 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

European Scientific Journal, *ESJ*

November 2023

European Scientific Institute, ESI

The content is peer reviewed

ESJ Humanities

November 2023 edition vol. 19, No. 32

ISSN: 1857-7431 (Online)
ISSN: 1857-7881 (Print)

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Generativity is a Core Value of the ESJ: A Decade of Growth

Erik Erikson (1902-1994) was one of the great psychologists of the 20th century[1]. He explored the nature of personal human identity. Originally named Erik Homberger after his adoptive father, Dr. Theodore Homberger, he re-imagined his identity and re-named himself Erik Erikson (literally Erik son of Erik). Ironically, he rejected his adoptive father's wish to become a physician, never obtained a college degree, pursued independent studies under Anna Freud, and then taught at Harvard Medical School after emigrating from Germany to the United States. Erickson visualized human psychosocial development as eight successive life-cycle challenges. Each challenge was framed as a struggle between two outcomes, one desirable and one undesirable. The first two early development challenges were 'trust' versus 'mistrust' followed by 'autonomy' versus 'shame.' Importantly, he held that we face the challenge of **generativity** versus **stagnation in middle life**. This challenge concerns the desire to give back to society and leave a mark on the world. It is about the transition from acquiring and accumulating to providing and mentoring.

Founded in 2010, the European Scientific Journal is just reaching young adulthood. Nonetheless, **generativity** is one of our core values. As a Journal, we reject stagnation and continue to evolve to meet the needs of our contributors, our reviewers, and the academic community. We seek to innovate to meet the challenges of open-access academic publishing. For us,

[1] Hopkins, J. R. (1995). Erik Homburger Erikson (1902–1994). *American Psychologist*, 50(9), 796-797. doi:http://dx.doi.org/10.1037/0003-066X.50.9.796

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

generativity has a special meaning. We acknowledge an obligation to give back to the academic community, which has supported us over the past decade and made our initial growth possible. As part of our commitment to generativity, we are re-doubling our efforts in several key areas. First, we are committed to keeping our article processing fees as low as possible to make the ESJ affordable to scholars from all countries. Second, we remain committed to fair and agile peer review and are making further changes to shorten the time between submission and publication of worthy contributions. Third, we are looking actively at ways to eliminate the article processing charges for scholars coming from low GDP countries through a system of subsidies. Fourth, we are examining ways to create and strengthen partnerships with various academic institutions that will mutually benefit those institutions and the ESJ. Finally, through our commitment to publishing excellence, we reaffirm our membership in an open-access academic publishing community that actively contributes to the vitality of scholarship worldwide.

Sincerely,

Daniel B. Hier, MD

European Scientific Journal (ESJ) Natural/Life/Medical Sciences

Editor in Chief

European Scientific Journal, ESJ
November 2023 edition Vol.19, No.32
ISSN: 1857-7881 (Print) e - ISSN 1857-7431

International Editorial Board

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Table of Contents:

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

ESJ Humanities Peer-reviewed

Exploring How Systemic Racism Affects African American Students' College Choice Decisions: A Comparative Case Study Analysis

Dr. Timothy P. Yancy
Associate Athletic Director, Education Graduate Programs,
Delaware State University, DE, USA

Doi:10.19044/esj.2023.v19n32p1

Submitted: 21 September 2022
Accepted: 14 November 2023
Published: 30 November 2023

Cite As:
Yancy T.P. (2023). *Exploring How Systemic Racism Affects African American Students' College Choice Decisions: A Comparative Case Study Analysis*. European Scientific Journal, ESJ, 19 (32), 1. https://doi.org/10.19044/esj.2023.v19n32p1

Abstract

A lot of attention has been given to the problem of institutionalized racism in academia lately. From a young age, the road to success in school has not always been an easy route for African American students. According to Bottiani, Bradshaw, and Mendelson (2016), students' perceptions of differential treatment, exclusion, and discrimination by teachers and adults in school appear to play a significant role in the poor outcomes among the youth of color. The climate change surrounding racial issues and U.S. economic downturn have had a significant impact on students of color as regards to their commitment to higher education (Karkouti, 2016). This paper attempts to answer the overarching research question such as: How does systemic racism play a role in African American students' college choice decisions? The results from this paper are displayed in critical race theory, as it is a crucial factor in the analysis of choice theory.

Abstract: College Choice Decisions, Systemic Racism, African American Students, Critical Race Theory, Predominantly White Institutions (PWI)

Introduction

In the context of our country's long history of social injustice, the issue of systemic racism in higher education has recently gained a lot of attention. Constantly, African American students have suffered injustice that has reach

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

a tipping point. The call to action for combating systemic racism has sparked a cultural phenomenon that has made inroads in all walks of life. Consequently, this study seek ways to explore, compare, and contrast the factors or reasons linked to the systemic racism that influences African American students' decision-making when deciding to join an institution of higher education.

The African American students' experiences in the U.S. are unique. Most importantly, there are many factors that are beyond students' control that have shaped it, such as historical and economic issues. However, this is a top priority in respect to student's college choice. Historically, the academic journey from early school for African American students has not been straightforward. In schools, African American students are more likely to be labeled mentally challenged or learning disabled and overrepresented in special education programs. In addition, they are less likely to appear in talented or gifted programs such as Honors classes or Advanced Placement courses (Ngozwana, 2012). Furthermore, they are subjected to expulsions and suspensions and the retaining rate is alarming. One out of five African American students received an out-of-school suspension, and they are 3.5 times more likely than their Caucasian peers to be suspended or expelled (Brown, 2014). Consequently, many African American students lack adequate opportunities to develop positive classroom experiences. They are often berated for minor classroom behavioral issues that become magnified by teachers and administrators (Bell, 2015).

Over the years, researchers have identified three major problems that have emanated for African American men before they enter into higher education such as: lack of quality teachers in K-12 education, overrepresentation of African American male students in special education programs, and a lack of African American male students as well as other students of color in advanced placement (A.P.) courses at the secondary education level (Hilton & Ray, 2015). According to Bottiani, Bradshaw, and Mendelson (2016), students' perceptions of differential treatment, exclusion, and discrimination by teachers and other adults in school appear to play a significant role in the poor outcomes among youth of color. However, there are lot of barriers when it comes to admitting more Black students to the nation's selective universities. The climate change surrounding racial issues and the U.S. economic downturn have had a significant impact on the commitment of students of color in respect to higher education (Karkouti, 2016).

Historically, Black Colleges and Universities (HBCUs) have played a significant role in expanding educational opportunities in the United States (Brown II, 2013; Fleming, 1984). This study attempts to answer the overarching research question: How does systemic racism play a role in

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

African American students' college choice decisions and the factors affecting the decision?

Theoretical Framework to Lead this Study

This study is grounded in Critical Race Theory and College Choice/decision theory. The conceptual framework for this study was provided by the Critical Race Theory (CRT). This is because CRT explores and analyzes the experiences of students of color, which can inform cross-cultural inclusivity practices in a number of ways. However, CRT was appropriate for this study because it presents practical techniques that can be used by academic advisors and other higher education administrators when working with students of color. CRT can also serve as a theoretical framework through which a person can understand various ways on advising interactions and practices with students of color in order to offer help or exert harm (Lee, 2018). This study applied CRT because it challenges the status quo and examines racial difrences in myriad contexts, such as the many ideologies and norms embedded in educational institutions (Robertson, 2017). Furthermore, CRT has been used to normalize and analyze racialized experiences in research and practice by challenging traditional paradigms, methods, texts, and discourses on race, gender, and class.

Based on the different models within each of the college choice and decision theories, there is an understanding on why African American students might choose to attend an HBCU or Predominantly White Institutions (PWI). Models by Iloh (2019), Glasser (1984), Hasen and Litten (1989), and Freeman (2005) provide an explanation of college selection and decision-making aspects within each example to support the study objectives.

Methodology

The present study is a non-experimental qualitative comparative case study analysis. This study will use qualitative research, which entails collecting and analyzing non-numerical secondary data, in order to understand concepts, opinions, experiences, and phenomena. The aim is to gain in-depth insights into the problem, answer the research question, or generate new ideas for future research. Qualitative researchers engage in naturalistic inquiry and explore real-world settings by inductively developing rich narrative descriptions of the cases they are investigating. Inductive analysis across case studies yield patterns and themes which is the fruit of qualitative research (Austin & Sutton, 2014). The purpose of this study is to analyze data for insights within, across, and between cases (Yin, 2005; Creswell, 2013). Therefore, this comparative case study design involves comparing, contrasting, analyzing, and synthesizing the similarities, differences, and patterns across three selected case studies that share a common focus, goal, or

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

phenomenon. This study also used secondary data sources from all three cases, which includes documentation, archival records, interviews, physical artifacts, direct observations, and participant observation. The researcher has collected and integrated data within the case study research, which is unique to other qualitative approaches. This has help in facilitating a holistic understanding of the phenomenon being studied.

Data Collection

This qualitative research is designed to reveal the meaning that informs the action, practices, or outcomes using rigorous and systematic transcribing, coding, comparing, analyzing, and interpreting the trends and themes with a focus on retaining the true meaning. However, such research is used to understand how people experience the world. Qualitative researchers often consider themselves "instruments" in research because all observations, interpretations, and analysis are filtered through their own personal lens (Bhandari, 2020). This case study analysis involves intensive analysis of the following three selected case studies to understand and gain an in-depth holistic view of the research problem.

i. Mack Hah-neef (2020): Deciding while black: Perceptions of racial climate and the factors that influence African American students' college choice,
ii. Mitchell Candis (2018): The Effects of Type of Institution (HBCU vs. PWI) and Acculturation Level on Minority Status Stress, Perceived Faculty Support, Persistent Attitudes, and Perception of the University Environment, and
iii. Alexander Juan (2017): Key factors that influence first-generation college students to attend a historically black college and university.

Consequently, these three research studies, conducted within ten years, were selected through extensive database searches using specific words. The titles and research questions from the selected case studies were extracted and compared using a color-coding method to show internal consistency.

Data Analysis Procedure

The researcher extracted the relevant data from the selected case studies and utilized this data for secondary data analysis. The selected case studies were semantically coded to assess their inter-relatedness, understand the text data, label the emerging sections with codes, examine the codes for similarities, and then combine the codes into broad themes. To initiate the data analysis, the following preliminary themes were developed: Student, College, University, African American, Black, Racism, and Identity.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

The selected studies were uploaded to ATLAS ti9 to arrange and code the major themes. A word cloud was assembled by ordering the importance of the phrases from all three case studies. Next, a hierarchical network was constructed where the coding revealed an emerging themes. Furthermore, the codes were arranged into themes or categories to create a database of topics that were widely discussed in the case studies (Creswell, 2008, p. 252). This process give room for the researcher to observe the density, comprehend in-depth understanding to answer the research questions, and ensure the credibility of the data analysis. Subsequently, themes were developed by utilizing the six-step processes suggested by Caulfield (2019).

Results

Findings on Theme One: Systemic Racism in Higher Education

In analyzing the three case studies, the first theme that emerged was Systemic Racism in Higher Education. In Case Studies 1 and 2, the findings of these research studies displayed an acknowledgment of racism as a factor in African American students choosing to attend an HBCU or a PWI.

Findings on Theme Two: African American Students Decision Making

In Case Studies 1 and 3, the process of choosing a college to attend was another theme that emerged. The decision-making factors of African American students are prominent themes in each case study. In this theme, three small sub-themes have been discovered: college choice and decision factors, reasons for choosing HBCUs, and reasons for choosing PWIs.

Findings on Theme Three: Experiences of African American Students in HBCUs and PWIs

In study 1, recent high school graduates from HBCU and PWI-bound have a high expectations of college life that are typical of experiences that will duplicate high school in a larger community. In study 2, the students at the historically black colleges and universities (HBCUs) reported a better psychological and functional faculty support levels than their PWI counterparts.

Findings on Theme Four: Minority Students' Stress and Anxiety in HBCUs and PWIs

In case study 2, the report from African American students at PWIs were more stress related and exposure to racial discrimination are being underrepresented on these campuses. As codes emerged, the researcher could see linkages between the factors influencing college choice and the selected theoretical frameworks of college choice decision and critical race theory. In this study, CRT was used in analyzing how race and privilege play a major role in society and also how it plays a role in higher education specifically. In

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

this study, college choice and decision theories were used. In addition, several college choice and decision theories were used to analyze how college students think and arrive at their decisions to attend a college or university.

However, the findings in case study 1 helped the researcher to connect the case findings to other cases utilized in this study. In case study 1, the theme of systemic racism in higher education was also discovered. This is connected to the findings and other themes from other case studies. In case 1, "African American students use racial climate and the significant presence of a diverse or same-race student body to validate their final selection" (Hah-neef, 2020, p. 43).

In case study 2, there were discussions about how African American students have more positive perceptions at an HBCU and also how the experiences of black students at PWIs were negative. These findings have helped in discovering minority students' stress and anxiety at HBCUs and PWIs, as a key theme emerging from the analysis of case study 2. African American students on an HBCU campus would report lower minority status stress levels than their counterparts on a PWI campus. Collectively, the current analysis suggests that institutional racism affects African American students' college choices.

Conclusion

While answering the research question, the findings of this study have revealed that the role that systemic racism plays in college choice decisions of African American students is displayed in critical race theory. This is because it is a crucial factor in the analysis of choice theory. In the context of systemic racism, the critical race theoretical lens that affects the college choice decisions of African American students shows that race is an embedded factor in college choice decisions because of a deeply rooted and racist normalized traditions. The cross-analysis of the studies confirms that African American students use racial climate and the significant presence of a diverse or same-race student body to validate their final selection (Hah-neef, 2020).

This research confirms that racism and many other factors play a crucial role in the college choice decisions of African American students in attending predominately white institutions of higher education. It is apparent from this study's findings to note that racism is an issue for African Americans in their college choice decisions.

Consequently, the students' decision-making for higher studies or deciding on their careers is a complex process. However, there is still much to learn about how African American students choose a college education for themselves. It is instructive to engage in a racial analysis of the access and choice processes to better understand the oppressive structures encountered by college-bound African American students. Contrarily, the college enrollment

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

decision-making process for students can, on the surface, appear fair and inclusive across racial lines, although this is not the case (Comeaux, Chapman & Contreras, 2020).

Conflict of Interest: The author reported no conflict of interest.

Data Availability: All of the data are included in the content of the paper.

Funding Statement: The author did not obtain any funding for this research.

References:

1. Alexander, J. M. (2017). *Key factors that influence first-generation college students to attend a Historically Black College and University*. Doctoral dissertation, Creighton University.
2. Austin, Z. & Sutton, J. (2014). Qualitative research: getting started. *Can J Hosp Pharm*. 67(6):436–40.
3. Bhandari, P. (2020). *An introduction to qualitative research*. Retrieved from https://www.scribbr.com/methodology/qualitative-research/
4. Bottiani, J. H., Bradshaw, C. P., & Mendelson, T. (2016). Inequality in Black and White high school students' perceptions of school support: An examination of race in context. *Journal of Youth and Adolescence*, 45(6), 1176-1192. doi:10.1007/s10964-015-0411-0
5. Bell, D. (1992). *Faces at the bottom of the well*. New York: Basic.
6. Brown, K. D. (2014). Teaching in color: A critical race theory in education analysis of the literature on preservice teachers of color and teacher education in the U.S. *Race Ethnicity and Education*, 17(3), 326-345.
7. Brown II, M. C. (2013). The declining significance of historically black colleges and universities: Relevance, reputation, and reality in Obamamerica. *Journal of Negro Education, 82*(1), 3–19. http://dx.doi.org/10.7709/jnegroeducation.82.1.0003
8. Caulfield, J. (2019). *How to do thematic analysis*. Retrieved from https://www.scribbr.com/methodology/thematic-analysis/#:~:text=Thematic%20analysis%20is%20a%20method,meaning%20that%20come%20up%20repeatedly.nChicago Press.
9. Comeaux, E., Chapman, T. K., & Contreras, F. (2020). The college access and choice processes of high-achieving African American students: A critical race theory analysis. *American Educational Research Journal, 57*(1), 411–439. https://doi.org/10.3102/0002831219853223.
10. Creswell, J. W. (2008). Research Design: Qualitative, Quantitative, and Mixed-Method Approaches. London, Sage Publications

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

11. Creswell, J. W. (2013). *Qualitative inquiry & research design: Choosing among five approaches* (3rd ed.). SAGE Publications.
12. Freeman, K. (2005). *African Americans and college choice: The influence of family and school.* Albany, NY: State University of New York Press.
13. Glasser, W. (1984). *Control theory: A new explanation of how we control our lives*. New York: Harper Row
14. Hah-neef, M. M. (2020). *Deciding While Black: Perceptions of Racial Climate and the Factors That Influence African American Students' College Choice* (Doctoral dissertation, New York University).
15. Hanson, K. & Litten, L. (1989). Mapping the road to academia: A review of research on women, men and college selection process. In N P. Perun (Ed.), *The undergraduate woman: Issues in education,* 73-98. Lexington, MA: Lexington Books.
16. Hilton, A.A. & Ray, C.A. (2015). Black male collegians: Increasing access, retention, and persistence in higher education. *Journal of College Student Development*, 56(4), 414-416.
17. Iloh, C. (2019). An Alternative to College "Choice" Models and Frameworks: The Iloh Model of College-Going Decisions and Trajectories. *College and University*, 94(4), 2–9.
18. Lee, J.A. (2018). Affirmation, support, and advocacy: Critical race theory and academic advising. *NACADA Journal, 38*(1). 77-87. doi.org/10.12930/NACADA-17-028
19. Karkouti, I. H. (2016). Black students' educational experiences in predominantly white universities: A review of the related literature. *College Student Journal*, 50(1), 5970.
20. Mitchell, C. R. (2018). *The effects of type of institution (HBCU vs. PWI) and acculturation level on minority status stress, perceived faculty support, persistent attitudes, and perception of the university environment.* Doctoral dissertation, University of La Verne.
21. Ngozwana, N. (2018). Ethical dilemmas in qualitative research methodology: Researcher's reflections. *International Journal of Educational Methodology,* 4(1). 19-28.
22. Robertson, R.V. (2017). I know it [racism] still exists here: African American males at a Predominantly White Institution. *Humboldt Journal of Social Relations, (39)*
23. Yin, R. K. (2014). *Case Study Research Design and Methods* (5th ed.). Thousand Oaks, CA: Sage Publications.

ESJ Humanities Peer-reviewed

Recent Issues and Problems in Bangladesh-India Relations: A Bangladeshi Perspective

Md. Ershadul Huq
University of Chittagong, Bangladesh

Doi:10.19044/esj.2023.v19n32p9

Submitted: 15 September 2023
Accepted: 09 November 2023
Published: 30 November 2023

Cite As:
Huq M. E. (2023). *Recent Issues and Problems in Bangladesh-India Relations:A Bangladeshi Perspective*. European Scientific Journal, ESJ, 19 (32), 9.
https://doi.org/10.19044/esj.2023.v19n32p9

Abstract

The relationship between India and Bangladesh has steadily grown in recent years, particularly after Bangladesh Prime Minister Sheikh Hasina took office in January 2009. Indian Prime Minister Narendra Modi praised the relationship as a "golden period" in 2019. Indeed, Bangladesh is crucial to India's "Neighborhood First" and "Act East" policies and has played a critical role in sustaining peace and security in the country's Northeast region. However, despite their mutual goodwill, there is some pessimism regarding the relationship's future. This article examines the historical evolution of India-Bangladesh relations, the diverse perspectives on the relationship (Economic et al.), Bangladesh's significance to India, and the issues that threaten to cloud India-Bangladesh ties. Through this research, we can easily see the recent India-Bangladesh relations, whether it moves steadily or not. We can also discover the problematic issues that still exist and cause mistrust between both countries. Finally, give a precise scenario for the country's policymakers that this tie is essential for both countries and should be stronger only when policymakers give more importance and resolve these problems as soon as possible.

Keywords: Bangladesh; India; Economic Relations; Defense Relations; Geo-Strategic; Security; Significance; Diverse Perspectives; Threaten Issues; Relationship

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Introduction

It is often experienced that there remain troubled relations between neighboring countries due to conflict and disputes surrounding various issues. However, Bangladesh-India bilateral relations are exceptions and are regarded as a role model in the world regarding relations among neighboring countries. Though the relationship has been carried over the years with varying degrees of congeniality, no one can deny the significance of this bondage in the larger South Asian context. These two neighboring states are not only bonded by the similarity of history, socio-cultural heritage, and land border but also by India's historic role in the liberation war of 1971 when Bangladesh waged a nine-month-long war against Pakistan. So, Bangladesh and India, two neighboring states, have become connected as historic allies not only by the centuries of shared history, society, politics, culture, and religion but also by the liberation war of 1971(Singh, 2013). Over the past few years, the upward trajectory of cooperation between the two countries on various aspects has gathered momentum. The year 2021 has marked 50 years of Bangladesh-India relations, which many lauded as a 'precious achievement'. However, issues such as border killing, water sharing of the Transboundary Rivers, illegal migration, etc. occasionally cause irritations. Though agreements on 'zero border killing' between two countries have been reached recently, the lack of realization of this is creating frustration. The water-sharing issue of Transboundary Rivers is another irritant to the Bangladesh-India bilateral relations as India has aborted to comply and ensuring fair share to Bangladesh due to the continuous dispute between the central government and the provincial government of West Bengal. Another matter of concern for Bangladesh is the 'Citizenship Amendment Act (CAA)', enacted in 2019. This Act was criticized worldwide due to its classification of citizens based on religion. With such an act in action, almost two million migrants, the majority of whom were Muslims, have been precluded from the National Register of Citizens (NRC) in Assam. There is a concern that they may flee illegally to Bangladesh as they are worried about being sent to detention camps otherwise. In addition to these, the Latest matter of controversy in Bangladesh-India relations arose due to India's lack of stance on the cause of Bangladesh's interests in the Rohingya issue (Yasmin, 2021).

Methodology

For social science research, there are many approaches available. This research primarily relies on scholarly views and Writings since its goal is to explain the historical evaluation of India-Bangladesh relations, the diverse perspectives on the relationship (Economic et al.), Bangladesh's significance to India, and the issues that threaten to cloud India-Bangladesh ties. Both countries would carefully resolve the problematic issues and foster the relationship more

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

strongly, and policymakers of both countries would carefully deal with these. This study gathers secondary data using the qualitative method. Secondary data are collected by studying relevant journals, newspapers, and online articles.

