the following are aspects that aid qualitative teaching and research in geography

Interview: An interview is a method of inquiry in which participants are asked a set of questions. It is a face-to-face interpersonal role situation in which one-person (the interviewer) asks another person (the interviewee) questions that are responded to orally (Awotunde and Ugodulunwa, 2014). It can be semi-structured or and structured and can use different mediums (e.g., phone, email, in-person). A semi-structured interview is one in which you have an idea about the types of questions you ask but the order and way you ask the question may vary. A

structured interview is a specified set of questions that is asked in the same order using the same words during each interview.

Focus Group Discussion: This is a method in which a heterogeneous population come together in one room to discuss a certain topic of interest (Shummer-smith, 2024). Typically, a facilitator organizes the focus group and will guide the conversation to keep the topic of conversation on track. The strength of this method is the opportunity for free flow of conversation; comments tend to stimulate new ideas and discussion topics. The challenge associated with this method is that it is possible for a few assertive people to dominate the conversation.

Participant Observation: This refers to when a researcher embeds him- or herself in the research context by becoming an active participant. In this, the observer is part of the setting in which observation is taking place. For example, a nursery schoolteacher who is interested in studying the patterns of interaction among nursery school children, can conduct the study in his/her school using observation as a major technique for data collection. In this case, the teacher is part of the setting in which observation is carried out.

Survey: This method uses a set of written questions that the participants answer directly on paper or online. According Awotunde and Ugodulunwa, (2014), surveys are very much like census. However, the two differ in that a survey examines a sample from a population, while census enumerates an entire population. Contemporary survey research can be said to be a product of American researchers and their development work in some sectors of American society.

Oral history: This is the process of gathering and listening to people tell their stories and share knowledge. It refers to a spoken account of a witness, or a participant in events of potential historical significance. This

evidence can be obtained through a recorded personal interview, which has been recorded when an eyewitness related his/her experience. Ballads, tales, sagas and other forms of oral tradition are also useful in conveying records of events for posterity. According to Shummer-smith (2024), traditionally oral histories were passed down through generations, building the knowledge bases of communities. Oral histories are often recorded so that both the information, as well as the voices and character of the story telling, can be preserved.

Participatory Mapping: Sometimes called sketch mapping, this is asking a set of questions and having the participants draw how they view the world in a map form. It is typically done using a piece of paper but could be done using digital free drawing applications.

Journalism: When a researcher or a participant documents his or her thoughts feelings or ideas on a topic on a regular basis, it is referred to as journaling. Journaling is a free-flow writing exercise.

Content analysis: This method collects content in multimedia formats from the media, policy documents and other outlets and then codes the material for common themes and ideas.

Qualitative Data Analysis: Qualitative data is collected via the methods described above and then is often transcribed and thematically coded. This means a researcher will read the transcript to identify common themes. There are multiple strategies to code qualitative data, either by formulating codes prior to collection it and reading transcripts, or by the researcher identifying common themes that emerge from the data.

Interpretive Analysis: Analyzing texts, images, and other data sources to understand the meanings and interpretations of geographic phenomena.

Case Studies: Conducting in-depth examinations of specific cases or

locations to gain a nuanced understanding of geographic issues.

Ethnographic Research: Using ethnographic methods, such as participant observation and interviews, to study the experiences and perspectives of individuals and groups.

Narrative Analysis: Analyzing stories and narratives to understand how people make sense of their geographic environments.

Implications of Quantitative and Qualitative Approaches to Geography Education

Quantitative and qualitative techniques are applied in various areas of geography and environmental education, including urban planning, environmental studies, transportation, and regional development, allowing geographers to make data driven decisions and policies (Shummer-smith, 2024). These methods enable geographers to provide empirical evidence for their findings and helps to contribute to a more rigorous understanding of spatial phenomena. The integration of qualitative and quantitative approaches in geography and environmental education has several implications:

Enhances Research Skills: Students learn to design and conduct research projects that combine quantitative and qualitative methods. Also, students develop skills in analyzing and interpreting different types of data, including numerical and narrative data.

Stimulates Critical Thinking and Problem-Solving: Students learn to critically evaluate different methodologies and approaches. Similarly, students develop skills in applying different methods to complex geographic problems.

Developing versatile researchers: Educating students in both quantitative and qualitative approaches enables them to tackle a wide range of research questions and problems.

Preparing students for diverse careers: Equipping students with both

quantitative and qualitative skills prepares them for careers in research. Specifically, students are prepared for careers in policy, industry, and community development. Equally, students learn to work across disciplines, combining geography with other fields like environmental science, economics, or sociology.

Quantitative approaches aren't inherently more effective than qualitative approaches; they serve different purposes and offer distinct strengths (Gomez, 2020). Quantitative approach excels at analyzing large datasets, identifying patterns, trends, and correlations through numerical data. It is useful for hypothesis testing, predictive modeling, and generalizability. On the other hand, qualitative approach Provides an in-depth, nuanced insights into complex phenomena through non-numerical data (e.g., text, images, observations). It is useful for exploring contexts, meanings, and experiences. Gomez, (2020) asserted that both approaches can be complementary as they adopt the mixed-methods research, which combines quantitative and qualitative methods to achieve a more comprehensive understanding. Also, they are context-dependent, that is they possess the effectiveness to depend on research questions, objectives, and the nature of the phenomena being studied. Ultimately, the effectiveness of an approach depends on its alignment with research goals and questions.

Conclusion

The study of geography in higher education institutions benefits significantly from both qualitative and quantitative approaches. These two methodologies offer distinct yet complementary perspectives on understanding geographic phenomena. While Quantitative approach provides data-driven insights, objectivity, and predictive power, enabling researchers to analyze spatial patterns, model geographic phenomena, and make informed decisions. Qualitative

Approach on the other hand offers an in-depth understanding, contextualized knowledge, and diverse perspectives, allowing researchers to explore the meanings, interpretations, and experiences of individuals and groups in relation to geographic phenomena. By combining quantitative and qualitative methods, researchers can triangulate findings through the Validation of results by cross-verifying data from different sources and methods. Both students and teachers can gain a more comprehensive understanding through the Integration of numerical data with narrative insights to develop a richer understanding of geographic phenomena. Finally, complex research questions can be addressed through a mixed-methods approach to tackle complex research questions that require both quantitative and qualitative data.

Recommendations

1. Nigerian tertiary institutions should regularly review and update their geography and environmental education curricula to incorporate both quantitative and qualitative approaches, ensuring students are equipped with a comprehensive understanding of environmental issues and research methods.
2. Tertiary institution educators should receive training and capacity building opportunities to enhance their skills in both quantitative and qualitative research methods, enabling them to effectively teach and mentor students in these areas.
3. Geography and environmental education departments should foster interdisciplinary collaboration with other departments, such as environmental science, sociology and economics, to promote a holistic understanding of environmental issues and develop innovative solutions to complex problems.

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