Historical Evolution of Bangladesh-India Relations

The two neighboring countries of South Asia, Bangladesh and India, have been historically enjoying close relations since the Independence of Bangladesh in 1971, except for a few years of anomalies. When the people of East Pakistan fought in the war of independence against the West Pakistani military rule under the leadership of Bangabandhu Sheikh Mujibur Rahman, India's assistance and humanitarian support were unparalleled. Due to geographical contiguity, Bangladesh was left with no choice but to accept favor and support from India. From India's perspective, helping Bangladesh to liberate could be seen as both an act of good neighborliness and an opportunity to reflect the principles of Gandhian and Nehruvian philosophies (Yasmin, 2021). The history of Bangladesh-India relations can be broadly divided into three phases, namely the first phase under the first civilian regime led by Bangabandhu Sheikh Mujib (Period between 1972 and 1975), the second phase under military dictators (Period between 1975 and 1990) and third phase (Period from Post 1990 till present). The first civilian government of Bangladesh under Bangabandhu Sheikh Mujibur Rahman maintained profound friendship and cooperation with India, which was delineated as a 'honeymoon' period. During the period between 1972 and 1975, India agreed to withdraw military troops in response to Sheikh Mujib's request; two neighboring states signed a treaty named 'Treaty of Friendship, Cooperation and Peace' on 19 March 1972 and Land Border Agreement (LBA) in 1974(Chowdhury, 2020). The second phase began with the fall of the Mujib regime by a brutal military coup on 15 August 1975 that saw the assassination of the Father of the Nation along with his family members. The post-Sheikh Mujib era began with the rise of General Ziaur Rahman, a decorated hero of the liberation war. His foreign policy emphasized building relations with China and Western and Islamic countries. Bangladesh-India relations during his regime were marked by mistrust, suspicion, and hostility. General Ershad, the successor of General Zia, also adopted a similar policy toward maintaining relations with India as his government projected India as an imperialistic and opportunistic regional hegemon (Karim, 2020). The third phase began with the ousting of Military dictator General Ershad and the revival of democracy in December 1990. After the revival of democracy, Begum Khaleda Zia-led BNP, a democratic party, was in power between 1991 and 1996. However, the relations between India and Bangladesh did not improve during this period. However, relations improved dramatically when the Awami League under Sheikh Hasina returned to power in 1996. The signing of the Ganges water-sharing Treaty reflected

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

such tremendous improvement in bilateral relations between 1996 and 2001. The relations aggravated to their lowest ebb when the BNP came to power and held the state power between 2001 and 2006. With the election of 2008, the Awami League under Sheikh Hasina again assumed office when India–Bangladesh ties gained new momentum (Quader, 2019). The bilateral relations between Bangladesh and India marked a 50th anniversary recently project a noticeable pattern of fluctuation as the relations improve when the Awami League government assumes office and ties deteriorate when a non-Awami League government holds power (Chowdhury, 2020).

India-Bangladesh Relations' Recent Developments

Bangladesh-India bilateral relations have been shaped not only by century-old historical, geographical, cultural, social, and economic ties but also by the pivotal role played by India in the birth of Bangladesh. Contemporary issues, problems, cooperation, and developments of the relations between two neighboring countries can be classified into three significant aspects, namely Military, Economic, and Geostrategic aspects, and they are elaborated below:

Defense

Cooperation in the area of defense can be traced back to the birth of Bangladesh in 1971. The Indian military forces trained, collaborated, and led Bangladeshi freedom fighters in the Liberation War to give birth to a sovereign state of Bangladesh. However, the military and defense cooperation between Bangladesh and India was neglected for a long time. India and Bangladesh have been sharing a warm relationship since the Awami League captured the state power in the election of 2008. Since then, both countries have cooperated in various economic, social, scientific, and technological areas. In 2017, the two countries states signed several agreements and Memorandum of Understanding (MoUs) in defense cooperation. Among these MoUs, an agreement on extending a line of credit worth US$500 million to purchase defense equipment is worth mentionable. Regular mutual visits by the Presidents and armed forces leaders have also become routine matters between the two countries. Besides, joint exercises, medical assistance, and training programs are held by the participation of the defense services of both countries (Bhattacharjee, 2018). In January 2021, 122 members of the Bangladesh Armed Forces participated in India's Republic Day parade (Basu, 2021). India also showed similar endeavors as military contingents from India joined the parade of the Victory Day ceremony alongside the country's forces on 16 December 2021 (BSS, 2021). However, due to the China factor, there is also a matter of apprehension regarding the India–Bangladesh defense partnership. China, being the most significant arms provider of Bangladesh and the latest

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

procurement of two submarines by Bangladesh from China, has become a matter of concern for India (Bhattacharjee, 2018).

Economic

The economic aspect of Bangladesh-India bilateral relations includes Industrial and trade relations between the neighboring countries. Top industrialists from India, like Tatas and Adanis, have set up their network in Bangladesh as the manufacturing units of the above Indian industrial groups have been set up at Sonargaon, Dhaka. Regarding trade, bilateral economic relations possess unexplored possibilities, with a prospect of USD 16.4 billion in bilateral trade. Bangladesh is the biggest trading partner of India in South Asia, whereas India is Bangladesh's second biggest trading partner. However, the main problem lies in the massive trade imbalance between the two countries. Though the volume of trade reached the landmark of USD 10 billion in FY 2019-20, trade imbalance was predominant in the trade exchange. The trade ratio was 1:8, where Bangladesh exported USD 1.26 billion and imported USD 8.2 billion (Shazzad, 2021). Such imbalance in bilateral trade has become a matter of Political discontentment in Bangladesh. Besides, such deficit in bilateral trade has been magnified by the Informal and unrecorded trade that occurs through unguarded land borders between the two countries since the birth of Bangladesh (Dutta, 2010). The experts advocate that a Comprehensive Economic Partnership Agreement (CEPA) between these countries can devise a level playing field for Bangladesh and unleash the full potential of economic engagement. It is hoped that both countries will begin negotiations for signing a Comprehensive Economic Partnership Agreement (CEPA) with India in 2022 to realize such potential. If agreed successfully, the CEPA would cover various issues and address trade, investment, and government procurement impediments (Mirdha, 2021).

Geostrategic and Security

From a geostrategic perspective, Bangladesh’s foreign policy is momentous to India as India surrounds it from three sides and shares most of its border with India. Similarly, India wants to fulfill its dream of becoming a "regional hegemon, " which requires Bangladesh’s unwavering support. So, both the neighboring countries are in dire need of each other in their journey. Two neighboring states share a 4,096km border, the longest that India shares with any of its neighbors. Since 2008, bilateral relations have been experiencing an upward trend. The resolution of the maritime boundary dispute 2014 brought new promise of geostrategic cooperation between the two countries as India gave up approximately 19,467 sq. km in the Bay of Bengal without any further challenge. They sorted out their land conflict the following year by implementing the Land Border Agreement (LBA) in June

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

2015 (Mahajan, 2021). The two countries first signed a transit agreement to enhance connectivity in 2010. The two neighboring governments also agreed on a protocol allowing India to wield four riverways through Bangladesh to connect Kolkata and Murshidabad to Assam, Tripura, and Meghalaya in 2015. In 2015, India signed a memorandum of understanding (MoU) for using Chattogram and Mongla ports after years of demand. Within a few years, it turned into an agreement (Byron and Palma; Daily Star, 2019). Besides, Bangladesh has become the most crucial partner in India's strategic calculations. It provides a route for connecting Northeastern Indian states to its mainland and helps curb insurgencies in these states.

India's Interest in Bangladesh

The relations between Bangladesh and India are based on neighborhood, trustworthiness, and strategic importance, which no party can ignore in this changing geopolitical landscape of South Asia. There exist reasons for the primacy of Bangladesh in India's geopolitical and strategic calculus. Firstly, the unique position of Bangladesh in the eastern part of South Asia provides it the opportunity to play a leading role in connecting South Asian states such as Bhutan, India, and Nepal with the ASEAN and other countries of East Asia (Chaudhury, 2018). Secondly, Bangladesh can also play a significant collaborative role in providing the security of the northeastern states and eastern India. If Bangladesh does not agree to cooperate with India, it is almost difficult for India to curb insurgencies from these parts. In addition, integrating those states with the heartland is challenging to manage if India does not access the northeast through Bangladesh. Thirdly, Trade counts for economic growth in a globalizing world. Bangladesh is crucial for India because it is one of India's biggest trading partners. Fourthly, Bangladesh enjoys much greater attention because the neighboring countries share more than 40 rivers. Bangladesh is a lower riparian state, so it does not get its fair share of water from these rivers. However, the failure of India to behave sensibly in sharing river water justly with Bangladesh will be catastrophic not only for Bangladesh but also for the Northeast, West Bengal, and further away states of India. Finally, it is stable, tolerant, and progressive. Bangladesh is a must for India to curb terrorism, insurgency, and other forms of transnational crimes (Bajpai, 2011).

Conflicts between Bangladesh and India, both current and recent

Farakkha Matter

Water conflicts for the Farakkha and Teesta barrages are projected to receive the same priority as the trade imbalance. Bangladesh recognized a water conflict along the Farakkha when India began operations in 1975. In 1972, Bangladesh and India formed a joint river commission (JRC) to share

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Ganga's water for flood management, river system improvement, and cultivation. A preliminary arrangement was agreed for 41 days from 21st April to 31st May to transfer 11,000 to 16,000 cubic water meters. However, India continued to withdraw water even after 31st May without respecting the agreement (Rahman, 2004). Some people also claimed that the Farakkha barrage started working without mutual understanding, so it became the core of the disputes between the two countries. With the improvement of the bilateral discussion between the countries, the engagement between India and Bangladesh kept worsening, and the unanticipated murder of Bangabandhu Sheikh Mujib generated an explosion in Delhi. India continued to extract water from the Ganga despite the sincere attempt made by the BD. In the meantime, significant political changes have occurred both in India and Bangladesh, creating a new shape in the mutual relations between the countries. After that, the Ganga treaty was agreed on 12th December 1996. Regarding the treaty, Bangladesh receives 35,000 cusecs of water, and the remaining would go to India if the water flow is 75,000 cusecs or more excellent. In alternate 10-day periods between 11th March and 10th May, every country would get 35,000 cusecs water (HOSSAIN, 2016). India, however, did not comply with the arrangement. It has been seen that water flow in a critical situation benefited India the most. As explained by the requirement by both countries, India had better sort out the issue of sharing an equal quantity of water due to sincerity (Anuttama, 2021).

Teesta Barrage Disputes

India began to extract water by building a barrage across the river at Gozoldoba. In the dry season, water flow to Bangladesh was reduced to 2020 cusecs from 5,000 cusecs on the 28th of February 2005. Bangladesh acquired only 1400 cusecs water (Hossain, 2016). Because of this reduced water flow, the cultivation program of Bangladesh hurt majorly around the Teesta barrage. Bangladesh has uplifted the matter in several joint river commission meetings, and all the efforts went into the vein. To keep the river in good shape, the specialist suggested keeping 20 to 30 percent of Teesta water stored in the lean period and giving the remaining part as per the magnitude of the river catchment region. Both countries decided in 2013 to negotiate an arrangement to make BD easier with the Teesta water. Mamata Banerjee, chief minister of West Bengal, visited Bangladesh and discussed the issue with the Bangladeshi PM. However, Mamata rejected the proposal as the central government of India did not discuss the Teesta water matter with Mamata before it was agreed with BD (Saghal, 2011). Because of this fact, the proposal could not be implemented. PMs of both countries sat together again and solved the matter after the government of India was changed in 2015. After settling the issue, Mamata consented to share logical water-sharing agreements with the Indian

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

central government while accompanying Indian Prime Minister Narendra Modi to Bangladesh. However, it still is a matter of concern for both countries. Bangladesh was obliged to seek support from China as India has not sorted out the Teesta issue. India has enough time to solve the matter so that Bangladesh does not need assistance from China. India's weak relationship with the adjacent countries may have pressed Bangladesh toward Beijing, and many Bangladeshi specialists predicted that. The Teesta issue must be sorted out for the integrated relationship between Bangladesh and India and long-lasting interest as soon as possible (Joya, 2020).

Trade Imbalance

The trade deficit is the most crucial among the existing challenges in India-Bangladesh relations. It is now a shared realization that the imbalance does not favor the interest of either partner. Since 1972, many agreements have been signed between the two neighboring countries to lessen the inequality in bilateral trade. The first one-year trade agreement between the two countries came on 28 March 1972 in the "Treaty of Friendship, Cooperation and Peace." In March 1973, Bangladesh's export to India was 14 million dollars, whereas India's export to Bangladesh was 18.5 million dollars (Madaan, 1996). In July 1973, the two countries signed another "Balance Trade and Payment Agreement (BTPA)" agreement to regulate bilateral trade relations for three years. However, this agreement failed to bring the desired result in bilateral trade, as the imbalance recorded at the end of the year was 8.18 million dollars (Saber, 2008). In the post-Mujib era, after the brutal assassination of Sheikh Mujib in August 1975, the relations between the two countries became troublesome as both countries started keeping their distance from each other. To add more woes, the Bangladesh government began to lean toward China, the Western world, and Muslim countries regarding military and economic ties. Besides the burgeoning trade deficit, restrictions such as tariff and non-tariff barriers impeded the entrance of Bangladesh goods into the Indian market. For example, the tariff duty on consumer goods in Bangladesh was 23%, whereas the for the same products was 30-55% in India (Saber, 2008). So, the Bangladeshi goods had to face massive impediments to compete with the local interests of India, and thus, bilateral trade relations between the two countries suffered the most. However, the links started improving after the Awami League under Prime Minister Sheikh Hasina occupied the office in 1996. However, it did not last long as the Bangladesh National Party (BNP) returned to power in the 2001 election (Lailufar, 2005). However, the bilateral ties experienced an upward trend when Sheikh Hasina took over as the PM after the December 2008 election. However, the trade deficit has remained a burning question for the relationship.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Border Killing

The Bangladesh-India border has been designated a "killing border" and the world's deadliest boundary (Percot,2020). Since the onset of 2000, human rights violations have been a significant concern on the Bangladesh-India borderlands. India implemented a 'shoot-to-kill' policy towards undocumented Bengali immigrants. According to statistics, between 2000 and 2020, 1230 Bangladeshi people were shot to death near the Bangladesh-India border (Van, 2005). It expresses worries that border guards on the India-Bangladesh border are the most aggressive border force (Odhikar, 2021). After demonstrating the number of killings, has it benefited India's historical bonds with Bangladesh? This has harmed the bilateral relationship and increased skepticism of India among top officials and the general public. Even though both nations' border officials met and held many talks, the outcome remains pitiful, causing pain to the people of Bangladesh and raising the question of whether India is a modest ally or adversary. Taking it seriously, the Indian government should have created an efficient program to reduce the killing as soon as possible; otherwise, the decade-old ties would be irreversibly damaged.

Rohingya Issue

More than a million Rohingya people have taken shelter in the crowded camps of Bangladesh since 2017 (Indrajit, 2021). However, according to sources, these Rohingya refugees live in degrading conditions of sordid camps and engage in crimes such as human and drug trafficking (Nayarima, 2019). Besides, conflicts among the groups are causing concern, making the law-and-order situation in Cox's Bazar region worse (Indrajit, 2021). So, the Prime Minister of Bangladesh, Sheikh Hasina, rightly expressed her concern regarding the security threats in Bangladesh. As a reliable ally of India in South Asia, Bangladesh desired India's support in the issue of the Rohingya refugees' repatriation to Myanmar. However, there is continued suspicion about India's role in Bangladesh, as there is a widespread perception that India's assistance to Bangladesh in dealing with the crisis has been insufficient.

Perceptions of Indian Political Elites Cause Mistrust

Political Elite's speeches about Bangladesh sometimes have a negative impression of India and challenge its friendly nature towards Bangladesh. According to a press briefing, BJP General Secretary Amit Shah described Bangladesh as a country of ‘millions of poverties.’ However, knowing the fact that Bangladesh is a faster economic growing country in South Asia. In a recent election campaign in the West Bengal and Assam Border states, Prime Minister Narendra Modi and other senior BJP leaders have often raised the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

issue of alleged unauthorized immigration from Bangladesh. In a 2019 election rally, Amit Shah described illegal immigrants as "Termites," adding that the BJP government would pick up infiltrators one by one and throw them into the "Bay of Bengal." These comments drew sharp criticism from rights groups and triggered anger in Bangladesh. These types of perceptions by the Indian political Elites have resulted in deteriorating Bangladesh-India relations. In July 2020, former senior Indian Diplomat Pinak Rajan Chakravarty wrote an op-ed in the New Indian Express titled, "Bangladesh too on the Chinese radar." Consequently, the Hindustan Times, in its editorial focus on Bangladesh, "Warred that India was losing a friendly neighbor through wrongheaded policies." These perceptions may cause mistrust. Indian elites should abstain from misconception and refrain from spreading hype. Instead, thus, should be optimistic about fostering India-Bangladesh ties properly value Bangladesh and its importance: India should also understand that "Bangladesh should have an independent policy so that it can deal with India, China, America, and other countries separately if India failed to realize that then it may lose Bangladesh's close ties recent time in 2021. The anger over Prime Minister Modi's visit is, therefore, "Clear warning to Delhi if the sensibilities of its neighbor are not addressed. India may end up being friends only with the government in Dhaka and not with the people of Bangladesh.

Unkempt Promises:

Unkempt promises are a common phenomenon in Bangladesh-India bilateral ties, and it has been occurring as a decade-old legacy. Many disputed issues have been unsolved, including Teesta River Water sharing, still deteriorating the ties. For instance, In September 2020, Bangladesh requested that India reinstate onion exports to the countries New Delhi had suspended unexpectedly. India is Bangladesh's largest onion supplier, with an annual average purchase of over 35,000 tons. Following the export prohibition, onion prices in Bangladesh increased by more than 50%, causing the government to source supplies elsewhere and subsidize onions. As a result, while India has historically had a positive relationship with Bangladesh, it has squandered numerous opportunities to strengthen it. At the start of 2021, a dispute occurred over the vaccine supply created by Oxford University and Astra Zeneca, which Manufactures the vaccine in collaboration with India's Pune-based serum institute. SII CEO Adar Poonawalla stated that India has prohibited serum from selling doses on the private market until the vaccine has been provided to everyone in the country. The announcement sparked a frenzy in Bangladesh, which signed a deal with India to acquire 30 million vaccine doses. However, many Bangladeshis interpreted the comments to mean India abandoned its commitments under the agreement. Although Poorawalla and the Bangladesh Foreign Minister later affirmed that

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Bangladesh was on track to receive the vaccine, the statement sowed distrust among the Bangladeshi people. Some took to social media to brand India as an untrustworthy neighbor. Although several Indian scholars recognized Bangladesh's significance for India, journalist Shekhar Gupta asserted, "Bangladesh is India's most benevolent neighbor." However, as a result of much of India's Mainstream media's failure to recognize and appreciate the significance of its relationship with Bangladesh, India has adopted policies that are isolating its 'most crucial friend, Bangladesh.'

External Influences

Throughout the nation. The prolonged enmity between New Delhi and Dhaka will be China's most significant advantage, increasing Bangladesh's political and economic sway. Bangladesh's geographic position has made it advantageous for China as a developing nation looking for foreign investment (Shikha, 2014). Numerous experts from both countries still doubt Bangladesh's relationship with India. The relationship between the two countries is severely strained as a result of a multitude of unresolved issues, and the resulting mistrust has created a space for countries like China to intervene in Bangladesh to win over the people and come to a resolution because Bangladesh is strategically situated for both India and China, its main rival. This has led to a quiet tug-of-war between Beijing and New Delhi over Dhaka to tighten their grip. Bangladesh and China have also had a long-standing relationship. Bangladesh's primary trading partner now is China, with whom the country has had ties for centuries. The staggering amount offered to Bangladesh by a foreign country has been calculated at 38 billion US dollars for Chinese investment in Bangladesh (Bhattacharya, 2019). This includes various infrastructure projects to strengthen economic ties between Bangladesh and China. Currently under development is the $1.65 billion Payra Coal Power Plant. China's 25% stake in the Dhaka stock exchange is one of many Chinese instruments still in the planning stages and awaiting formal clearance (Bhattacharya, 2018). China has also given Bangladesh significant help in the domain of defense. Bangladesh was South Asia's second-largest importer of Chinese arms after Pakistan. According to a 2020 Stockholm International Peace Study Institute study, Bangladesh is China's second-largest military equipment buyer. One-fifth of China's military shipments are transported through Dhaka (Pieter, 2021). Regarding China's investments in Bangladesh's naval defense, India has expressed worry. Especially in light of Bangladesh purchasing a type 035 submarine from China for an astronomically low price. 2019 (The Daily Tribune). According to several South Asian analysts, this military cooperation "would give China a strategic foothold on India's Eastern Land in Bangladesh" (Kondapalli, 2002). Due to this, India is now more cognizant of China's position in what some regard as

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

its doorstep. Beijing has a lot more money than Delhi to provide to its neighbors. Due to China's significant investments, several nations have changed their loyalty to China (Niaz, 2005). Meanwhile, experts disagree on whether India's neighbors are a reason for concern. India is not interested in settling the current problems, which allows China to approach Bangladesh and other South Asian Indian neighbors. Growing connections between China and Bangladesh have frequently angered India. They have little choice but to circumnavigate the geopolitical landscape of Southeast Asia cautiously, as rising demand for Bangladesh could push it into China's hands. India's "neighborhood first" policy will suffer significantly (Subir, 2017). Let us say India continues to be ignorant of this complex issue. If that occurs, China will replace Pakistan as Bangladesh's closest friend, raising security questions for India and thwarting its long-held ambition to become an Asian superpower (Sakhuja, 2009). Subir Bhowmik, editor-in-chief of the Eastern Link News Site, believes Dhaka may have turned to Beijing because of India's tense relations with its neighbors.

Conclusion

Bangladesh, India's most dependable South Asian partner, is not a mere neighbor. It is one of India's most critical strategic allies, and India cannot afford to ignore it. On the other hand, Bangladesh, which shares most of its border with India, has always prioritized India in its foreign policy. As India embarks on a lengthy journey to achieve its aim of being a "Regional power," Bangladesh has the potential to become South Asia's economic center of gravity due to its strategic location as the Bay of Bengal's gateway; both countries rely on one another. However, the existence of disputed issues and the emergence of new ones continue to concern the future of Indo-Bangladesh relations. This contagious issue fosters distrust, erecting barriers to the long-term vision and mutual belief. Both countries must recognize that a lack of faith may allow other countries to interfere, which would be particularly dangerous for India, given China's proactive efforts in South Asia to strengthen economic, military, and strategic ties with all countries, including Bangladesh. Bangladesh's geostrategic location is critical for China's access to the Indian Ocean, as Bangladesh is the Indian Ocean's gateway. Bangladesh borders India, and it is the most strategic and convenient way to manage the Indian North East region. Therefore, if disputed issues create mistrust, China's activity with Bangladesh may increase, posing an offensive security threat to India. A recent example is China's proposal to invest $1 billion in constructing the Testa Dam. Although it is a well-known fact that the Bangladesh-India Teesta River dispute dates back a decade, the Indian government has yet to resolve it, and China has seized the opportunity to expand its cooperation with Bangladesh. Like other regional powers, India must play a pivotal role as a

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

South Asian giant. For example, the European Union is the world's most potent organization today, but it did not emerge overnight. During its formation, large countries such as France, Germany, and the United Kingdom made numerous sacrifices for small countries to strengthen the organization. Thus, India should have played a pivotal role in resolving all disputed issues in Bangladesh and South Asia as a regional economic and military power. At this point, the Indian political elite and media should understand the critical nature of Bangladesh and refrain from spreading any news that would be detrimental to the government and the people of Bangladesh. Due to ongoing disputes, the countries may face blows and bottlenecks in the coming days. Still, they should not allow antagonism to fester and miscommunication and mistrust to plague their ties. Reliability does not require a long-term relationship; it requires keeping promises, providing support during difficult times, expressing solidarity with a common cause, and working together to address immigrant challenges. The pre-captive policy of avoiding potential pitfalls will ultimately determine the future direction of Bangladesh-India relations over the next 50 years.

Conflict of Interest: The author reported no conflict of interest.

Data Availability: All of the data are included in the content of the paper.

Funding Statement: The author did not obtain any funding for this research.

References:

1. Anuttama, B., (2021). “India must settle the Teesta River dispute with Bangladesh for lasting gains.”
2. Bhaumik, S., (2017). Keener on arms from China, Bangladesh dithers on defense pact with India. South China Morning Post, 23.
3. Basu, N. (2021, March 24). India, Bangladesh will deepen defense& security ties: Foreign security ahead of Modi’s visit. *The Print*.https://theprint.in/diplomacy/india-bangladesh-will-deepen-defence-security-ties-foreign-secy-ahead-of-modis-visit/627915/
4. Bajpai, K. (2011, September 17). *Why Bangladesh should matter to us.* TheTimesOfIndia.*https://timesofindia.indiatimes.com/edit-page/Why-Bangladesh-should-matter-to-us/articleshow/10009443.cms*
5. Bhattacharjee, J. (2018). *India-Bangladesh Defense Cooperation: Coming of Age, At Last?* Issue No.250.ORF.
6. Bhattacharya, D., (2019). Economic Diplomacy top priority: Women. The Daily Star, February
7. Bhattacharya, J., (2018). Decoding China-Bangladesh relationship, Observer Research Foundation: India.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

8. Byron, R. & Palma, P. (2019, November 29). India's Transit Thru' Bangladesh: Reaping benefit is a challenge—the *Daily Star*.https://www.thedailystar.net/frontpage/india-bangladesh-trasit-route-challenge-reap-benefit-1833220.
9. BSS. (2021, December 16). Contingents from India, Russia, and Bhutan participate in the Victory Day parade. *The Daily*
10. Chaudhury, D.P. (2018, November 9). *Bangladesh: A regional connectivity hub linking South Asia withSoutheastAsia.*TheEconomicTimes.https://economictimes.indiatimes.com/news/politics-and-nation/bangladesh-a-regional-connectivity-hub-linking-south-asia-with-southeast-asia/articleshow/66554793.cms
11. Chowdhury's. (2020). Five Decades of India-Bangladesh Relations. In S. Narayan& S. Datta (Eds.), Bangladesh at 50: Development and Challenges. (1st Ed., pp.222-241). Orient Black Swan Private Limited.
12. Dutta, P. (2010). *India-Bangladesh Relations: Issues, Priorities and Recent Developments* (Report No. 97). Institute of Peace and Conflict Studies.
13. HOSSAIN, A., (2016). *Future of Bangladesh-India relationship-a critical analysis*. AIR WAR COLLEGE MONTGOMERY United States.
14. Indrajit, M., (2021). Indefinite Hosting of Rohingya Refugees a Growing Concern for Bangladesh. *Diplomat brief, weekly newsletter*
15. Joya, T., (2020). "India Bangladesh transboundary river management: understanding the tipaimukh controversy." ORF issue brief no. 334, Observer Research Foundation.
16. Karim, M.R. (2020). Bangladesh-India relations: Honeymoon period returned? *Journal of Advances in Humanities and Social Sciences*, 6(5), 171–182.DOI: 10.20474/jass-6.5.3.
17. Kondapalli, S., 2002.China's string of pearls strategy: Creeping entry into the Indian Ocean. IDSA, January 2002.
18. Lailufar, Y., (2005). India-Bangladesh tussles. *The Bangladesh Observer, October 17*
19. Mahajan, A. (2021, March 24). India-Bangladesh relations: A robust history and optimistic future. *Wion*.https://www.wionews.com/south-asia/india-bangladesh-relations-a-robust-history-and-optimistic-future-372759
20. Madaan, D.K., (1996). *Indo-Bangladesh Economic Relations and SAARC. Deep* and Deep Publications.
21. Mirdha, R.U. (2021, December 15). CEPA negotiations with India start next year—the *Daily*

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Star.https://www.thedailystar.net/business/economy/news/cepa-negotiations-india-start-next-year-2917866.
22. Nayarima, B., (2019). Bangladesh wants India to pressure Myanmar on Rohingya refugees.
23. Niaz, T., (2005). China's March of South Asia, China Brief, 5(9), April 26
24. Odhikar., 2021.A national human rights organization
25. Quader, T. (2019). India-Bangladesh Relations: With Special Reference to Narendra Modi's Regime. Journal of South Asian Studies, 07 (01), XX-XX.DOI: 10.33687/jsas.007.01.2906.
26. Pieter, D., (2020). Trends in international arms transfers (SIPRI Stockholm: March 2021).
27. Percot, M., 2020.'Picking up the neighbors' waste': migration of Bangladeshi villagers to India metropolises. *Migration and Development*, *9*(1), pp.43–55.
28. Rahman, Z., (2004). Water Sharing Discord Between Bangladesh and India: People in the Crossfire. News Network.
29. Sakhuja, V., (2009). China-Bangladesh relations and potential for regional tensions. *China Brief, 9*(15), 10–12.
30. Shikha, D., (2014). Bangladesh-China: Respective Objectives and Strategies, *IPCS*, May 30.
31. Saghal, P., (2011). Manmohan's Dhaka Visit: Mamata Banerjee's Absence Sabotaged Teesta Treaty. *India Today*, *September 11*.
32. Saber, B.G.M., (2008). National Security of Bangladesh: Challenges and Options. *NDC E-JOURNAL, 7*(1), pp.1-26.
33. Singh,N.(2014).India and Development Partnerships: Special Reference with Bangladesh in 21st Century.*ProcediaSocialandBehavioralSciences*,157,137142.doi:10.1016/j.sbspro.2014.11.017
34. *Star*.https://www.thedailystar.net/news/bangladesh/news/contingents-india-russia-and-bhutan-participate-victory-day-parade-2918996
35. Shazzad, H. (2021, December 31).Is India still a reliable friend of Bangladesh? *The Daily Star*.https://www.thedailystar.net/views/opinion/news/india-still-reliable-friend-bangladesh-2929096
36. Van Schendel, W., (2005). The Bengal borderlands: Beyond state and nation in South Asia Anthem Press.
37. Yasmin, L. (2021, March 26). Neighbors By Chance, Friends By Choice: Celebrating 50th AnniversaryOfIndiaBangladeshRelations.OutlookIndia.https://www.outlookindia.com/website/story/opinion-neighbours-by-chance-

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

friends-by-choice-celebrating-the-50th-anniversary-of-india-bangladesh-relations/378335

38. Yasmin, L. (2021, March 26). *Neighbors By Chance, Friends By Choice: Celebrating 50th Anniversary Of India Bangladesh Relations*. Outlook India. https://www.outlookindia.com/website/story/opinion-neighbours-by-chance-friends-by-choice-celebrating-the-50th-anniversary-of-india-bangladesh-relations/378335

ESJ Humanities Peer-reviewed

Re-Visitation of "The Epic of Sunjata": Using Virtual Reality (VR) as a Method of Instruction

Dr. Ladji Sacko
Professor, Department of Languages and Literatures,
Delaware State University, DE, USA

Doi:10.19044/esj.2023.v19n32p25

Submitted: 21 September 2022
Accepted: 10 November 2023
Published: 30 November 2023

Cite As:
Sacko L. (2023). *Re-Visitation of "The Epic of Sunjata": Using Virtual Reality (VR) as a Method of Instruction.* European Scientific Journal, ESJ, 19 (32), 25.
https://doi.org/10.19044/esj.2023.v19n32p25

Abstract

This paper focuses on students learning literature in the classroom, presenting it as a challenging "out of culture experience". The expanded world history curriculum now encompasses a global perspective, moving beyond a European focus. To engage with topics beyond Europe, students must cultivate approaches that extend beyond mere memorization of dates and locations. One approach to adopt is the use of VR to expose students to literature from outside Africa and Europe (VR). A narrative such as "The Epic of Sunjata" may teach valuable lessons, as it will pique students' curiosity about subjects outside Africa and Europe.

Keywords: The Epic of Sunjata, Virtual Reality, Method of Instruction, Mali-West Africa, Socio-Cultural Trends

Introduction

"The Epic of Sunjata" originated from the Empire of Mali, which is one of the greatest northwestern African empires that took over the grasslands for centuries. The story of "Sunjata" is handed down from generations orally. "The Epic of Sunjata" is the story of "Sunjata Keita" and the building of the Empire of Mali in the thirteenth century. The story gained such widespread popularity that it became firmly embraced by the people of Mali. Interestingly, scholars, researchers, and tourists have written about the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

story. The Epic of Sunjata is told by a particular cast of people that are descendants of Sunjata Keita's ethnic group. The "Griots" males and /or "Griottes" females sing or tell the story at every ceremony they attend. "The Epic of Sunjata" needs to be virtualized in order for students and faculty to learn the culture of Mali and non-Europeans' stories. The objective of this paper is to illustrate the use of Virtual Reality (VR) as a teaching method for world literature instructors and students, using videotaping as an example.

Virtual Reality (VR) Recording Research in Mali-West Africa: "The Epic of Sunjata."

During the 2019 American Council on the Teaching of Foreign Languages (ACTFL) Convention in Washington, D.C., "Innovation of New Technologies for Implementing Languages and Literature in the Classroom" emerged as a prominent resource, showcasing key advancements in educational technology. The project involves recording Virtual Reality (VR) videos with subtitles, showcasing fieldwork outcomes that encompass "Oral Traditions" epics originating from Mali, West Africa. These epics, attributed to "Griots or Troubadours," are translated from the local dialect, "Bambara," into English/French. As the first epic print to capture the rich oral traditions of the "Bambara" ethnic group in Mali-West Africa, a video Virtual Reality (VR) recording is intended as a scholarly reference for African Studies, ethnicity, folk literature, religion, and colonialism. This will contribute to the ongoing debate on the identity of Blacks in Western Society and their African Heritage.

Jansen Jan (1996) in "The Sunjata Epic: The Ultimate Version" describes how, in recent decades, the Sunjata epic has garnered significant attention as a masterpiece of African oral literature. It is frequently included in undergraduate courses in literature or world history at American universities. The "Sunjata Epic is regarded as a major part of the historical heritage of the famous medieval Mali Empire in the fourteenth century. Radianti, Jaziar and Maajchrzak, Tim and Fromm, Jennifer and Wohlgenannt, and Isabell (2020) conducted a systematic review on immersive virtual reality applications for higher education in the field of Computer and Education.

The exploration of virtual reality (VR) benefits and applications in various scenarios is evident through the inclusion of design elements, lessons learned, and research agenda. Virtual Reality (VR) holds significant potential, and its application in education has garnered substantial research interest in recent times. For example, the incorporation of learning theories

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

from world literature is not currently taken into account in the development of VR applications designed to support and guide learning outcomes. Virtual Reality (VR) is primarily focused on the usability of VR apps instead of learning outcomes, and immersive VR has mostly been a part of experimental and development work rather than being applied regularly in actual teaching. Nevertheless, VR seems to be a promising technology. Benjy, Marks, and Thomas (2021) in their study, "Adoption of Virtual Reality Technology in Higher Education: An Evaluation of Five Teaching Semesters in a Purpose-Designed Laboratory," assert that the utilization of Virtual Reality (VR) into higher education is in its early stages of adoption as a teaching platform. The technology can facilitate immersive learning in environments that are not physically accessible to students via 3D models and interactive 360º video. Today, adoption rates of VR technology for teaching have not been well described across higher education institutions. The development of these technologies are currently underway in this twenty-first century.

The primary focus of this paper is the application of VR in narrating the story by a renowned griot/storyteller of Mali. However, the specific emphasis is on utilizing VR in the storytelling of a well-known griot/storyteller from the "Epic of Sunjata." This narrative, never before brought to life in virtual form, presents an opportunity to engage students in classrooms.

The first part of the video recasts the Empire of Mali, which lasted in various forms from the 13th to the 17th century and plays a unique role in regional oral tradition. Mali is the center to which many surrounding traditions of origin attach themselves. The “Sunjata Keita’s Epic” reveals the myth of the foundation or genesis of the ancient Kingdom of Mali as well as its pre-colonial, socio-political, and cultural trends. This ancient realm, currently designated as one of Mali's administrative divisions, predates the era of French colonialism and endured through its early stages. The Bambara/Mandingo group predominantly resides there. Renowned for its rich oral traditions, steeped in distinctive socio-cultural trends, the group is particularly celebrated for the transmission of its history and legends through storytellers, including "griots, troubadours, and traditional healers." Prominent French missionaries in the late nineteenth and early twentieth centuries and contemporary African and Europeans Scholars have written about this specific ethnic group. Monteil Charles (1977) authored "Les Bambara du Segou et du Kaarta", while Bird Charles (1977) provided a critical review of "Sunjata: Three Mandinka Versions" in Research in

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

African Literatures (1987). Additionally, Bird Charles, Fa-Digi Sissoko, and John William Johnson (1988) contributed to "The Epic of Son-Jara: A West African Tradition" serving as a significant scholarly reference (1992). Notably, David Conrad's latest work, "Sunjata: A West African Epic of the Mande People" in paperback (2004) is an essential addition to this scholarly discourse. This edition stands well on its own, yet a significant source of enjoyment lies in the fresh background stories for characters connected to "Sunjata," particularly the pivotal role played by women. Presenting the narrative of "Sunjata" through the immersive experience of Virtual Reality (VR), as conveyed by the griot/storyteller, would be an exceptional and enriching experience for both the students and faculty.

The "Visitation of 'The Epic of Sunjata'" will be presented as a Virtual Reality (VR) video. This innovative project aims to facilitate experimental learning for students, enabling them to engage with the content from their classrooms or homes. The VR recordings, captured in Mali, West Africa, will encompass various aspects, including: a.) Immersion in the culture and language of Bambara. b.) Exposure to the language through video in either Bambara or French. c.) Presentation of "The Epic of Sunjata" within its culturally authentic setting. d.) The recorded video narrative of "The Epic of Sunjata" will also serve as a valuable resource for faculty and students worldwide, contributing to the exploration of languages and literature within higher education institutions.

The second phase of Virtual Reality (VR) aims to challenge conventional perceptions of "oral" texts as purely social documents by emphasizing their literary, aesthetic, and historical significance. This phase seeks to advance scholarly research on a specific ethnic group by extending beyond the identification of ethnic characteristics. This research will be limited to one (1) griot/storyteller data collection. All the stories of “The Epic of Sunjata” told by other griots/storytellers are similar stories. It will be interesting to examine the impacts of Islam, Christianity, and French colonialism on the culture and the project of modernity.

Analysis of "The Epic of Sunjata"

Understanding the narrative of "The Epic of Sunjata" is pivotal to fully grasp its potential as a teaching tool. The story of Sunjata Keita, the hero who overcomes adversity to establish the Mali Empire in the 13th century, is compelling and culturally enlightening (Stephen Belcher, 1999). The plot unfolds a rich tapestry of characters that represent the cultural and societal norms of the era. The story not only portrays leadership but also symbolizes the human values of courage, tenacity, and resilience. The

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

characters range from the cunning and strong Sunjata, the sympathetic figure of Sogolon, the prophesied buffalo woman, and the usurping sorcerer king, Sumanguru. Their interactions and experiences provided an intricate view of the sociopolitical and cultural environment of West Africa in the 13th century.

Methodology

This research utilizes qualitative research with a narrative research design, which is suitable for telling stories in detail. The researcher converts the narratives about the experiences of individuals, describes their life experiences, discusses the meaning of the experience with the individual, and offers interpretation using Virtual Reality (VR) technology. Virtual Reality (VR) video recording will serve as a scholarly reference for African Studies, encompassing history, ethnicity, folk literature, religion, and colonialism. This contribution aims to enrich the discourse on the identity of Blacks in Western society and their connection to African heritage. Furthermore, this research compiles different versions of "The Epic of Sunjata" recounted by two (2) or three (3) distinct griots/storytellers within the Bambara and/or Mandingo communities of Mali. The chosen version of "The Epic of Sunjata" will be transformed into virtual reality video recordings. The outcomes of this study will contribute to the Humanities, including Literature, Languages and Cultures, History, and Political Sciences, thus benefiting Delaware State University (DSU) and global Language and Literatures Departments in Higher Education.

Virtual Reality (VR) is regarded as a window for the location of the vestiges of African oral traditions among the griots/storytellers (Bambara and/or Mandinka language). Given that Mali is predominantly Bambara, a griot/storyteller, renowned for narrating "The Epic of Sunjata," would be chosen. Moreover, a great interest has been developed in the relationship between different contemporary versions of “The Epic of Sunjata.” For example, findings reveal that versions are similar, while narrative patterns between “griots/storytellers” differs. In Virtual Reality (VR), the chosen griot or storyteller introduces the narrative by providing a brief biography, including details about ethnic background. This is followed by the standard format presentation of such texts where an edited transcription is on the bottom of the screen, and the corresponding translation is done orally in English/French.

Classroom Experimentation

Three different classes will be utilized to carry out an experimental study so as to determine the effectiveness of the VR tool in facilitating an

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

understanding of world literature. In each class, students will be exposed to the VR module of "The Epic of Sunjata," and their interaction, comprehension, and interest level will be recorded. The evaluation of these variables will be performed through a variety of methods, including direct observation, open discussions, and questionnaires (Hawkins, 2020).

Classroom Dynamics Analysis

The implementation of VR technology is expected to bring about significant changes in the dynamics of the classroom. The study observes these changes in terms of student interaction, engagement, interest levels, and the overall classroom environment. The goal is to understand how VR can influence classroom dynamics, promote active engagement with subject matter, and enhance interpersonal communication among students (Merchant et al., 2014).

Dissection and Results

Following the completion of the classroom experimentation, the obtained results will be dissected meticulously. The primary focus is on student engagement, comprehension of the story, and the impact of VR within classroom dynamics. The challenges encountered during the experiment will be highlighted, including insights derived from the process. Furthermore, quantitative data from the questionnaires will be used to reinforce the findings.

The Role of Cultural Sensitivity

In the discussion of education, cultural sensitivity is an indispensable factor. It establishes an understanding of cultural diversity and underlines the need for inclusiveness in learning environments (Gay, 2002). By enabling students to virtually experience "The Epic of Sunjata," they get to explore and appreciate a culture different from their own. The immersive experience of the VR module fosters a greater understanding of the culture of Mali and cultivates a higher degree of cultural sensitivity. The study contributes to the broader discourse on the role of cultural sensitivity in education and explores how technology can enhance this aspect.

Summary - “The Epic of “Sunjata”—Major Characters

“Sunjata” is the son of the King of the Mandinka ethnic group, “Maghan Kung Fata”, and one of his wives, “Sogolon”, is a pagan with occult knowledge. “Sunjata’s chief rival is an older half-brother named “Dankara Tuma”. Dankara Tuma’s mother puts a curse on “Sunjata”, compelling him to ascend with a staff crafted from a sacred tree. Upon the death of the King, Dankara Tuma rules for a brief time before the sorcerer

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

“Sumanguru” usurps the throne of Mali. “Sumanguru” is warned by soothsayers that “Sunjata” is destined to become King. To prevent this, "Sumanguru" summons "Sogolon" and earns the admiration of various monarchs who will later come to his aid. The sister of “Sunjata” seduces “Sumanguru in order to trick him into revealing the secret of his sorcery. She passes the knowledge on to “Sunjata”, who promptly uses it to destroy “Sumanguru”. Before then, “Sumanguru” saves himself by changing into a bird (or a stone). Unsatisfied with the size of his Kingdom, “Sunjata” proceeds to expand it at the cost of his neighbor’s lands.

Conclusion

"Sunjata" is a captivating narrative of daring exploits and acts of bravery that champions the Mande value of courage in the face of opposition. Some scholars have also noted an emphasis on female characters and their essential roles in the family. Other scholars have asserted that the “Epic of Sunjata” played an important role in bringing together diverse groups of people into one nation by giving them a common story. The Virtual Reality (VR) in this paper mainly focused on the characteristics of its accounts and its transmission through generations. Classical and Medieval Literatures writers, such as David Conrad (2004), Gordon Innes (2000), Stephen Belcher (1999), Isidore Okpewho (1999), and Jan Jansen (2001) have done extensive work on “The Epic of Sunjata”. Nevertheless, this research paper aims to contribute to the creation of a significant collection of oral traditions within Classical Medieval Literature in the 21st century, employing Virtual Reality (VR) as a tool for collecting stories. This in turn will benefit the Department of Languages and Literatures at Delaware State University, Dover, Delaware, where American literature, African American literature, World literature, and the field of Literature in general are currently taught.

Plans For Data Collection

- Share the Virtual Reality (VR) research with colleagues.
- Share/publish the Virtual Reality (VR) experience of "The Epic of Sunjata" in Bamako, Mali.
- Train Delaware State University on the use of Virtual Reality (VR) in the classroom, which is the leading area of pedagogical technology development with great potential for digital, experiential learning.
- Provide Virtual Reality (VR) and video resources for application in General Education (World Literature Course on the “Epic of Sunjata”).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

- Provide digital experiential learning to students as they encounter "Epic of Sunjata" in their course of study.

Conflict of Interest: The author reported no conflict of interest.

Data Availability: All of the data are included in the content of the paper.

Funding Statement: The author did not obtain any funding for this research.

References:

1. ACTFL (2019). "Innovative of New Technology for Implementation of Less Commonly Taught Languages in the Classroom." Convention Center, Washington, DC.
2. Benjy, Marks, Thomas, & Jacqueline, (2021). "Adoption of Virtual Reality (VR) Technology in Higher Education: An Evaluation of Five Teaching Semesters in a Purpose Designed Laboratory." 2021 July 8; 1-19. DOI: 10.1007/s10639-021-10653-6.
3. Belcher & Stephen (1999). "African Epic-Sunjata Keita." (First published by: Niane, D. T., (1965). Sunjata). Published University of Birmingham Press, 1999.
4. Bird, S. (1977). "Sunjata Criticism-Review of Sunjata: Three Mandinka Versions: Research in African Literatures (1987). Vol.8, No3, Winter 1977.
5. Bird, S., Charles, Sissoko Fa-Digi, Johnson, & William, J. (1988). "The Epic of Son-Jara: A West African Epic of the Mande people." Africa, 64(2), DOI: 10.2307/1160986.
6. Conrad & David, C. (2004). "Sunjata: A West African Epic of the Mande peoples." Hachette Publishing.
7. Gay, G. (2002). Preparing for culturally responsive teaching. Journal of Teacher Education, 53(2), 106-116.
8. Hawkins, I. (2020). Virtual Reality and the New Classroom Norm. Journal of Technology and Educational Practices, 12(2), 14-20.
9. Innes Gordon (2000). "Sunjata (Penguin Classics)"-Paperback (2000) (Author) Bamba Susso, Banna Kanute, Gordon Innes, Lucy Duran, Graham Furrniss, Penguin Classics, January 1, 2000.
10. Jansen Jan (2001). "The Sunjata Epic-The Ultimate Version." Research in African Literature, 32(1), 14-46.
11. Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. Computers & Education, 70, 29-40.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

12. Monteil Charles (1977). “Les Bambara du Segou et du Kaarta.” 32 editions published between 1923 and 1977 in French and English and held by 172 World Cat member libraries Worldwide.
13. Okpewho Isidore (2006). “Sunjata Epic-Home, Exile, and the Space In Between.” Research in African Literature, 37(2), 68-73.
14. Radiani, Jaziar, Maajchrzak, Tim, Fromm, Jennifer, Wohlgenannt, & Isabell (2020). “Computer and Education”—A Systematic Review of Immersive Virtual Reality (VR) Application for Higher Education: Designed Elements, Lessons Learned, and Research Agenda.” Computers & Education, 147, April 2020, 103784.

ESJ Humanities Peer-reviewed

Etude de l'Erosion Hydrique dans le Contexte Sahélien par l'Analyse Statistique des Paramètres Géo-Morphométriques et des Données Pluviométriques : Cas du Bassin Versant du Ferlo

Niang Gallo
Laboratoire de climatologie et de l'environnement,
Université Cheikh Anta Diop, Senegal
Faty Abdoulaye
Laboratoire d'hydrologie et de morphologie,
Université Cheikh Anta Diop, Senegal
Faye Guilgane
Laboratoire de géomorphologie,
Université Cheikh Anta Diop, Senegal

Doi:10.19044/esj.2023.v19n32p34

Submitted: 01 August 2023
Accepted: 02 November 2023
Published: 30 November 2023

Cite As:
Gallo N., Abdoulaye F. & Guilgane F. (2023). *Etude de l'Erosion Hydrique dans le Contexte Sahélien par l'Analyse Statistique des Paramètres Géo-Morphométriques et des Données Pluviométriques : Cas du Bassin Versant du Ferlo*. European Scientific Journal, ESJ, 19 (32), 34. https://doi.org/10.19044/esj.2023.v19n32p34

Résumé

Cette étude met en évidence l'érosion hydrique dans une région aride du Sahel au cours de la période suivant les sévères séries de sécheresses des années 1970 et 1980. Elle se consacre au cas du bassin du Ferlo et s'effectue à travers l'analyse des influences géo-morphométriques et des effets de la fréquence des grandes hauteurs de pluie. Les aspects linéaires, de relief et de surface du bassin versant ont été examinés à partir d'une image SRTM de 30 m de résolution à l'aide d'outils spatiaux dans ArcGIS. La fréquence des jours pluvieux et l'occurrence des grandes hauteurs sont traitées par des méthodes d'analyse statistique. Les résultats obtenus montrent une forme allongée, un relief assez faible et contrasté, une texture de drainage grossier, un réseau hydrographique hiérarchisé en 5 ordres dont le ratio de bifurcation (5,025) révèle une influence de la structure géologique sur le tracé méandrique du réseau hydrographique. Ces caractéristiques font état d'un potentiel de

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

ruissellement assez lent mais sur une surface très sensible à l'érosion. La répartition aléatoire du nombre de jours pluvieux (de plus de 10 mm) et la fréquence élevée des hauteurs de pluie dont la récurrence est de 20 ans, 50 ans ou 100 ans au cours de la période consécutive à l'année 1990 indique une dynamique érosive plus ou moins active dans le bassin.

Mots-clés: Géo-morphométrie, hauteur de pluie, érosion hydrique, bassin versant, Ferlo

Water Erosion in the Sahelian Context: The Case of the Ferlo Watershed

Niang Gallo
Laboratoire de climatologie et de l'environnement,
Université Cheikh Anta Diop, Senegal
Faty Abdoulaye
Laboratoire d'hydrologie et de morphologie,
Université Cheikh Anta Diop, Senegal
Faye Guilgane
Laboratoire de géomorphologie,
Université Cheikh Anta Diop, Senegal

Abstract

This study highlights water erosion in an arid region of the Sahel during the period following the severe series of droughts of the 1970s and 1980s. It focuses on the case of the Ferlo basin and is carried out through the analysis of geo-morphometric influences and the effects of the frequency of large rainfall heights. Linear, relief, and surface aspects of the watershed were examined using a 30 m resolution SRTM image using spatial tools in ArcGIS. The frequency of rainy days and the occurrence of high heights are treated by statistical analysis methods. The results obtained show an elongated shape, a rather low and contrasting relief, a coarse drainage texture, a hydrographic network hierarchical in 5 orders whose bifurcation ratio (5.025) reveals an influence of the geological structure on the meandric layout of the hydrographic network. These characteristics indicate a potential for runoff rather slowly but on a surface very sensitive to erosion. The random distribution of the number of rainy days (more than 10 mm) and the high frequency of rainfall heights with a recurrence of 20 years, 50 years or 100 years during the period after 1990 indicate a more or less active erosive

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

dynamic in the basin.

Keywords: Geo-morphometry, rainfall height, water erosion, watershed, Ferlo

Introduction

L'étude des phénomènes hydro-sédimentaires exige l'observation et la compréhension des interactions entre divers facteurs biophysiques et anthropiques. Cette interaction se présente comme un processus du cycle hydrologique à l'échelle globale ou du bassin versant. Ainsi, les bassins versants et les sous-bassins versants constituent les unités fondamentales de la gestion des ressources en terre et en eau. Depuis les années 1940, le bassin versant demeure l'unité de référence pour les travaux de cartographie et de modélisation de phénomènes hydrologiques (Horton, 1945 ; Smith, 1950 ; Schumm, 1956 ; Strahler, 1964 ; Bodian, 2011 ; Faty, 2017), de quantification des précipitations et des écoulements (Dacosta, 1989) ou d'étude hydrologique (Sow A. A., 2007). Pour les géomorphologues, la théorie davisienne et le modèle USLE de Wischmeier et Smith (1978) constituent les sources d'inspiration ayant conduit à l'adoption du bassin versant comme cadre idéal pour l'étude de l'érosion (Michel, 1973; Sogon, 1999; Cheggour, 2008; Cissokho, 2011; Sow S. A., 2017; Niang G. , 2021). Le bassin versant constitue ainsi l'unité géomorphologique par excellence pour mieux apprécier les différents facteurs et modalités qui déterminent le cycle de l'eau et le transport des sédiments (Fort, François, & Arnaud-Fassetta, 2015).

Dans les milieux arides et semi-arides du Sahel, les bassins versants connaissent une situation hydro-morphogénique particulière. En effet, contrairement aux milieux estuariens ou deltaïques où le fonctionnement sédimentaire, animé par des courants marins, fluviaux et éoliens, est complexe, ces milieux présentent un hydrodynamisme régi par la pluie. C'est le cas du bassin du Ferlo. Dans cet espace, si la pluviométrie a connu un déficit chronique, l'évolution de la fréquence des pluies maximales ne semble pas suivre la même dynamique (Niang G. , 2021).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

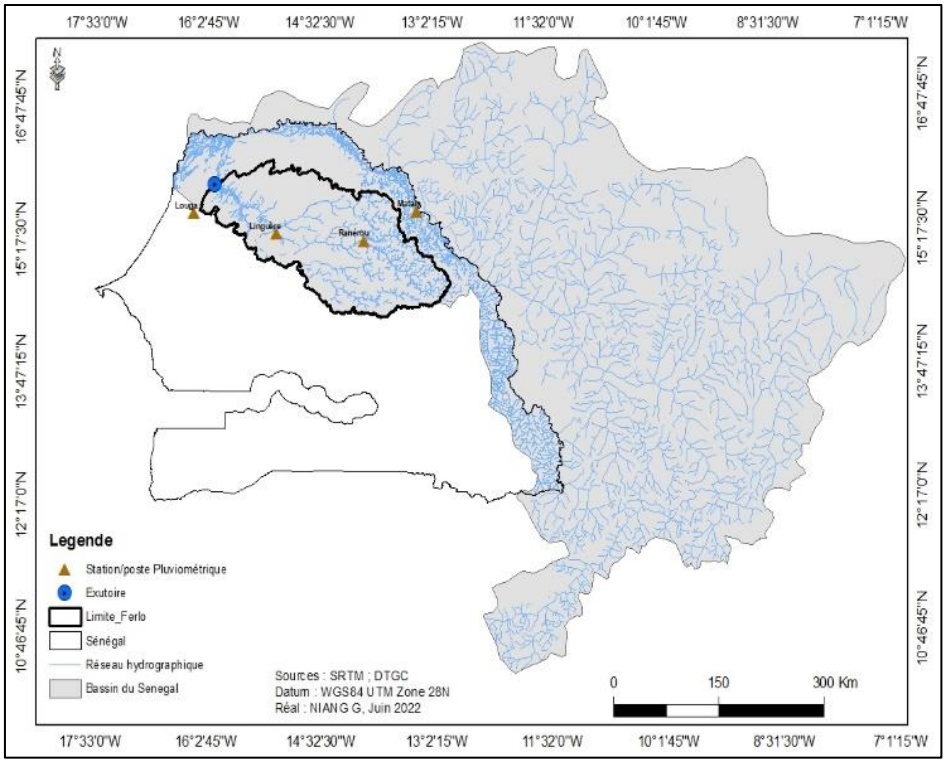

Figure 1. Localisation du bassin versant du Ferlo

L'objectif de cette contribution est d'étudier le processus d'érosion dans le bassin versant du Ferlo par les méthodes spatiales. Localisé en latitude entre 14° 30 Nord à 16° 18 Nord, et en longitude entre 12° 36 Ouest à 16°02 Ouest (figure 1), le Ferlo est une région endoréique qui s'étend sur une superficie 37748 Km², soit 21 % du territoire nationale. Son exutoire se situe dans le lac de Guiers qui est relié au fleuve, dans son delta, par un canal de 17 km, la *Taoué*.

L'hydrosystème du Ferlo prend sa source au sud de Bakel, près du village de Lougué-Mody sur le plateau dunaire à 99 m d'altitude qui surplombe les levées et bourrelets de berges de la moyenne vallée du fleuve Sénégal. C'est un sous-affluent inférieur du fleuve Sénégal. Situé au cœur du domaine aride sahélien où la variabilité pluviométrique et les amplitudes thermiques entrainent différentes formes d'altération superficielle (hydroclastie, thermoclastie, etc.), l'horizon superficiel du bassin demeure sensible au travail morphogénétique du ruissellement.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

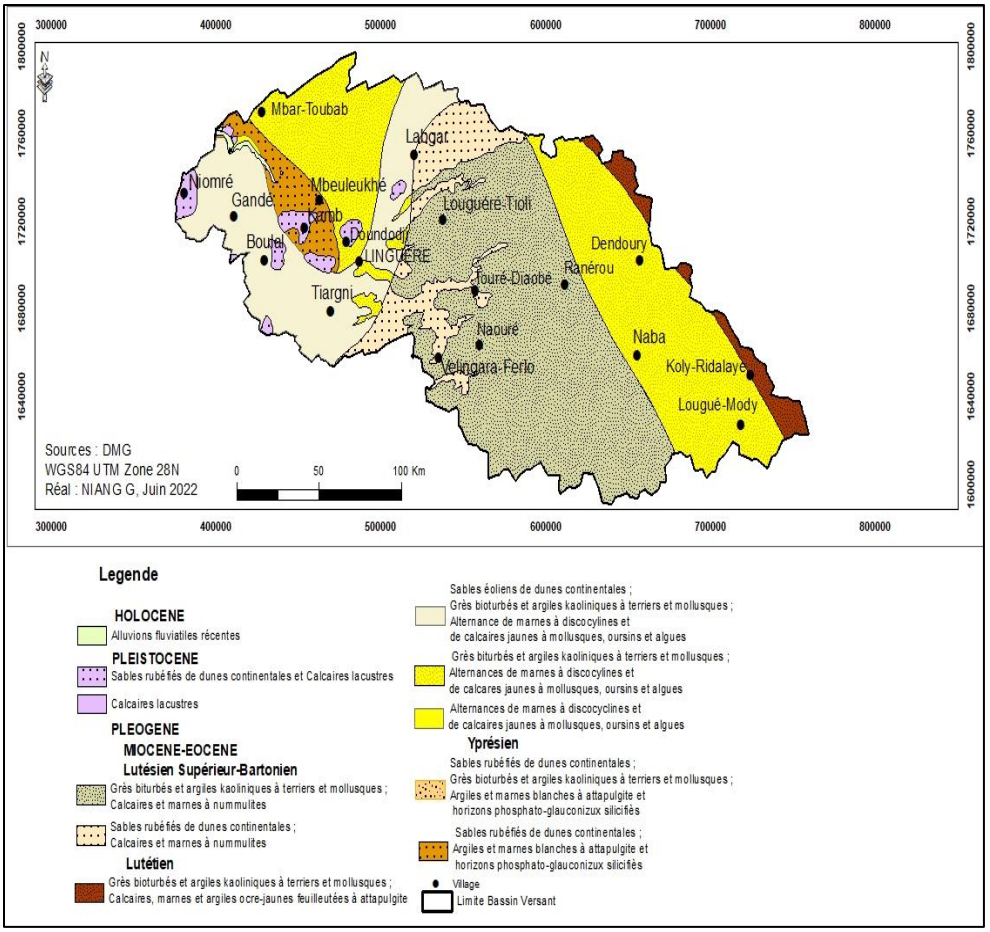

Figure 2. Structure géologique du bassin versant du Ferlo

Les dunes de sables rubéfiés (Michel, 1973) dominant le paysage morphologique du bassin reposent sur un substratum Secondaire-Tertiaire (figure 2) et sont couvertes par des sols hérités du Quaternaire. Principalement constitués par des dépôts de sables ferrugineux tropicaux non ou peu lessivés et bruns rouges subarides, ces sols sont meubles et mal protégés par des formations végétales disparates et sénescentes (steppes arbustives à arborées) faisant place suite aux mutations consécutives aux sécheresses des années 1970 et 1980 et à la pression agropastorale.

1. Matériel et méthodes

1.1. Données et matériels

Les données collectées et les outils de traitement sont présentés dans le tableau 1. Le bassin versant du Ferlo a été extrait sous ArcGIS à partir de l'image SRTM. Afin d'illustrer une bonne répartition des hauteurs de pluies journalières, quatre stations ont été choisies dont la série acquise à l'ANACIM

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

est de 58 ans (1941 à 2008) pour les stations de Linguère et de Matam et de 46 ans (1963-2008) pour la station de Louga et le poste de Ranérou. Enfin, une carte topographique de la zone d'étude a été nécessaire pour valider le réseau hydrographique extrait de l'image SRTM.

Tableau 1. Données et outils de traitement

Types de données	**Echelles**	**Sources**	**Outils de traitement**
SRTM*	30 m	*NASA** (http://www2.jpl.nasa.gov/srtm/)*	ArcGIS
Carte topographique	1/50 000	DTGC***	ArcGIS
Pluviométries	Journalières	ANACIM****	Excel

**Shuttle Radar Topography Mission **National Aeronautics and Space Administration ***Direction des Travaux Géographiques et Cartographiques ****Agence Nationale de l'Aviation Civile et Météorologique*

1.2. Méthode

1.2.1. Paramètres morphométriques

L'analyse géo-morphométrique est basée sur une approche synthétique des paramètres linéaires, de forme et de relief. Auparavant, ces paramètres ont été calculés à l'aide des formules proposées par différents spécialités (tableau 2).

D'abord, la carte topographique a été géoréférencée et le réseau hydrographique numérisé dans un environnement SIG a permis de valider le réseau hydrographique extraite de l'image SRTM. Les cours d'eau sont ensuite hiérarchisés selon la loi Strahler (1964). Ainsi, le nombre (Nu) et la longueur des cours d'eau (Lu) ont permis de calculer les paramètres linéaires comme la longueur moyenne (Lum) et le Ratio de bifurcation (Rb) de chaque ordre.

Ensuite, la géométrie et la morphologie du bassin sont déterminées par les aspects de forme ou de surface. La surface désigne l'aire de réception des précipitations et d'alimentation des cours d'eau (Laborde, 2000). Elle est délimitée par un contour appelé périmètre (P). Ces deux paramètres ont été automatiquement calculés sur ArcGIS via la fenêtre Arctoolbox. La longueur du bassin (L), distante de l'exutoire au point le plus éloigné de la ligne de partage des eaux, correspond à celle du rectangle équivalent. Ces indicateurs de taille et de forme ont permis de calculer le ratio d'élongation (Re), le ratio de circularité (Rc), le facteur forme (Ff) et le coefficient de compacité (Kc) en vue de déterminer la forme approximative du bassin, mais aussi la densité de drainage (Dd), la fréquence de flux (Fs) et la texture de drainage (T) afin de déterminer les caractéristiques spatiales du bassin.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Tableau 2. Les paramètres morphométriques utilisés

Aspects	Paramètres	Formules	Références
Linéaires	N° d'ordre des cours d'eau (U)	Hiérarchisation du réseau hydrographique	Strahler, 1964
	Nombre de cours d'eau (Nu)	**Nu** = N1+N2+...Nn ; où, N1 = Cours d'eau de premier ordre, N2 = Cours d'eau de second ordre et Nn = Cours d'eau d'ordre 'n'	Strahler, 1964
	Longueur des cours d'eau (Lu)	**Lu** = L1+L2…Ln ; où, L1 = Longueur des cours d'eau de premier ordre, L2 = Longueur des cours d'eau de second ordre et Ln = Longueur des cours d'eau d'ordre 'n'	Horton, 1945
	Longueur moyenne des cours d'eau (Lum)	**Lum** = Lu / Nu	Strahler, 1964
	Rapport de longueur des cours d'eau (Lur)	**Lur** = Lu / (Lu + 1)	Horton, 1945
	Ratio de bifurcation (Rb)	(**Rb**) = Nu / (Nu + 1) ; où Nu = Nombre de segments des cours d'eau présents dans l'ordre donné, Nu+1 = Nombre de segments de l'ordre supérieur suivant	Schumm, 1956
De forme	Surface du bassin (A)	**A** (km²)	
	Périmètre du bassin (P)	**P** (km)	
	Longueur du bassin (L)	**L** = Longueur en km du rectangle correspondant	
	Densité de drainage (Dd)	**Dd** = Lu / A	Horton, 1945
	Fréquence de flux (Fs)	**Fs** = Nu / A	Horton, 1945
	Texture de drainage (T)	**T** = Dd × Fs	Smith, 1950
	Ratio d'élongation (Re)	**Re** = √(A/π) / L ; où, A = Superficie du bassin, π = 3,14, L = Longueur du bassin	Schumm, 1956
	Ratio de circularité (Rc)	**Rc** = 4 πA / P²	Miller, 1953
	Facteur de forme (Ff)	**Ff** = A / L²	Horton, 1945
	Coefficient de compacité (K_c)	$\mathbf{K_G} = 0{,}28*\frac{P}{\sqrt{A}}$; où K_G= Coefficient de compacité de Gravelius, P = Périmètre du bassin, A = Superficie du bassin	Gravelius, 1914
De relief	Relief du bassin (Rb)	**Rb** = H - h ; Ecart entre le relief plus élevé et le relief plus faible	Hadley et Schumm, 1961
	Rapport du relief (Rr)	**Rr** = Rb / L	Schumm, 1963
	Relief relative (Rre)	**Rre** = Rb x 100/P	Schumm, 1963
	Nombre de Robustesse (Rn)	**Rn** = Rre x Dd	Schumm, 1963
	Pente (m)	**m**= Δy/Δx ; où Δy est un changement vertical, Δx est un changement horizontal	Todhunter, 1888

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Enfin, à l'aide des valeurs altitudinales du Modèle Numérique de Terrain (MNT), les aspects de relief sont générés. Il s'agit du relief du bassin (Rb), du rapport de relief (Rr), du nombre de robustesse (Rn), mais aussi de la pente en mètre.

1.2. 2 Analyse fréquentielle des hauteurs de pluie

Afin d'étudier le potentiel érosif des pluies, une analyse fréquentielle est appliquée aux hauteurs de pluies journalières de la série 1941-2008 des stations de Linguère et de Matam, de la série 1963-2008 des stations de Louga et du poste pluviométrique de Ranérou. Elle consiste d'une part à examiner la répartition des hauteurs de pluies supérieures ou égales à 10 mm qui, selon Thiam (1985), sont susceptibles de favoriser le ruissellement et l'érosion. Ces pluies sont réparties en quatre classes : [10 - 20 mm], [21- 30 mm], [31 - 40 mm] et] > 40 mm [; et pour chacune la fréquence du nombre de jours est analysée. Par ailleurs, la loi de Gumbel a été ajustée aux maxima de pluies journalières des séries en vue d'estimer leur temps de retour. Le maximum journalier correspondant à la pluie maximale enregistrée entre le 1er janvier et le 31 décembre de chaque année. La fonction de répartition de la loi de Gumbel (ou loi double exponentielle) est la suivante :

$f(x) = \exp\left(-\exp\left(-\frac{x-a}{b}\right)\right)$, avec la variable réduite suivante : $u = \frac{x-a}{b}$, où a et b sont des paramètres du modèle de Gumbel.

La distribution s'écrit ainsi $f(x) = \exp(-exp(u))$ et $u = -\ln(-\ln(f(x)))$

L'estimation de $f(x)$ repose sur un tri de la série par valeurs croissantes permettant d'associer chaque valeur à son rang r. Ainsi, après un classement par ordre croissant de chaque échantillon de pluies maximales de taille n, l'expression de la fréquence empirique ou expérimentale de non-dépassement de Hazen pour une valeur x de rang r se note :

$$f(xr) = \frac{r - 0{,}5}{n}$$

Où *n* est la taille de l'échantillon considéré.

Le temps de retour T d'un évènement est défini comme étant l'inverse de la fréquence de l'apparition de cet évènement, soit :

$$T = \frac{1}{1 - f(xi)}$$

Où T : temps de retour (nombre d'années) ; f (xi) : fréquence de non dépassement.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

1. Résultats

1.1 Caractérisation géo-morphométrique du bassin versant

Les paramètres géo-morphométriques d'un bassin versant peuvent être regroupés en trois ensembles : les aspects linéaires, les aspects de forme et les aspects de relief (Zakaria, Majumder, & Rahman, 2016). Les aspects linéaires caractérisent le réseau hydrographique. Les aspects de formes et ceux de relief déterminent la géométrie et la morphologie du bassin versant qui, constituant des propriétés intrinsèques, influencent le régime de fonctionnement du réseau hydrographique du bassin. Subséquemment, afin d'établir la relation entre la morphologie du bassin et l'écoulement à la surface, la nature et la topologie du réseau hydrographique sont examinées avant de dégager les caractéristiques morphologiques et spatiales du bassin.

2.1.1 Un réseau hydrographique peu dense et plus ou moins bien organisé

Le bassin versant du Ferlo présente un réseau dendritique de cinquième ordre (figure 3). Le nombre (Nu) et la longueur de cours d'eau (Lu) décroissent dans le sens inverse du numéro d'ordre (U) ; tandis que la longueur moyenne (Lum) augmente à mesure que l'ordre augmente à l'exception du quatrième ordre (Tableau 3). Cette rupture de la Lum et les variations du Lur peuvent être reliés aux changements de la pente, de la topographie (Rama, 2014) et de l'état des roches (Singh, Arya, & Singh, 2020), traduisant un développement de l'activité érosive dans le bassin. Le ratio de bifurcation (Rb) supérieur à 5 (variant de 4 à 6,25) indique que la structure géologique exerce un contrôle plus ou moins important sur le réseau de drainage du bassin.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

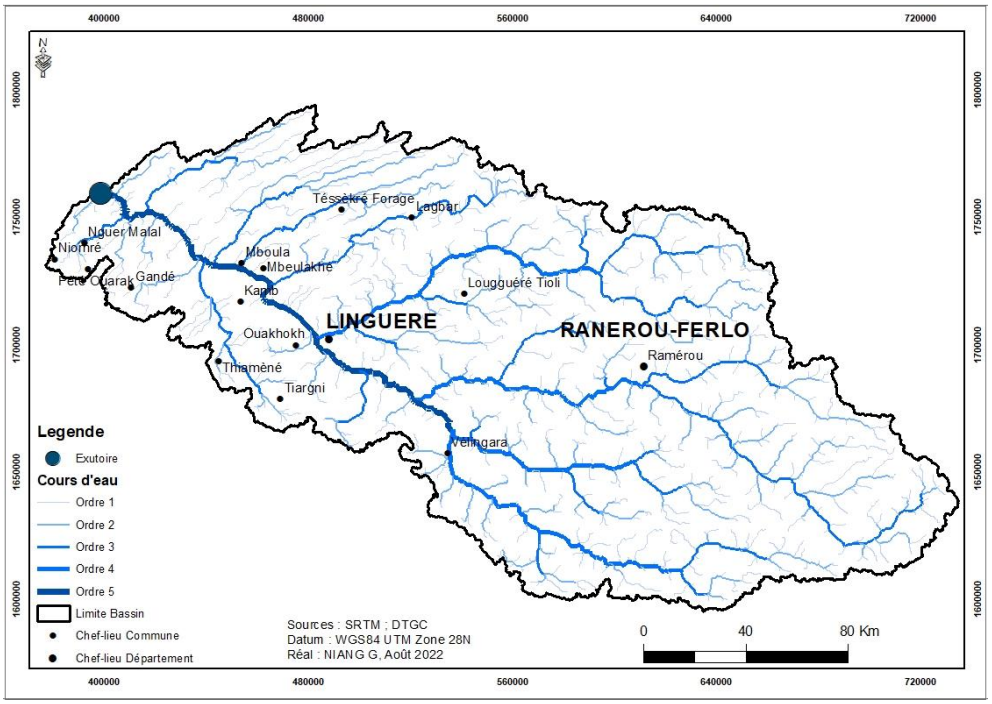

Figure 3. Réseau hydrographique du bassin versant du Ferlo selon l'ordre de Strahler

Ainsi, les trois paramètres calculés (Lum, Lur et Rb) révèlent certes un risque élevé d'inondation mais aussi une capacité non négligeable de transport des charges et solides.

Tableau 3. Aspects linéaires du bassin versant du Ferlo

N° d'ordre des cours d'eau (U)	Nombre de cours d'eau (Nu)	Longueur des cours d'eau (Lu) en km	Longueur moyenne des cours d'eau (Lum) en km	Rapport de longueur des cours d'eau (Lur)	Ratio de bifurcation (Rb)
1	607	3818,67	6,29	1,89	4,93
2	123	2018,71	16,41	1,86	4,92
3	25	1080,95	43,23	2,29	6,25
4	4	471,79	10,29	2,17	4
5	1	216,67	216,7	-	-
Total/Moyenne	2320	6210,17	47,52	2,11	5,025

Source : SRTM-30m.

2.1. 2 Un bassin allongé à texture très grossière

Les résultats des paramètres géométriques et morphométriques du basin sont consignés dans le tableau 4. Il s'agit d'un vaste bassin dont la longueur du rectangle équivalent est de 387,71 km. Les valeurs proches de 0 du ratio d'élongation (Re < 0,7), du ratio de circularité (Rc < 0,7) et du facteur forme (Ff = 0,25), ainsi que le coefficient de compacité supérieur à 1,5 (Kc =

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

2,23) indiquent une forme allongée selon les classifications respectives de Schumm (1956), de Miller (1953), de Horton (1945) et de Gravelius (1914).

Tableau 4. Aspects de forme et de surface du bassin versant du Ferlo

Aspects de formes	
Surface (A en km²)	37749,35
Périmètre (P en km)	1548,35
Longueur du bassin (L en km)	387,71
Ratio d'élongation (Re)	0,28
Ratio de circularité (Rc)	0,19
Facteur de forme (Ff)	0,25
Coefficient de compacité (Kc)	2,23
Densité de drainage (Dd en Km/km²)	0,16
Fréquence de flux (Fs)	0,06
Texture de drainage (T)	0,0096

Dès lors, le fonctionnement morpho-hydrologique du bassin est enjoint à un temps de concentration long. Cette situation est illustrée aussi par les faibles valeurs de la densité de drainage (Dd : 0,16 km/km²), de la fréquence de flux (Fs : 0,6) et la texture de drainage (T : 0,0016) qui indiquent, selon Smith (1939) et Horton (1945), une texture très grossière et, par ricochet, un sol perméable, une végétation clairsemée, un relief peu accidenté et un ruissellement superficiel lent. Dans le bassin, la texture granulaire et perméable des sables éoliens disposés en strates sur les grés du Continental Terminal favorise l'infiltration et constitue une contrainte à la densité hydrographique.

2.1.3 Un relief de dunes assez contrasté

Le modelé global est un ensemble de vastes lambeaux de plateaux tabulaires, joins par de larges dépressions aux pentes variables de 2 % à 32 % (figure 4), souvent creusées par des vallées peu profondes.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

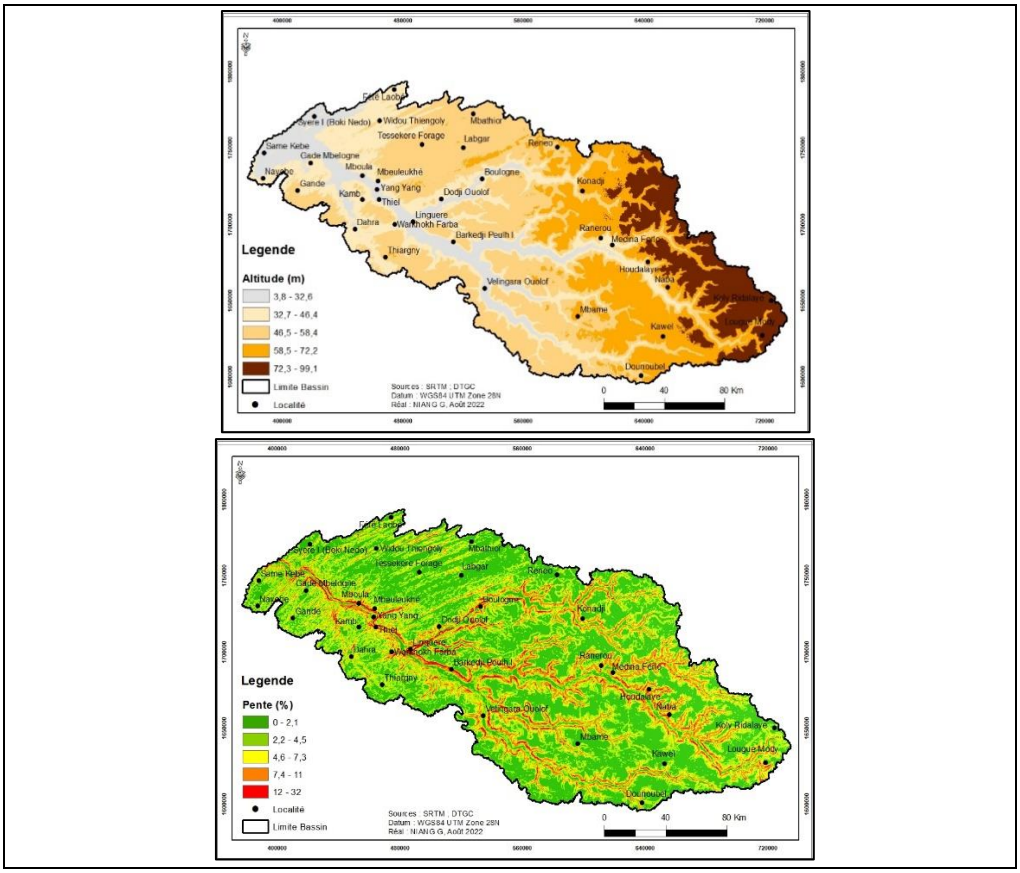

Figure 4. MNT et pentes du bassin versant du Ferlo

Les dunes dominent le paysage morphologique, atteignent 99,1 m au Sud-est et s'abaissent progressivement vers l'Ouest (3,8 m à l'exutoire). Elles s'étalent sous des formes et à des niveaux d'évolution différents.

Les paramètres du relief (tableau 5) mettent en exergue une dénivelée (ou relief du bassin – Rb) assez significative (95,3 m) résultant des variations altitudinales entre dunes et dépressions et d'une pente globale assez forte en témoigne le rapport du relief (Rr : 0,25). De ce fait, la valeur assez importante du relief relative (Rre : 6,15 %) et celle modérée du nombre de robustesse (Nr : 0,98) font état d'un bassin au potentiel de ruissellement moyen mais avec un degré de sensibilité assez important de la surface des sols à l'érosion.

Tableau 5. Les aspects de relief du bassin du Ferlo

Aspects de relief	
Relief du bassin (Rb en m)	95,3
Rapport du relief (Rr)	0,25
Relief relatif (Rre)	6,15
Nombre de robustesse (Nr)	0,98

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

2.2 Analyse fréquentielle des hauteurs de pluie

Sur les périodes de référence (figure 5), le nombre moyen annuel de pluies journalières évolue selon le rythme de la variabilité interannuelle et spatiale de la pluviométrie (14 à Linguère, 15 à Ranérou, 10 à Louga et 13 à Matam). Plus élevé durant la phase antérieure aux années 1970, il reste faible lors des décennies de sécheresse 1970-1980 puis croît progressivement depuis les années 1990. Les pluies de 10 à 20 mm, plus représentatives avec une fréquence de 43% à Linguère, 47 % à Ranérou et à Matam, 48 % à Louga, ne semblent pas être affectées par la variabilité pluviométrique. Les pluies de 21 à 30 mm ont une fréquence de 29 % à Linguère, 27 % à Ranérou, 23 % à Matam et 20 % à Louga. Les pluies de 31 à 40 mm et celles de plus de 40 mm ont la même fréquence dans toutes les stations : 14 % à Linguère, 13 % à Ranérou, 16 % à Louga et 15 % à Matam.

De fortes fréquences des hauteurs de pluie de 30 à 40 mm et > 40 mm peuvent être enregistrées dans les zones à plus faible pluviométrie (Louga) et même au cours des années de déficit ou des périodes de sécheresse. Ces situations indiquent que la distribution et la fréquence des hauteurs de pluie sont aléatoires ne suivent pas le rythme de la variabilité pluviométrique. Les pluies peuvent alors conserver partout leur potentiel érosif et même lors des décennies de sécheresse.

Les figures 6 et 7 révèlent que la moyenne des pluies maximales journalières a dépassé 50 mm pour toutes les stations (59,05 mm à Linguère, 58,28 mm à Matam, 51,79 mm à Louga et 60,63 mm à Ranérou). Le maximum a par ailleurs dépassé 100 mm à Matam (162,3 mm reçu le 09/08/1942), à Linguère (122 mm enregistré le 09/09/1998) et à Ranérou (128 mm reçu le 21/08/1983), mais s'estompe à 90,3 mm à Louga à la date du 11/08/1989. D'autres épisodes pluvieux supérieurs à 100 mm ont été observés à Linguère (107,2 mm le 03/08/1945), à Matam (100,3 mm le 17/08/1958 et 121,5 mm le 24/07/2004) et à Ranérou (104,7 mm le 15/09/2000, 127,5 mm le 27/06/2003 et 105,7 mm le 19/07/2005). L'application de la loi de Gumbel sur ces données a permis d'estimer la récurrence des maxima de la période post-1990 (tableaux 5 et 6).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

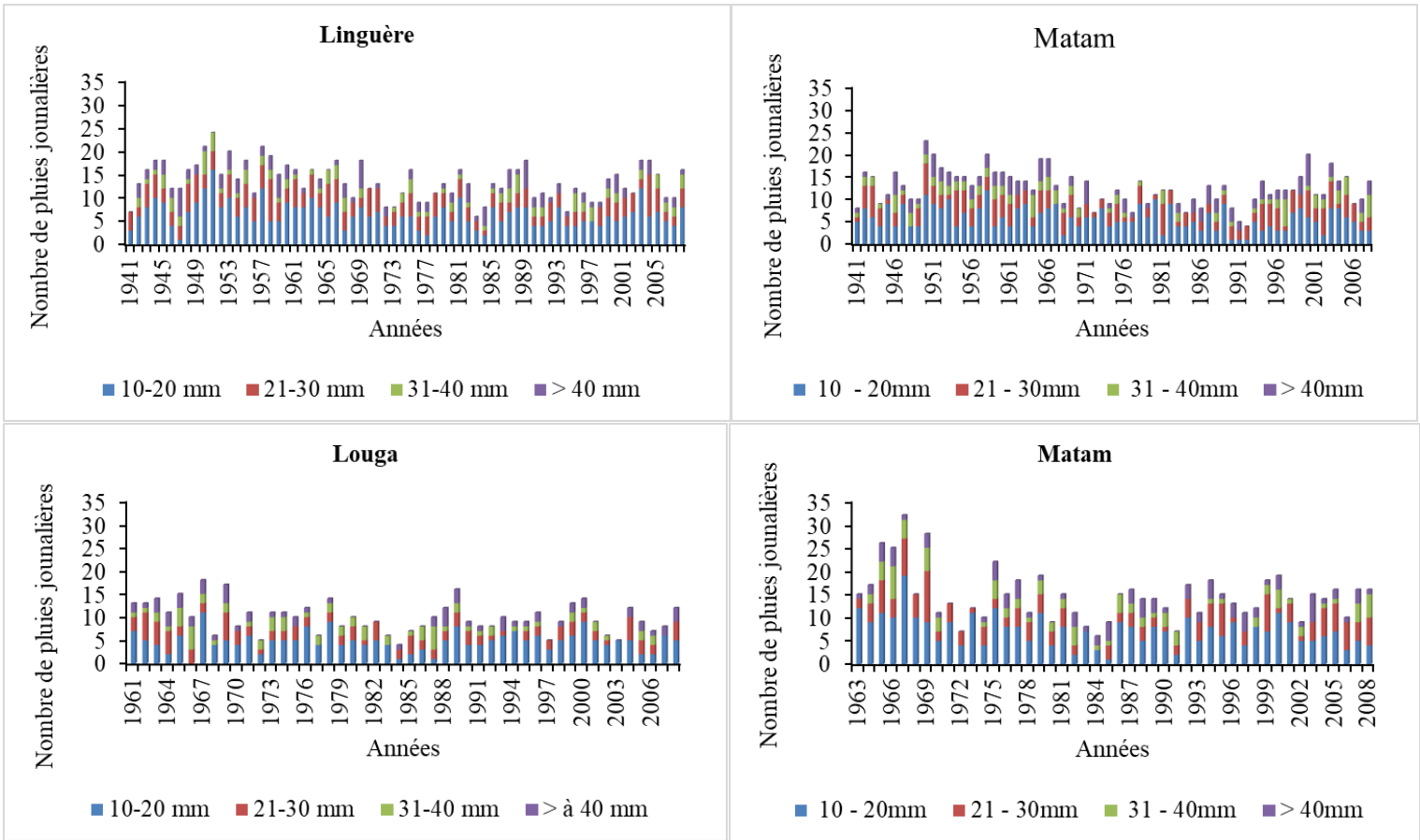

Figure 5. Evolution du nombre de pluies journalières à 10 mm de 1941 à 2008

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

L'évolution des pluies maximales journalières (figure 6) montre qu'à partir de 1990, les pluies dont le temps de retour dépasse 5 ans sont devenues très fréquentes. En plus, lors de cette période, au moins un maximum d'une récurrence de 10 ans et un autre d'une récurrence de 100 ans ont été enregistrés à Linguère et une pluie dont le temps de retour dépassant 20 ans a été recueillies à Matam.

Tableau 6. Récurrence des pluies maximales journalières (en mm) selon la loi de Gumbel de 1941 à 1990 à Linguère et à Matam

Récurrence		5 ans	10 ans	20 ans	50 ans	100 ans
Stations	Linguère	73,6	85,3	96,6	111,1	122
	Matam	79,6	95,4	110,6	130,2	144,8

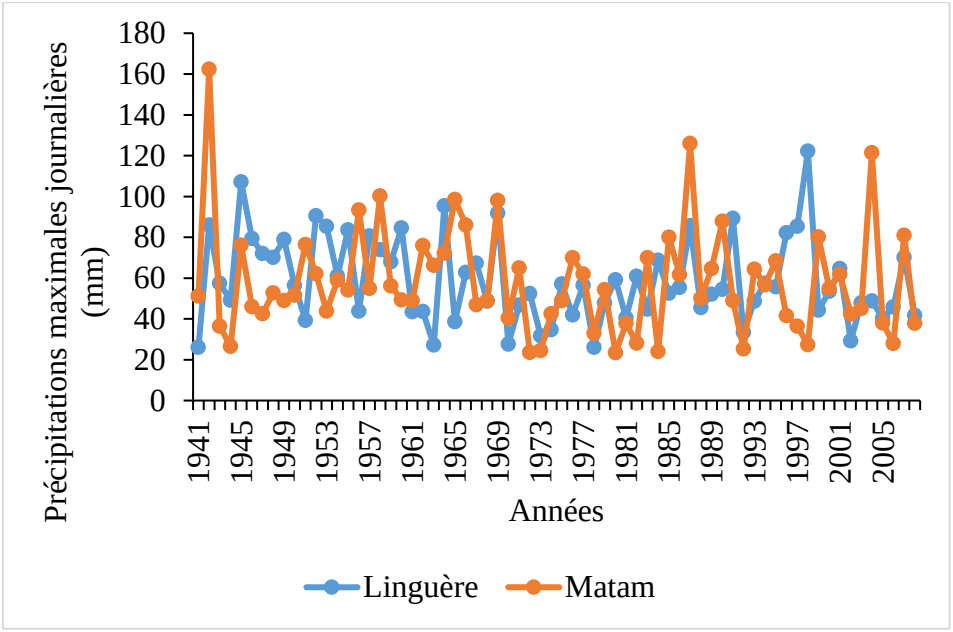

Figure 6. Evolution des précipitations maximales journalières de 1941 à 2008 à Linguère et à Matam

L'évolution des maxima journaliers au niveau des stations de Louga et de Ranérou (figure 7) montre que les hauteurs ayant un temps de retour dépassant 5 ans (68,3 mm, le 15 juillet 2005) et 10 ans (80 mm, le 28 Août 1999) à Louga et des maxima ayant un temps de retour dépassant 10 ans (104,7 mm, le 17 septembre 2000 et 105,7 mm, le 15 juillet 2005) et 20 ans à Ranérou ont été observés. Lors de cette période actuelle, un maximum de 100 mm dont la récurrence est égale environ 50 ans à Louga, entre 20 et 30 ans à Linguère et inférieure à 20 ans à Ranérou et à Matam, a été relevé au moins une fois dans chaque station. La pluviométrie dans le bassin du Ferlo reste donc marquée, aujourd'hui, par la hausse des hauteurs de pluies et de leur fréquence. Cette situation se traduit par une dynamique de l'érosion hydrique plus vive.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Tableau 7. Récurrence des pluies maximales journalières (en mm) selon la loi de Gumbel de 1963 à 1990 à Louga et à Ranérou

Récurrence		5 ans	10 ans	20 ans	50 ans	100 ans
Stations	Louga	67,5 mm	78,3 mm	88,6 mm	101,9 mm	111,9 mm
	Ranérou	78,1	94,5	110,3	130,7	146,1

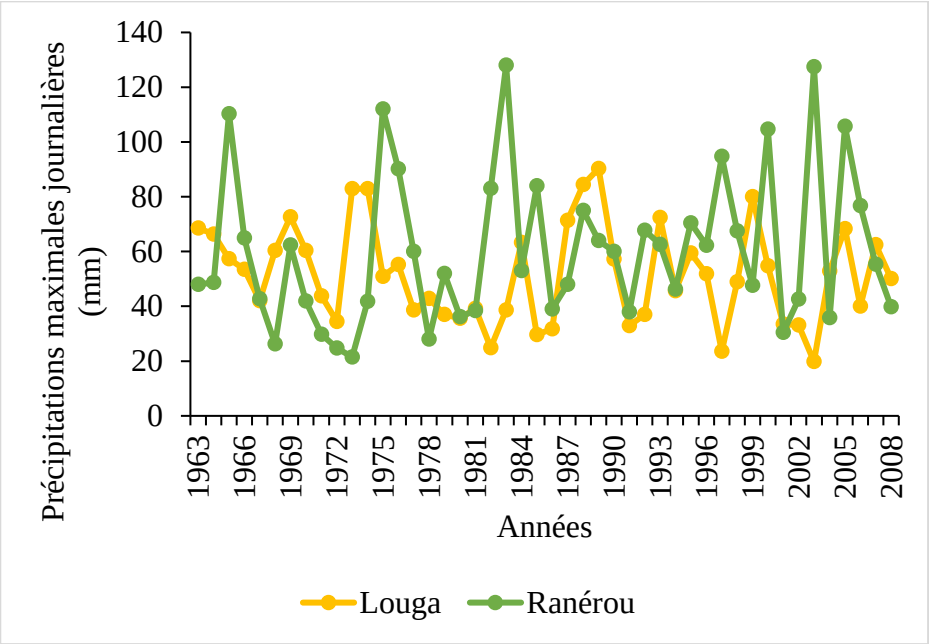

Figure 7. Evolution des précipitations maximales journalières de 1963 à 2008 à Louga et à Ranérou

2. Discussion

Les aspects linéaires, de formes et de relief ont permis de mettre en exergue l'influence de la géo-morphométrie sur la dynamique hydro-sédimentaire dans le bassin versant du Ferlo. L'impertinence de l'indice de compacité relative à l'utilisation du périmètre qui n'est pas fiable pour la détermination de la forme géométrique du bassin (Bendjoudi & Hubert, 2002) fait que les indices de forme qui ne font pas intervenir le périmètre du bassin versant sont aussi utilisés (le ratio d'élongation, le ratio de circularité et le facteur forme). Tous ces indices ont indiqué une forme allongée du bassin. Cette forme corrobore les résultats obtenus par Faye (2014) et ceux de Sow (2017) dans la zone couvrant le cours moyen du bassin du fleuve Sénégal. Quant à la densité de drainage (0,16 km/km²), la fréquence de flux (0,06) et la texture de drainage (0,0096), ils ont conféré au bassin une texture très grossière. La combinaison de facteurs de forme et de fréquence des affluents permet d'estimer le ruissellement du bassin (Faye C., 2014). Par ailleurs, les indices de forme, étant aussi des indicateurs de l'âge qualitatif du bassin versant (Pale, Kelele, & Da, 2020), font état d'un bassin en stade de jeunesse

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

au regard de sa forme allongée. Ainsi, le relief assez faible du bassin (95,3 m) et assez contrasté avec des pentes variant de 2,1% à 32% se caractérise par un potentiel de ruissellement assez faible. Cet état de fait s'explique par le rapport de relief (6,15%), mais aussi et surtout par une surface sensible à l'érosion comme l'atteste le nombre de robustesse (0,98) qui indique, par ricochet, que le réseau de drainage est sous un fort contrôle de la structure. Un système de ravinement est, ainsi, établi par le biais d'un réseau hydrographique, hiérarchisé en 5 ordres, drainant sur plusieurs kilomètres (47,52 km en moyenne) et très bifurquées (ratio de bifurcation de 5,025). Ces résultats s'opposent à ceux des travaux de Faye, 2018 ; Faye, et *al*., 2021 sur la partie continentale du bassin de la Gambie située dans le domaine climatique soudanien. Dans ces travaux, il a été démontré que les variables morphométriques du bassin du sixième ordre de la zone sont influencées par la lithologie et non par la structure.

La fréquence des hauteurs de pluie de 10-20 mm équivalent à la triple fréquence des hauteurs 30-40 mm ou de celle de plus de 40 mm montre que le caractère pluvieux du bassin est relié plus par l'importance du nombre de jours pluvieux que par la fréquence des grandes hauteurs de pluie. Toutefois, la baisse des fréquences de jours pluvieux est synchrone avec celle des hauteurs de pluies annuelles (Faty A., 2018). Depuis l'année 1969, la tendance est à la baisse jusqu'au début des années 1990 (Niang G. , 2021). C'est dans cette logique que Niang (2008) a indiqué un retour progressif des précipitations plus importantes depuis le début des années 90. Ainsi, la situation actuelle est marquée par une inégale distribution du nombre de jours de pluies (supérieures à 10 mm) et des maxima journaliers (supérieures à 40 mm), ainsi que la récurrence des pluies de plus de 100 mm qui dépasse légèrement 20 ans à Linguère et n'atteignant pas 20 ans sur les méridiens de Ranérou et de Matam. Les résultats issus de la caractérisation géo-morphométrique du bassin et ceux de l'analyse fréquentielle des hauteurs de pluie attestent que la morpho-dynamique hydrique a repris depuis le début des années 1990, mais de façon disparate dans le bassin.

Conclusion

L'érosion hydrique dans un milieu aride ou semi-aride du Sahel est régie par le ruissellement. Pour la compréhension de son processus et son contrôle, il devient nécessaire de calculer et d'interpréter les paramètres géo-morphométriques à l'aide de techniques SIG, mais aussi et surtout d'examiner le nombre et la fréquence des hauteurs de pluie.

Il ressort de cette étude que les processus hydro-sédimentaires du bassin du cinquième ordre du Ferlo sont influencés par la structure géologique et des conditions climatiques passées et actuelles. Les aspects morphométriques linéaires, de relief et de surface ont fait état d'un bassin jeune à potentiel de

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

ruissellement plus ou moins lent, au relief assez faible mais au substrat fortement sensible à l'érosion. De ce fait, la hausse amorcée depuis le début des années 1990 du nombre de jours pluvieux et de la fréquence des grandes hauteurs de pluie dont la récurrence dépasse 20 ans, 50 ans voire 100 ans indique une reprise de la dynamique érosive.

En définitive, la caractérisation géo-morphométrique et l'analyse fréquentielle des hauteurs de pluie sont des méthodes efficaces pour la maîtrise des problèmes environnementaux tels que la sécheresse, les inondations et l'érosion des sols à l'échelle d'un bassin versant.

Conflit d'intérêts : Les auteurs n'ont déclaré aucun conflit d'intérêts.

Disponibilité des données : Toutes les données sont incluses dans le contenu de l'article.

Déclaration de financement : Les auteurs n'ont obtenu aucun financement pour cette recherche.

Déclaration relative aux participants humains : Cette étude n'avait pas besoin d'être approuvée puisqu'aucune donnée vivante n'a été manipulée. Elle n'est donc pas concernée par les principes de la Déclaration d'Helsinki.

References:

1. Bendjoudi, H., & Hubert, P. (2002, décembre). Le coefficient de compacité de Gravelius : analyse critique d'un indice de forme des bassins versants. *Journal des sciences hydrologiques, 47*(6), pp. 921-930.
2. Bodian, A. (2011). *Approche par modélisation pluie-débit de la connaissance régionale de la ressource en eau : Application au haut bassin du fleuve Sénégal.* Thèse de doctorat, UCAD.
3. Cheggour, A. (2008). *Mesure de l'érosion hydrique à différentes échelles spatiales dans un bassin versant montagneux semi-aride et spatialisation par des SIG : Application au bassin versant de la Rhéraya, haut-atlas, Maroc.* Thèse de doctorat, Université Caddi-Ayyat, Semlalia-Marrakech.
4. Cissokho, R. (2011). *Développement d'un indice de vulnérabilité des sols à l'érosion éolienne à partir d'images sattelitales dans le bassin arachidier du Sénégal : cas de la région de Thiès.* Thèse de doctorat, Université Monréal.
5. Dacosta, H. (1989). *Précipitations et écoulements sur le bassin de la Casamance.* Thèse de doctorat de 3e Cycle, UCAD, Département de Géographie.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

6. Faty, A. (2018). *Modélisation hydrologique du haut bassin versant du fleuve Sénégal dans un contexte de variabilité hydro-climatique : Apport de la télédétection et du modèle Mike SHE.* Thèse de doctorat, UCAD, Département de Géographie.
7. Faty, A., Kane, A., & Ndiaye, A. L. (2017). Influence de la manifestation climatique sur les régimes pluviométriques saisonniers dans le haut bassin versant du Sénégal. *Revue des sciences de l'eau, 30*(2), pp. 79-87.
8. Faye, C. (2014). Méthodes d'analyse statistiques de données morphométriques : Corrélation de paramètres morphométriques et influence sur l'écoulement des sous-bassins versants du fleuve Sénégal. *Cinq Continents, 4*(10), pp. 80-108.
9. Faye, C. (2018). Caractérisation d'un bassin versant par l'analyse statistique des paramètres morphométriques : cas du bassin versant de la Gambie. (bassin continental Guineo-Sénégalais). *Revue Marocaine de Géomorphologie*(2), pp. 110-127.
10. Faye, C., Dieye, S., & Faye, G. (2021, Juin). Analyse morphométrique et hydrologique du sous-bassin versant du Niaoulé (bassin de la Gambie) à l'aide de techniques SIG. *Algerian journal of arid environment, 11*(1), pp. 54-75.
11. Fort, M., François, B., & Arnaud-Fassetta, G. (2015). *Géomorphologie dynamique et environnement.* Paris: Armand Colin.
12. Gravelius, H. (1914). Grundrifi der gesamten Gewcisserkunde. Band I : Flufikunde. *Compendium of Hydrology, I : Rivers, in German*, pp. 138-141.
13. Horton, R. E. (1945). Erosional Development of Streams and their Drainage Basins : Hydro-physical Approach to Quantitative Morphology. *Bulletin of the Geological Society of America*(56), pp. 275-370.
14. Laborde, J. P. (2000). *Eléments d'hydrologie de surface.*
15. Michel, P. (1973). *Les bassins des fleuves Sénégal et Gambie: Etude Géomorphologique.* Mémoire n°63, ORSTOM.
16. Miller, V. C. (1953). A quantitative geomorphic study of drainage basin characteristics in the Clinch Mountain area, Virginia and Tennessee. *Tech. Report. N° 3, Dept OF Geology, University Columbia*.
17. Niang, A. J. (2008). *Les processus morphodynamiques, indicateurs de l'état de la désertification dans le sud-ouest de la Mauritanie. Approche par analyse multisource.* Thèse de doctorat, Université de Liège, Département de Géographie/Faculté des sciences.
18. Niang, G. (2021). *Etude comparative des bassins versants de la basse vallée du Ferlo et du lac de Guiers : Dynamique actuelle de l'érosion,*

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

impacts et stratégies de lutte. Thèse de doctorat, Université Cheikh Anta Diop.

19. Pale, S., Kelele, A., & Da, D. E. (2020). Caractérisation géomorphométrique des formes de relief dans le bassin versant du Poni, au Burkina Faso. *Afrique SCIENCE, 3*(17), pp. 62-77.
20. Rama, A. V. (2014, Octobre). Drainage basin analysis for characterization of 3rd order watersheds using Geographic Information System (GIS) and ASTER data. *Journal of Geomatics, 8*(2), pp. 200-210.
21. Schumm. (1956). Evolution of drainage systems and slopes in badlands at Perth Amboy. *Bull.Geo.Soc.Am*(67), pp. 597-646.
22. Singh, A. P., Arya, A. K., & Singh, D. H. (2020). Morphometric Analysis of Ghaghara River Basin, India, Using SRTM Data and SIG. *JOURNAL GEOLOGICAL SOCIETY OF INDIA, 95*, pp. 169-178.
23. Smith, G. H. (1939). The morphometry of Ohio: The average slope of the land (Abstract). *Annals of the Association of American Geographers, 29*(94).
24. Sogon, S. (1999). *Erosion des sols cultivés et transports des matières en suspension dans un bassin versant de Brie, Application des traceurs radioactifs naturels et magnétiques.* Thèse de doctorat, Université Paris I_Panthéon-Sorbone.
25. Sow, A. A. (2007). *L'hydrologie du Sud-est du Sénégal et de ses confins Guinéo-Maliens. Les bassins de la Gambie et de la Falémé.* Thèse de doctorat d'Etat es Lettres et Sciences humaines, UCAD, Département de Géographie.
26. Sow, S. A. (2017). *Morphodynamique hydrique par ravinement et ses conséquences dans le bassin versant de Ourassogui, Nord du Sénégal.* Université Gaston Berger, Saint-Louis.
27. Strahler, A. N. (1957). Quantitative Analysis of Watershed Geometry. *Transactions of American Geophysical Union*(38), pp. 913-920.
28. Zakaria, M., Majumder, A.-K., & Rahman, M. M. (2016, Juin). Morphometric Analysis of Reju Khal Drainage Basin using Geographic Information System (GIS) and SRTM data. *International Journal of Scientific & Engineering Research, 7*(6), pp. 661-470.

ESJ Humanities Peer-reviewed

Cartographie Automatique des Zones Inondées et Evaluation des Dommages dans le District d'Abidjan depuis Google Earth Engine

Youn Ta Marc
Enseignant-Chercheur, Hydrogéologie, Télédétection, Base de Données et WEBSIG, Centre Universitaire de Recherche Appliquée en Télédétection (CURAT), Université Félix Houphouët-Boigny d'Abidjan-Cocody, Abidjan, Côte d'Ivoire
Njeugeut Mbiafeu Amandine Carine
Doctorant, Centre Universitaire de Recherche Appliquée en Télédétection (CURAT), Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire
Kamenan Satti Jean-Robert
Doctorant, Institut National Polytechnique Houphouët-Boigny (EDP-INPHB), Yamoussoukro, Côte d'Ivoire
Assoma Tchimou Vincent
Enseignant-Chercheur, Hydrogéologie, Télédétection et SIG, Centre Universitaire de Recherche Appliquée en Télédétection (CURAT), Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire
Jourda Jean Patrice
Enseignant-Chercheur, Télédétection et SIG en Hydrogéologie, Centre Universitaire de Recherche Appliquée en Télédétection (CURAT), Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire

Doi:10.19044/esj.2023.v19n32p54

Submitted: 30 September 2023
Accepted: 09 November 2023
Published: 30 November 2023

Cite As:
Youn Ta M., Njeugeut Mbiafeu A.C., Kamenan Satti J.R., Assoma T.V. & Jourda J.P. (2023). *Cartographie Automatique des Zones Inondées et Evaluation des Dommages dans le District d'Abidjan depuis Google Earth Engine*. European Scientific Journal, ESJ, 19 (32), 54. https://doi.org/10.19044/esj.2023.v19n32p54

Résumé

L'objectif de cette étude est de générer automatiquement des cartes de l'étendue des zones inondées dans le district d'Abidjan et d'évaluer les dommages causés. L'approche méthodologique a consisté à cartographier l'étendue des zones inondées en utilisant une méthode de détection des

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

changements basée sur les données Sentinel-1 (SAR) avant et après une crue spécifique. Ensuite, les différentes classes d'enjeux (telles que les cultures, les zones habitées, les bâtiments, les routes et la densité de la population) ont été extraites à partir de diverses sources de données gratuites. Puis la superficie des enjeux affectés a été évaluée, en superposant les classes d'enjeux sur les zones inondées. De plus, une interface web a été conçue à l'aide des packages de Google Earth Engine. Cette interface web offre à l'utilisateur la possibilité de visualiser l'étendue des zones inondées et les cartes des enjeux affectés, avec une estimation statistique, pour une date donnée dans l'intervalle allant de 2015 à la date actuelle. La cartographie des zones inondées à la date du 25 juin 2020 a révélé une superficie totale de 25219,23 hectares de zones inondées soit 11,50% de la superficie totale du District d'Abidjan. Une estimation des dégâts causés par cette crue indique que 22 307,53 hectares d'enjeux ont été affectés en moyenne, ce qui représente 88,45 % des zones inondées. Cette répartition se décompose en 13 538,49 hectares (soit 53,68 %) de terres agricoles touchées et 8 769,04 hectares (soit 34,77 %) de zones urbaines touchées, impactant en moyenne 35 065 personnes. Les résultats de cette étude ont permis de constater que la partie centrale de la zone d'étude, au-dessus de la lagune, présente le plus grand potentiel de risque d'inondation en raison de la morphologie du terrain et de la vulnérabilité élevée des zones construites qui occupent la plaine inondable.

Mots-clés: Inondation, Intelligence artificielle, Apprentissage automatique, Google earth engine, Sentinel-1, Alos Polsar, Abidjan, Côte d'Ivoire, dommages

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Automatic Mapping of Flooded Areas and Damage Assessment in Abidjan District, using Sentinel-1 radar Satellite Imagery from Google Earth Engine

Youn Ta Marc
Enseignant-Chercheur, Hydrogéologie, Télédétection, Base de Données et WEBSIG, Centre Universitaire de Recherche Appliquée en Télédétection (CURAT), Université Félix Houphouët-Boigny d'Abidjan-Cocody, Abidjan, Côte d'Ivoire
Njeugeut Mbiafeu Amandine Carine
Doctorant, Centre Universitaire de Recherche Appliquée en Télédétection (CURAT), Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire
Kamenan Satti Jean-Robert
Doctorant, Institut National Polytechnique Houphouët-Boigny (EDP-INPHB), Yamoussoukro, Côte d'Ivoire
Assoma Tchimou Vincent
Enseignant-Chercheur, Hydrogéologie, Télédétection et SIG, Centre Universitaire de Recherche Appliquée en Télédétection (CURAT), Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire
Jourda Jean Patrice
Enseignant-Chercheur, Télédétection et SIG en Hydrogéologie, Centre Universitaire de Recherche Appliquée en Télédétection (CURAT), Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire

Abstract

The objective of this study is to automatically generate maps of the extent of flooded areas in the Abidjan district and assess the resulting damages. The methodological approach involved mapping the extent of flooded areas using a change detection method based on Sentinel-1 (SAR) data before and after a specific flood event. Subsequently, various classes of assets, such as crops, residential areas, buildings, roads, and population density, were extracted from various free data sources. The affected asset areas were then evaluated by overlaying the asset classes on the flooded areas. Furthermore, a web interface was designed using Google Earth Engine packages. This web interface allows users to visualize the extent of flooded areas and maps of the affected assets, along with statistical estimates, for a specific date within the interval from 2015 to the current date. Mapping of the flooded areas as of June 25, 2020, revealed a total area of 25219.23 hectares of flooded areas, representing 11.50% of the total area of the Abidjan District. An estimation of the damages caused by this flood indicates that, on average, 22307.53 hectares

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

of assets were affected, accounting for 88.45% of the flooded areas. This distribution breaks down into 13538.49 hectares (53.68%) of affected agricultural lands and 8769.04 hectares (34.77%) of affected urban areas, impacting an average of 35,065 people. The study results revealed that the central part of the study area, located above the lagoon, presents the highest flood risk potential due to the terrain's morphology and the high vulnerability of built-up areas occupying the floodplain.

Keywords: Flooding, Artificial Intelligence, Machine Learning, Google Earth engine, Sentinel-1, Alos Polsar, Abidjan, Côte d'Ivoire, Damages

1 Introduction

Les zones urbaines de la Côte d'Ivoire sont régulièrement affectées par de fortes crues, en particulier dans le sud du pays (Adje & Kouadio, 2021; Mahaman Bachir et al., 2005). Abidjan, qui abrite la plus forte concentration humaine et des activités économiques du pays, est particulièrement menacée (ALLA et al., 2019). Ces phénomènes se répètent dans la ville et touchent toutes les classes sociales dans certains quartiers. Une analyse de l'impact des inondations urbaines à Abidjan a révélé de nombreuses pertes matérielles et plusieurs décès, soit 19 en 2022, 17 en 2020, 16 en 2015, 23 en 2014, 28 en 1996, avec une moyenne annuelle de 13 décès depuis 2009 (Fulbert, 2022).

Plusieurs facteurs socioéconomiques, démographiques, technologiques et topographiques de l'environnement urbain contribuent à aggraver le phénomène d'inondation dans le District d'Abidjan. Il s'agit notamment des défaillances dans le système d'assainissement et de drainage (ALLA et al., 2019; T. Ouattara et al., 2021), de l'imperméabilisation des sols (Jourda et al., 2003; Konaté et al., 2016), de la topographie du milieu (Alla et al., 2018; Ambroise et al., 1996), du développement urbain mal contrôlé et rapide (Habal, 2021; Savane et al., 2003), et des variations des événements pluvieux (Hauhouot, 2008; Konaté et al., 2016).

Face aux fréquentes inondations à Abidjan, une carte pertinente et détaillée du risque s'avère indéniablement un outil essentiel pour aider les populations à mieux appréhender le risque d'inondation dans la ville.

L'étude du risque d'inondation en milieu urbain est une problématique complexe qui exige une approche intégrée mobilisant plusieurs sources de données et disciplines. L'éventail de capteurs optiques et radar à haute résolution (avec différentes caractéristiques spectrales, spatiales et temporelles) ainsi que les nouvelles méthodes d'exploitation des données spatiales soulignent l'importance de la télédétection et des systèmes d'information géographique (SIG) comme outils fondamentaux pour l'inventaire, l'analyse et la cartographie des paramètres liés au risque d'inondation(Eba et al., 2021; Konaté et al., 2016). Cependant, de nouvelles

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

technologies basées sur le cloud, l'intelligence artificielle et les données de très haute résolution ont émergé, Il est donc judicieux d'explorer ces nouvelles approches pour améliorer la compréhension du phénomène d'inondation dans la zone d'étude.

L'objectif principal de cette étude est d'accroître les connaissances sur les inondations pluviales dans le District d'Abidjan et de proposer des outils de suivi ainsi que d'aide à la prise de décision, en vue d'améliorer la résilience des populations.

Afin de répondre à l'objectif principal qui a été fixé, il a été possible de manière spécifique de:

cartographier avec précision l'étendue des zones inondées en utilisant une méthode de détection des changements basée sur les données Sentinel-1 (SAR) avant et après une crue spécifique depuis GEE;

extraire et estimer la superficie des différentes classes d'enjeux affectées (telles que les cultures, les zones habitées, les bâtiments, les routes et la densité de la population);

concevoir une interface web qui offre la possibilité à l'utilisateur de visualiser l'étendue des zones inondées et les cartes des enjeux de surfaces affectés, avec une estimation statistique, pour une date donnée dans l'intervalle allant de 2013 à la date actuelle.

1 Zone d'Etude

Le District d'Abidjan est situé dans le Sud de la Côte d'Ivoire entre les latitudes 5°13' - 5°37' Nord et les longitudes 3°43' et 4°25' Ouest. Il est bordé au Sud par l'Océan Atlantique, au Sud-Ouest par le département de Dabou, au Sud-Est par le département de Grand-Bassam, au Nord par le département d'Agboville, à l'Ouest par le département de Grand-Lahou, et à l'Est par le département d'Alépé (Figure 1). Il s'étend sur une superficie d'environ 2137,43 km², et regroupe les communes d'Abobo, d'Adjamé, d'Anyama, d'Attécoubé, de Bingerville, de Cocody, de Koumassi, de Marcory, de Treichville, du Plateau, de Port-Bouët, de Songon et de Yopougon, auxquelles s'ajoute la sous-préfecture de Brofodoumé (INS, 2014).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

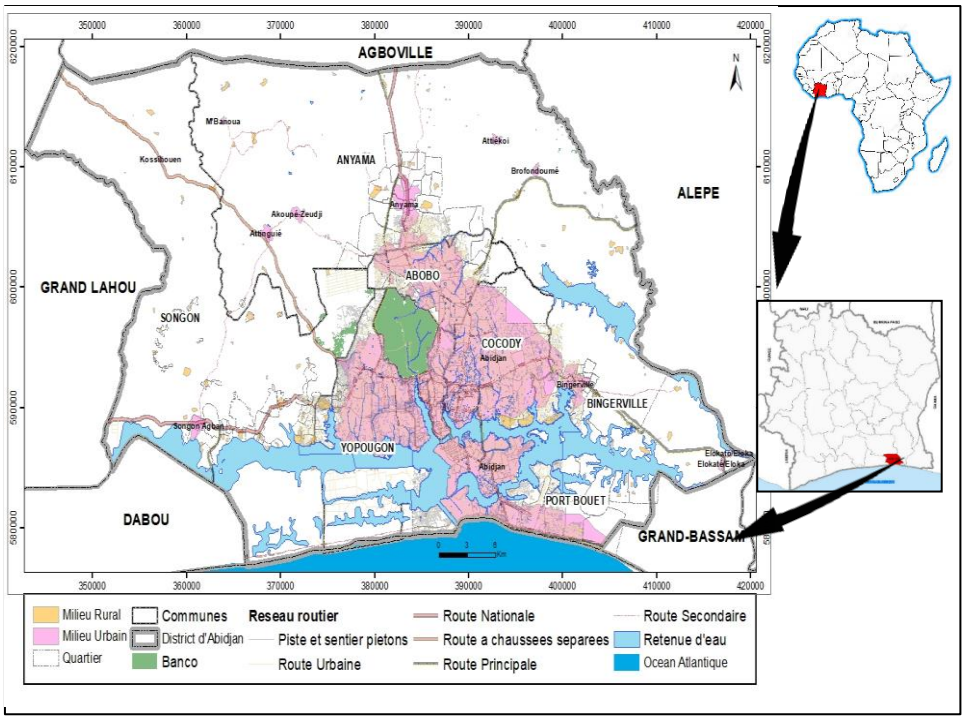

Figure 1. Situation géographique du District d'Abidjan

Cette région connaît une croissance continue marquée par une forte industrialisation et une urbanisation significative. La population était estimée à 65 000 habitants en 1950, 180 000 habitants en 1960, environ 1 million en 1975, environ trois millions d'habitants en 1998, 4 707 404 habitants en 2015 et 6 321 017 habitants selon le recensement global de la population fait par l'Institut National de Statistique en 2021 (INS, 2014). La population d'Abidjan est répartie de manière inégale dans l'espace et concentrée en milieu urbain (Figure 2).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

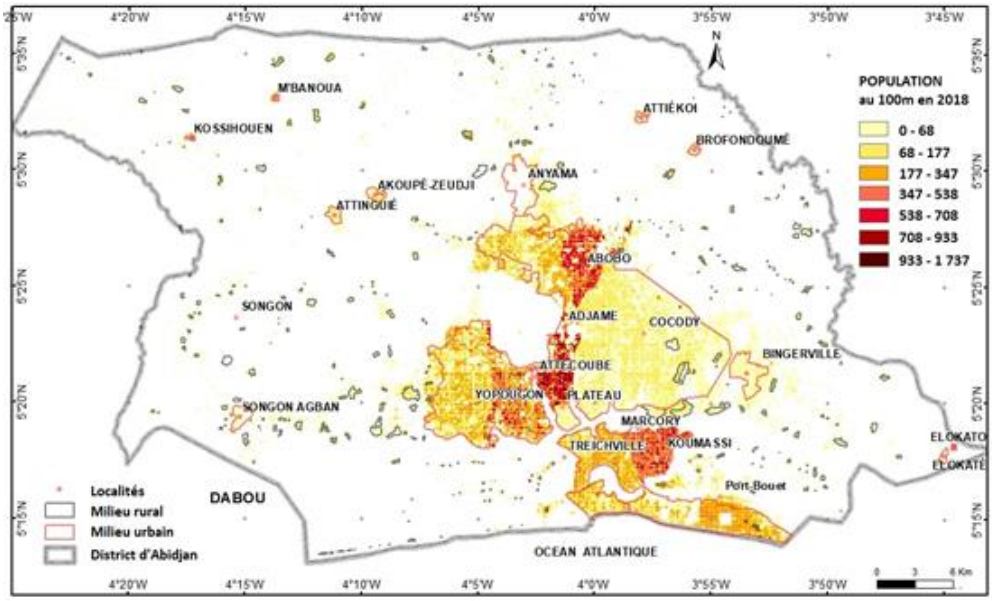

Figure 2. Répartition spatiale de la population du District d'Abidjan au 100 m (PopulationStat, 2021)

Le District d'Abidjan est traversé par trois principales rivières : la Comoé, la Tanoé et la Agnéby, Ces rivières jouent un rôle important dans le drainage de la région et l'approvisionnement en eau de la ville. Le système de drainage dans la zone d'étude présente une densité moyenne, avec un régime essentiellement irrégulier étroitement lié aux précipitations. Pendant la saison des pluies, les débits sont élevés avec de grandes inondations, tandis qu'en saison sèche, le débit diminue et les étangs se dessèchent, Les fleuves jouent principalement un rôle de drainage des eaux, tandis que certains cours d'eau ont été aménagés en caniveaux (Figure 3).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

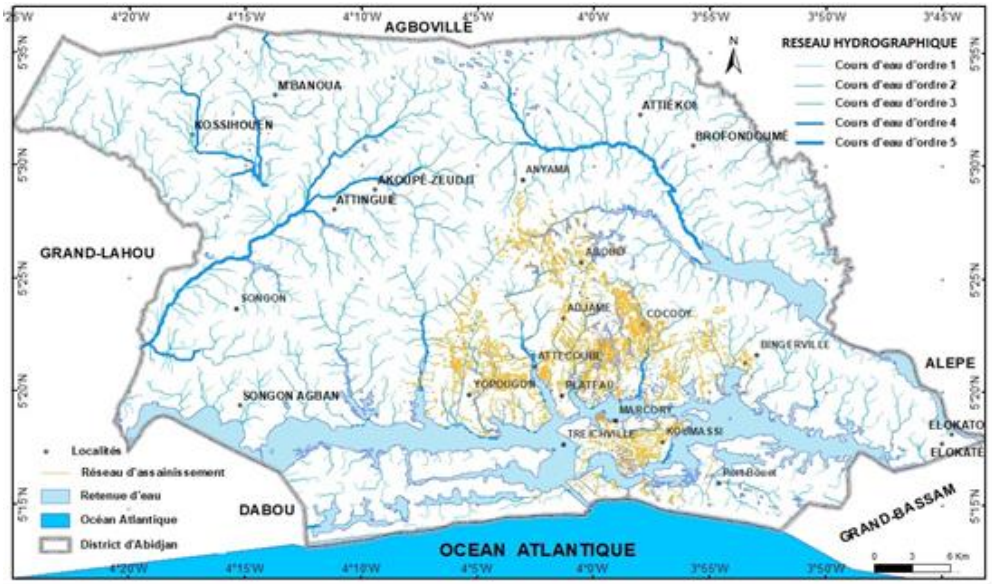

Figure 3. Système de drainage des eaux de la zone d'étude.

Le district d'Abidjan présente une variété de vallées et de formations géologiques, notamment les vallées fluviales formées par l'érosion causée par les rivières et les cours d'eau au fil du temps. On y trouve également des vallées estuariennes, généralement situées aux embouchures des rivières et dans les zones côtières soumises aux marées, ainsi que des vallées alluviales qui résultent du dépôt de sédiments transportés par les cours d'eau. La topographie du district d'Abidjan est profondément influencée par ces différents types de vallées, en plus de la présence des rivières, des lagunes et de l'environnement côtier. Chacune de ces vallées a un impact significatif sur la planification de l'utilisation des terres et sur le risque d'inondation dans la région.

Le modèle du réseau d'assainissement pluvial est constitué d'un ensemble d'ouvrages de drainage à ciel ouvert qui traversent des zones urbanisées et se connectent au milieu naturel par un grand talweg principal. Ce talweg achemine par gravité les eaux de pluie jusqu'à la lagune Ebrié, et sa sortie est équipée d'un groupe de buses pour évacuer les eaux en période de crue.

Cependant, certains de ces caniveaux ont été obstrués par des déchets, des ordures ou le dépôt de sable, tandis que d'autres ont été recouverts par un aménagement. Lors des événements pluvieux, un débordement rapide des ouvrages de drainage est observé. En aval, les batteries de buses sont submergées et ne parviennent plus à évacuer efficacement les eaux, entraînant une montée excessive du flux pluvial. Ceci conduit à des inondations qui submergent les routes et leurs environs, occasionnant ainsi de nombreux dégâts matériels.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

2 Materiela et methodes

2.1 Données

Cette étude requiert une vaste base de données comprenant les images satellites, les informations dérivées de l'occupation du sol, et les bases de données libres. Les images satellites utilisées pour l'élaboration de cette étude sont de type RSO (Radar à Synthèse d'Ouverture) Sentinel-1 et de type Modèle Numérique d'Élévation provenant du satellite ALOS PALSAR (Tableau 1).

Tableau 1. Caractéristiques des images satellites

Produit	Disponibilité	Résolution spatiale
RSO (Radar à Synthèse d'Ouverture) Sentinel-1	Acquisition d'images tous les 12 jours depuis le 3 avril 2014 et tous les 6 jours depuis le 25 avril 2016 avec l'association des deux satellites Sentinel-1A et Sentinel-1B,	10m
MNT ALOS PALSAR	24 janvier 2006	12,5m

Les images Sentinel-1 en bande C de la collection COPERNICUS/S1, en polarisation verticale d'émission/horizontale de réception (VH) ont été utilisées pour cartographier l'étendue des zones inondées en période de crue. Le choix de cette image est guidé par la qualité des images et leur disponibilité dans la zone d'étude. Contrairement à d'autres capteurs qui peuvent être affectés par les conditions météorologiques (nuages, pluie, obscurité), Sentinel-1 fonctionne en émettant des ondes radar et en mesurant leur réflexion, ce qui lui permet d'acquérir des images indépendamment des conditions météorologiques. Le système Sentinel-1 est composé de deux satellites (Sentinel-1A et Sentinel-1B) qui fournissent une grande fréquence de répétition des observations, ce qui permet de surveiller les zones inondées de manière régulière et de suivre leur évolution au fil du temps, La résolution spatiale des données Sentinel-1 est généralement suffisamment élevée pour distinguer les détails des zones inondées et des caractéristiques environnantes. Pour une appréciation optimale d'une étude en fonction du temps, il est judicieux d'utiliser des images de la même saison afin d'éviter les différences de réflectance des objets observables sur l'image. Ces raisons ont dicté le choix des images sentinel-1.

Le Modèle Numérique d'Élévation provenant du satellite ALOS PALSAR avec une résolution de 12,5 m rééchantillonné à 10m, et les cartes de la distribution spatio-temporelle des eaux de surface de 1984 à 2020 provenant du « JRC Global Surface Water Mapping », ont été exploitées pour affiner l'extraction des zones inondées.

Les données sur la population issues du GPWv411 (Gridded Population of the World version 4,11), les informations sur l'occupation issu des travaux de (Njeugeut et al., 2023), les données sur les bâtiments provenant de Open Buildings V2, ainsi que les informations sur le réseau routier et les

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

équipements issus de OSM (OpenStreetMap) ont également été utilisés pour estimer l'impact des zones inondées sur les enjeux dans le District d'Abidjan. Les données de terrain sont essentiellement les informations collectées sur les crues historiques telsque les emplacements des zones inondées et les niveaux d'eau observés lors des crues. Le choix des localités enquêtées s'est fait sur la base de la récurrence du phénomène de crue.

Le Code Editor de Google Earth Engine ainsi que le langage Java ont été exploités pour développer des scripts permettant de cartographier les zones inondées et d'estimer les dommages dans la zone d'étude. Pour automatiser le processus et convertir les scripts en applications via GEE, les packages de deveoppement d'application web offerts par Google earth engine telque ui,Select(), ui,Button() et ui,Panel(), ont été utilisés.

2.2 Méthodes

La méthodologie générale utilisée pour cartographier les zones potentiellement inondées afin d'estimer les dommages survenus en raison de l'inondation, dans GEE s'est faite en cinq étapes essentielles : i) cartographie ou détection des zones inondées ; ii) cartographie des enjeux ; iii) évaluation des dommages causés ; iv) Suivi temporel et v) développement de l'application de suivi des zones inondées (Figure 4).

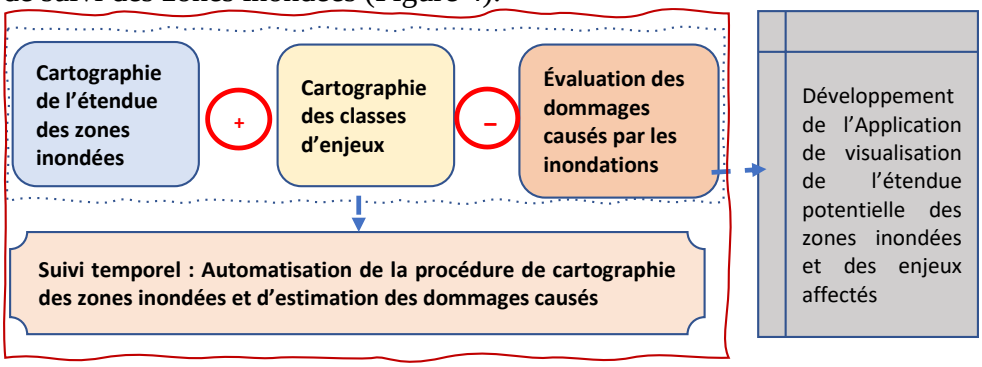

Figure 4. Diagramme simplifié de la Cartographie automatique des zones inondées et évaluation des dommages depuis Google Earth Engine

2.2.1 Cartographie des zones inondées

La cartographie des zones inondées (Figure 5) repose sur le traitement des images SAR (Synthetic Aperture Radar) de Sentinel-1 pour générer la carte de l'étendue des zones inondées. Ce processus comprend un traitement initial à l'aide du filtre de speckle, suivi de la détection des changements. Une approche de détection de changement est mise en œuvre en comparant une image avant et après un événement de crue.

Figure 5. Organigramme de la chaine de traitement pour la cartographie des zones inondées avec Google Earth Engine

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

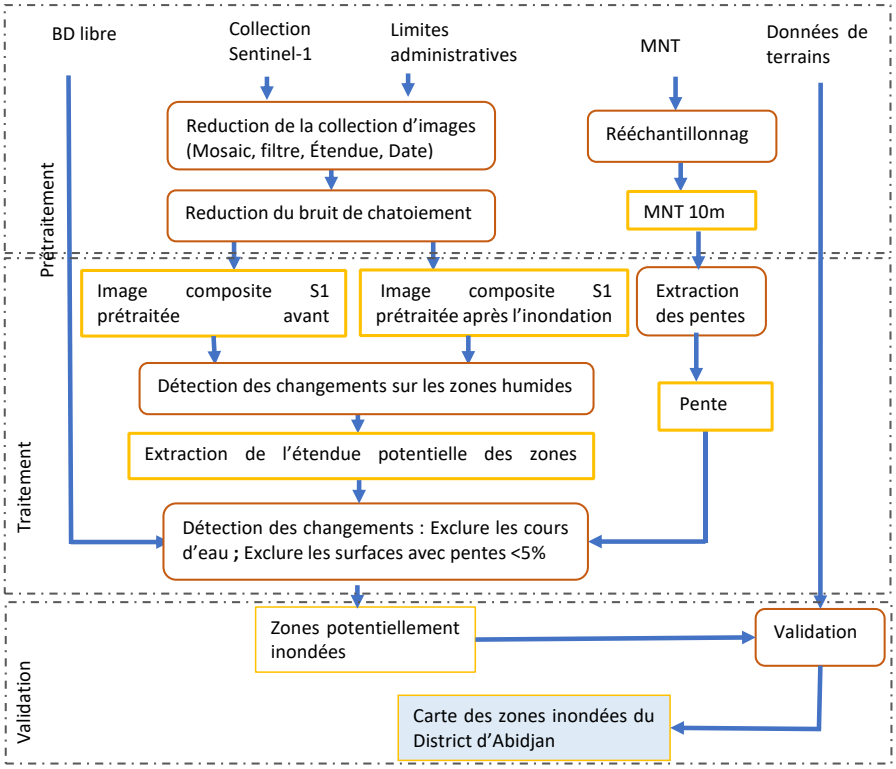

Figure 5 : Organigramme de la chaine de traitement pour la cartographie des zones inondées avec Google Earth Engine

2.2.1.1 Sélection et prétraitement des images

Les produits GRD (Ground Range Detected) de niveau-1 de Sentinel-1 dans Google Earth Engine (GEE) sont fournis avec plusieurs prétraitements nécessaires pour l'étude (calibrage radiométrique, correction du terrain ou orthorectification). En conséquence, seule la réduction de la collection d'images et l'élimination du bruit de chatoiement sont appliquées à l'ensemble des images Sentinel-1 dans ce processus.

Dans l'environnement de l'éditeur de code GEE, plusieurs contraintes ont été imposées sur les paramètres d'acquisition des images SAR (Radar à Synthèse d'Ouverture) Sentinel-1 afin de réduire la collection d'images disponibles dans l'ImageCollection 'COPERNICUS/S1_GRD' de GEE. Ces contraintes ont permis de sélectionner les images appropriées pour l'étude sur les inondations avec comme paramètres :

- le mode d'acquisition par Interferometric Wide (IW) ;
- la polarisation VH (émission verticale, réception horizontale) particulièrement adaptée à la cartographie des inondations ;
- la direction de l'orbite "ASCENDANT" sélectionné afin d'éviter les faux signaux positifs causés par les différences d'angle de vue ;

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

- la résolution spatiale de 10 m pour assurer une meilleure superposition des différentes couches d'information.

Des périodes temporelles ont été définies pour permettre la sélection d'un nombre suffisant d'images couvrant la zone d'étude sur un intervalle de temps donné. Pour un évènement de crue donné, deux périodes d'étude sont fixées :

- un mois avant la date de crue, considérée comme la période avant l'inondation ;
- un mois après la date de crue, considérée comme la période après l'inondation,

Pour atténuer l'effet du chatoiement inhérent à l'imagerie radar Sentinel-1 de niveau-1 Ground Range Detected (GRD), le filtre de lissage speckle a été appliqué aux produits GRD des événements avant et après l'inondation. Le filtrage a été réalisé en utilisant la technique du filtre moyen avec un rayon de lissage de 50 mètres, en utilisant un noyau circulaire à cette fin. L'objectif de ce filtre est d'estimer le bruit à partir du signal observé et de le réduire tout en préservant la radiométrie et les informations texturales de l'image. En éliminant les chatoiements grâce à cette technique de filtrage, la qualité des images radar est améliorée, permettant ainsi une meilleure perception des détails et des caractéristiques des zones inondées pour notre étude.

Le Modèle Numérique de Terrain (MNT) Alos Polsar de 12,5 m de résolution a subi un rééchantillonnage à 10 m avant d'être utilisé dans l'analyse géospatiale de cette étude. Ceci s'est fait dans l'optique d'adapter le MNT à une résolution qui permet de garantir la conformité avec les autres données utilisées et obtenir une représentation plus lisse du terrain.

2.2.1.2 Extraction de l'étendue potentielle des zones inondées

L'extraction des zones inondées s'est faite par une approche simple et directe de détection des changements (Long et al., 2014). Pour un évènement historique connu, des images pré (R) et post (F) inondation ont été sélectionnées. Ensuite, la mosaïque après-inondation est divisée par la mosaïque avant-inondation (Eq. 1). Ce qui permet d'obtenir une couche raster de l'indice de différence (ID) qui montre le degré de changement par pixel dans la scène, y compris les zones inondées.

$$ID = F/R \quad \text{(Éq. 1)}$$

Ensuite, le seuillage est appliqué à l'indice de différence (ID) pour détecter les zones inondées. Le seuil dépend des caractéristiques de l'étude. La valeur positive élevée est utilisée pour détecter les augmentations de rétrodiffusion radar, indiquant des zones inondées. Le seuil prédéfini de 1,25

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

défini et retenu par la méthode essai-erreur, est appliqué, attribuant 1 à toutes les valeurs supérieures à 1,25 et 0 à toutes les valeurs inférieures à 1,25. La couche raster binaire créée par ce processus montre l'étendue de l'inondation potentielle.

Enfin, en additionnant tous les pixels, l'information de surface est dérivée et convertie en hectares.

2.2.1.3 Affinage de la couche d'étendue des inondations

La couche des cours d'eau permanent (a) et la couche des pentes supérieure à 5 degrés (b) ont permis d'affiner l'étendue de l'inondation potentielle du District d'Abidjan (Figure 6).

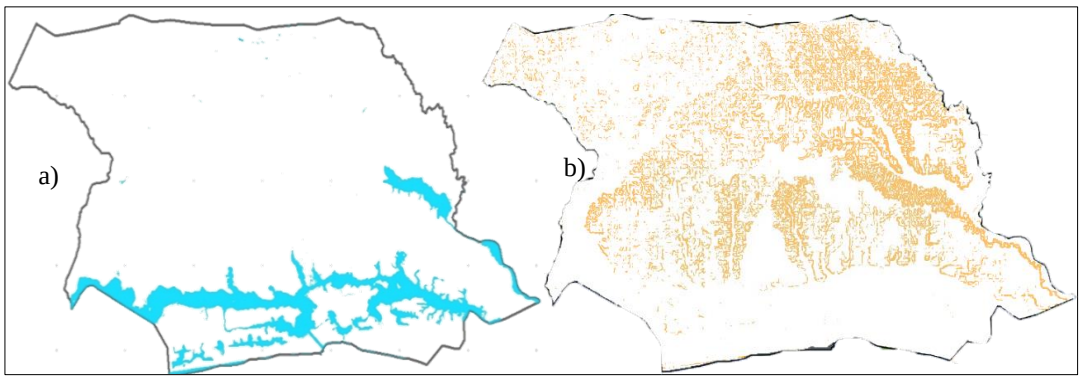

Figure 1. Paramètres d'affinages de l'étendue des zones inondées : cours d'eau (a) et pentes supérieures à 5 (b).

L'ensemble de données JRC Global Surface Water Mapping Layers v1.4, est utilisé pour masquer toutes les zones couvertes par des plans d'eau permanents ou naturels. Cette base de données de 30m de résolution a été mis à jour pour la dernière fois en 2021. Les plans d'eau permanents ou naturels (par exemple, les étangs, les rivières, les lacs, etc,) ont été masqués des zones inondées extraites afin de différencier les zones réellement inondées.

Ensuite, l'étape du masque des pentes inférieures à la valeur seuil a permis de déterminer les zones potentiellement inondables en fonction de la topographie. Cette étape a consisté depuis GEE à fixer la valeur maximale de 5 degrés comme seuil de pente en dessous duquel une zone est considérée comme potentiellement inondable. Le seuil approprié est défini en fonction de l'analyse de la carte de pentes, en identifiant les pentes qui semble correspondre aux cours d'eau de la zone d'étude. Puis les zones ayant une pente inférieure à la valeur seuil (>5%) sont ensuite exclues des zones inondées.

La connectivité des pixels d'inondation est évaluée afin d'éliminer ceux qui sont connectés à dix voisins ou moins soit 0,1 hectare. Cette opération réduit le bruit du produit de l'étendue des inondations.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

2.2.1.4 Validation de l'étendue des zones inondées

La collecte de données s'est principalement déroulée dans la commune de Cocody, au niveau de la Palmeraie, de Bonoumin et de la rue ministre, ainsi que dans certaines communes du district d'Abidjan, pendant la saison des pluies, entre juin et juillet 2020. La mission impliquait la visite de sites précédemment inondés, avec une méthodologie basée sur des enquêtes de terrain et des entretiens avec les résidents locaux. Les informations recherchées comprenaient la localisation exacte des zones inondées, des photographies illustratives, les traces de crues et les impacts socio-économiques.

2.2.2 Extraction des classes d'enjeux

L'approche méthodologique utilisée pour l'extraction des classes d'enjeux, a consisté à appliquer des masques pour isoler ces zones sur la base de l'information attributaire ou des intercessions de couches (Figure 7).

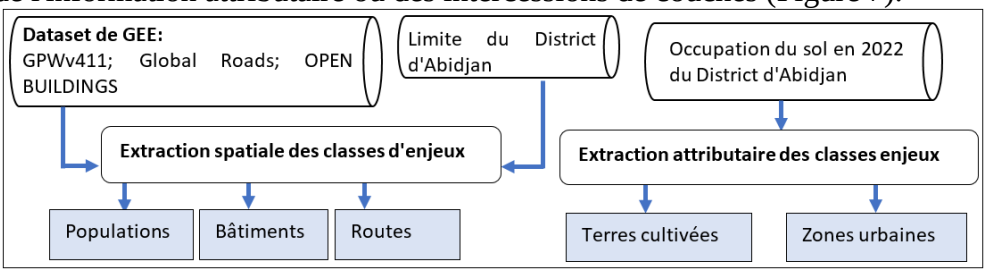

Figure 7. Extraction des classes d'enjeux étudiées, du District d'Abidjan

Plusieurs classes d'enjeux sont retenues pour évaluer les dégâts causés par les inondations :

- la classe culture issue de l'occupation du sol de 2022, qui regroupe toutes les variétés de cultures rencontrées dans la zone d'étude (hévéa, palmier, bananier, aménagement agricole…)
- la classe zone habitée extraite de l'occupation du sol de 2022, qui regroupe tout ce qui est habitations, routes et sols nus ;
- la population issue du GPWv411, d'une résolution spatiale de 1 km, rééchantillonnée à 10 m puis utilisée pour estimer le nombre de personnes exposées aux inondations,
- le réseau routier issue du jeu de données Global Roads;
- les bâtiments issues du jeu de données open buildings ;

Une fois la carte des zones inondées et la classification des enjeux obtenues, les dommages causés sont quantifiés.

2.2.3 Évaluation des dommages causés par les inondations

Les dommages causés par les inondations sont caractérisés comme la probabilité qu'une perte se produise (Kefi et al., 2018).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

L'approche méthodologique utilisée pour estimer les dommages causés par les inondations, a consisté à : (i)superposer les zones inondées cartographiées sur chaque classe d'enjeux extraite, puis (ii) analyser les enjeux croisés ou zones affectées (Figure 8).

L'analyse des zones affectées a consisté à calculer la superficie totale des enjeux inondés et à identifier les zones les plus touchées.

Afin d'évaluer la superficie des classes d'enjeux affectées, la couche des zones inondées a été croisée au raster de chaque classe d'enjeux. Ensuite, une intersection entre les deux couches est calculée et affichée comme une nouvelle couche raster qui correspond aux zones affectées. La superficie des zones exposées est ensuite estimée en additionnant les valeurs des pixels du raster des enjeux qui intercèdent les zones inondées.

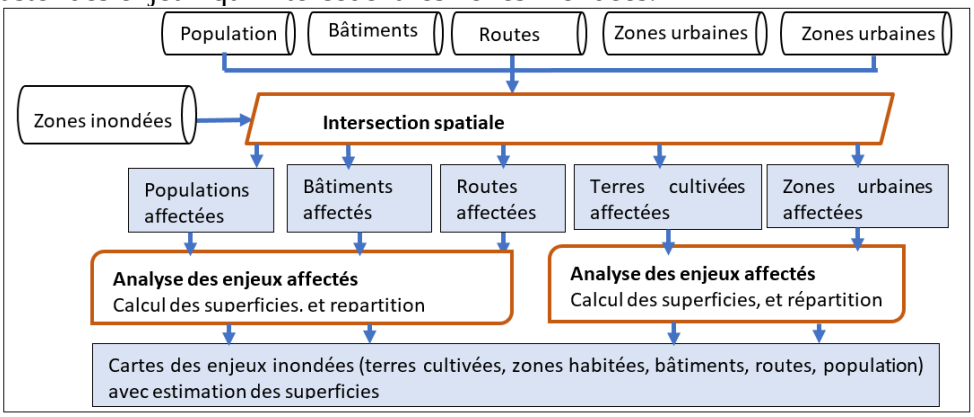

Figure 8. Évaluation des dommages causés par les inondations

Il en résulte, en fonction des classes d'enjeux retenues et croisées :

- l'emplacement des terres cultivées affectées avec une estimation de la superficie ;
- l'emplacement des zones urbaines affectées avec une estimation de la superficie ;
- l'emplacement et le nombre de personnes exposées;
- l'emplacement des bâtiments affectés avec une estimation de la superficie;
- l'emplacement du réseau routier affecté.

2.2.4 Suivi temporel et Automatisation du processus en application web

L'approche méthodologique a consisté à exploiter les outils de visualisation puissants de GEE pour afficher les résultats sous forme de cartes interactives et offrir aux utilisateurs la possibilité de personnaliser leurs paramètres, notamment la date, pour visualiser les résultats à la période choisie.

L'automatisation du processus de cartographie des zones inondées a

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

consisté à mettre en œuvre dans le script JAVA les étapes suivantes :

- la sélection et le traitement des images appropriées provenant de Sentinel-1 et d'autres sources de données, au sein de GEE via des scripts visant à extraire les zones inondées ;
- puis, l'extraction des classes d'enjeu et leur superposition avec les zones inondées. Cela a permis d'identifier les zones touchées par les inondations ;
- enfin, les calculs relatifs à la superficie des zones touchées, aux enjeux spécifiques tels que les terres cultivées et les zones urbaines, ainsi qu'à la densité de population exposée, ont été automatisés en utilisant les capacités de traitement de GEE.

La méthodologie adoptée pour le développement de l'application s'est articulée autour des étapes suivantes :

- la création de l'Interface Utilisateur grâce aux composants d'interface disponibles dans GEE, tels que ui.Select(), ui.Button(), et ui.Panel(). Cette interface offre aux utilisateurs la possibilité de sélectionner la période, ainsi que les types d'enjeux à visualiser ;
- l'intégration des fonctionnalités de visualisation interactive tel que : afficher ou masquer des couches, zoomer et se déplacer sur la carte ;
- l'affichage des résultats générés automatiquement, sous forme de cartes, de graphiques ou de tableaux, pour une compréhension aisée ;
- l'export des résultats sous forme de fichiers téléchargeables, tels que des images ou des fichiers CSV, pour des analyses plus approfondies ;
- la publication en ligne qui offre un accès aux utilisateurs depuis n'importe quel navigateur, éliminant ainsi la nécessité de télécharger ou d'installer des logiciels ;

L'automatisation du processus d'analyse des inondations grâce à GEE, combinée au développement de cette application dédiée, a permis d'accroître l'efficacité et l'accessibilité des résultats obtenus. Cela offre aux utilisateurs la possibilité de visualiser et d'interpréter rapidement les conséquences des inondations à la date de leur choix.

3 Resultats et discussions

3.1 Résultats

Cette partie présente les résultats des prétraitements et traitements des images radar sentinel-1 et du MNT Alos et leurs analyses pour la cartographie des zones inondées et l'évaluation des dégâts causés au niveau du District d'Abidjan depuis GEE.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

3.1.1 Cartographie des zones potentiellement inondées

3.1.1.1 Prétraitement des images

L'analyse comparative entre l'image filtrée et non filtrée en polarisation VH montre que le filtre moyen de rayon 5 m réduit considérablement le chatoiement présent sur les images Sentinel 1 du District d'Abidjan. Ce filtre diminue l'aspect granulaire du chatoiement, permet le lissage des zones homogènes et préserve les contours, les zones hétérogènes et les structures fines surtout dans les zones du bâti (Figure 9).

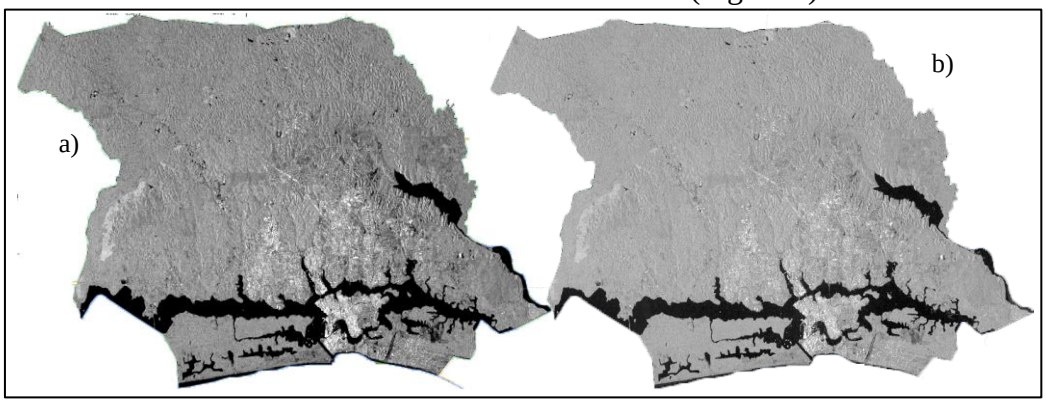

Figure 2. Réduction du chatoiement sur les images Sentinel 1 du District d'Abidjan : image brute (a) et image filtrée (b)

Les images prétraitées et filtrées avant et après le phénomène de crue (Figure 10), plus nettes, offrent ainsi la possibilité de mieux interpréter les données et d'extraire les informations utiles pour la cartographie des zones inondées.

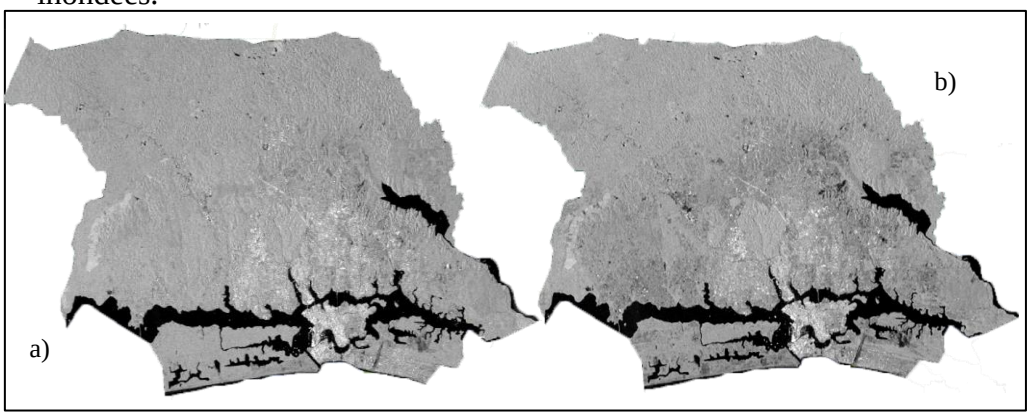

Figure 3. Images prétraitées avant (a) et après (b) la crue du 20 juin 2020 du District d'Abidjan

3.1.1.2 Étendues potentielles des zones inondées

La Figure 11.a présente la couche raster qui représente la différence entre l'image avant la crue et l'image après la crue du 25 juin 2020. Elle illustre

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

le degré de changement par pixel. Les valeurs élevées (pixels clairs) indiquent un changement important et les valeurs faibles (pixels sombres) indiquent un changement minime.

La couche raster binaire qui en résulte grâce au seuil de 1,25 imposé, illustré par la Figure 11.b, montre l'étendue de l'inondation potentielle (valeurs supérieures à 1,25).

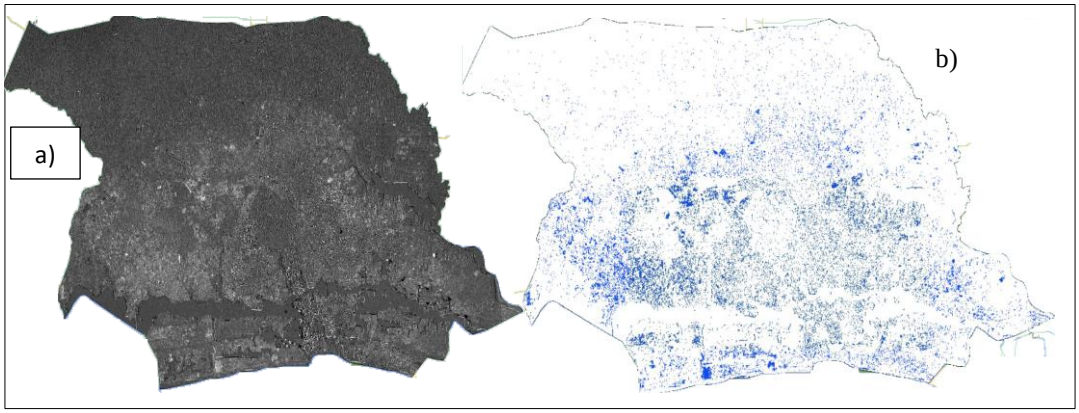

Figure 4. Couche raster binaire de la différence entre l'image avant et après la crue du 25 juin 2020 (a) et l'étendue de l'inondation potentielle (b) du District d'Abidjan

3.1.1.3 Analyse de la carte des zones inondées du District d'Abidjan

La Figure 12 présente la carte de l'étendue des zones inondées du District d'Abidjan relativement à la crue du 25 juin 2020, La superficie totale des zones potentiellement inondées dans l'ensemble du District est estimée à 25219,23 ha soit un pourcentage de 11,50%.

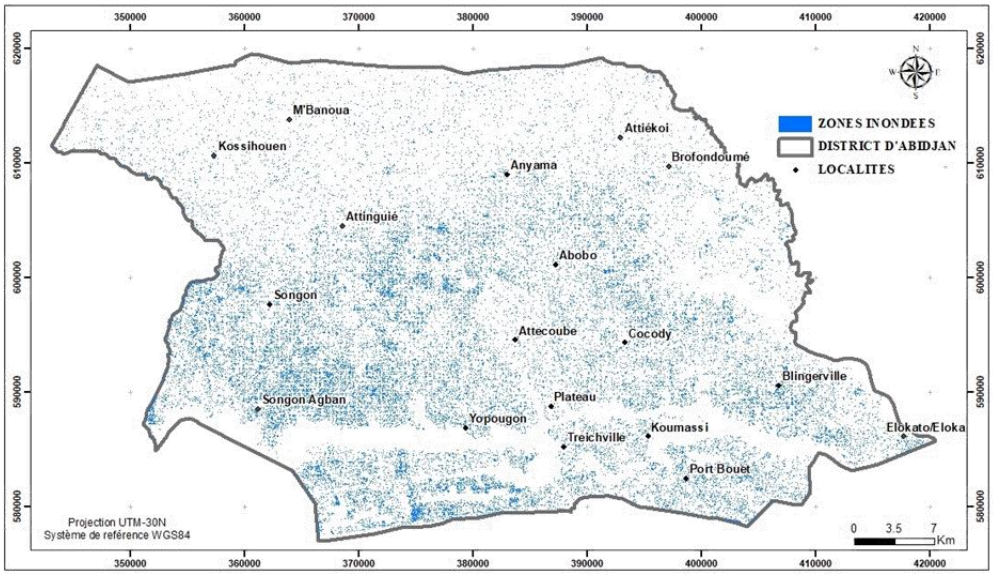

Figure 12. Carte des zones inondées du District d'Abidjan issue du traitement des images Sentinel-1 depuis GEE

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Le graphe de la Figure 13 illustre que les zones inondées sont inégalement réparties dans les communes du District d'Abidjan.

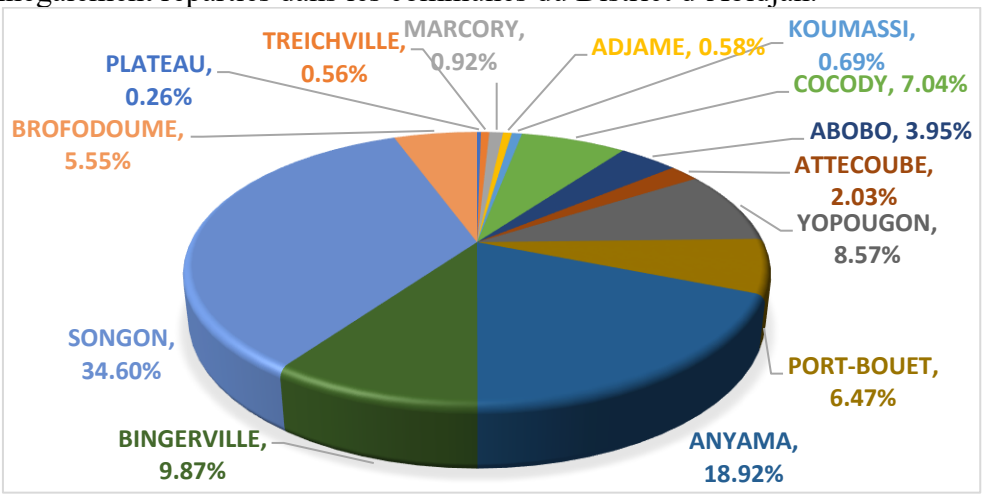

Figure 13. Répartition des zones inondées dans les différentes communes du District d'Abidjan

L'analyse de la répartition spatiale des zones inondées lors de la crue du 25 juin 2020 permet de hiérarchiser les communes du District d'Abidjan en fonction de l'impact des inondations, et du degré d'exposition (Tableau 2).

Tableau 2. Répartition spatiale des zones à risque d'inondation lors de la crue du 25 juin 2020

		Impact des inondations		Degré d'exposition		
Sous-Prefecture	Commune	Superficie des zones inondées ha)	Proportion des Zones inondées (%)	Superficie des Commune (ha)	Proportion communes inondées (%)	Proportion des communes non inondées (%)
Abidjan	Plateau	65,34	0,26%	635,83	10,28%	89,72%
	Treichville	140,96	0,56%	1648,82	8,55%	91,45%
	Marcory	231,18	0,92%	1889,50	12,23%	87,77%
	Adjame	145,97	0,58%	1200,35	12,16%	87,84%
	Koumassi	173,30	0,69%	1942,03	8,92%	91,08%
	Cocody	1775,90	7,04%	11776,80	15,08%	84,92%
	Abobo	995,05	3,95%	7154,48	13,91%	86,09%
	Attecoube	512,36	2,03%	4514,32	11,35%	88,65%
	Yopougon	2161,77	8,57%	16232,36	13,32%	86,68%
	Port-bouet	1630,98	6,47%	12788,11	12,75%	87,25%
Anyama	Anyama	4770,84	18,92%	50875,69	9,38%	90,62%
Bingerville	Bingerville	2489,80	9,87%	29274,40	8,51%	91,49%
Songon	Songon	8725,33	34,60%	60655,57	14,39%	85,61%
Brofodoume	Brofodoume	1400,44	5,55%	18653,40	7,51%	92,49%
Total		25219,23	100 %	219241,66	11,50%	88,50%

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

❖ **Impact des inondations par commune**

L'analyse de la proportion des zones inondées par commune dans le District d'Abidjan permet de classer les communes en fonction de l'impact des inondations. Classées comme les communes les plus touchées on a Songon avec 34,60% de la superficie totale des zones inondées ; suivie d'Anyama avec 18,92% ; Bingerville avec 9,87% ; Yopougon avec 8,57% ; Cocody avec 7,04% ; Port-Bouet avec 6,47% ; Brofodoumé avec 5,55%, et Abobo avec 3,95% de la superficie totale des zones inondées. En revanche, les communes les moins touchées sont Marcory avec 0,92%, Koumassi avec 0,69%, Treichville avec 0,56%, Adjamé avec 0,58%, et le Plateau avec 0,26%.

❖ **Degré d'exposition des communes**

L'analyse de la proportion des communes inondées permet de classer les communes du District d'Abidjan en fonction de leur exposition aux inondations. Les communes les plus exposées sont : Cocody, avec 15,08% de sa superficie inondée ; Songon, avec 14,39% de sa superficie inondée ; Abobo, avec 13,91% de sa superficie inondée ; Yopougon, avec 13,32% de sa superficie inondée; Port-Bouet, avec 12,75% de sa superficie inondée ; Marcory, avec 12,23% de sa superficie inondée; Adjame, avec 12,16% de sa superficie inondée ; Attécoubé, avec 11,35% de sa superficie inondée; Le Plateau, avec 10,28% de sa superficie inondée ; Anyama, avec 9,38% de sa superficie inondée; Koumassi, avec 8,92% de sa superficie inondée ; Bingerville, avec 8,51% de sa superficie inondée; et Brofodoumé, avec 7,51% de sa superficie inondée.

L'observation générale des zones inondées du 25 juin 2020, dans l'ensemble des communes du District, révèle que la superficie des zones inondées est estimée à 25219,23 hectares, environ 11,50% de la superficie totale du District d'Abidjan. La commune de Cocody est la commune la plus impactée avec 15,08% de sa superficie totale couverte. Ces résultats illustrent clairement que le District d'Abidjan fait face aux inondations pendant la saison de pluies.

Ces résultats illustrent clairement que le District d'Abidjan fait face aux inondations pendant la saison de pluies.

3.1.2 Extraction des classes d'enjeux

La figure 14 présente les cartes illustrant les classes d'enjeux milieu urbain et terres cultivées dans le District d'Abidjan.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

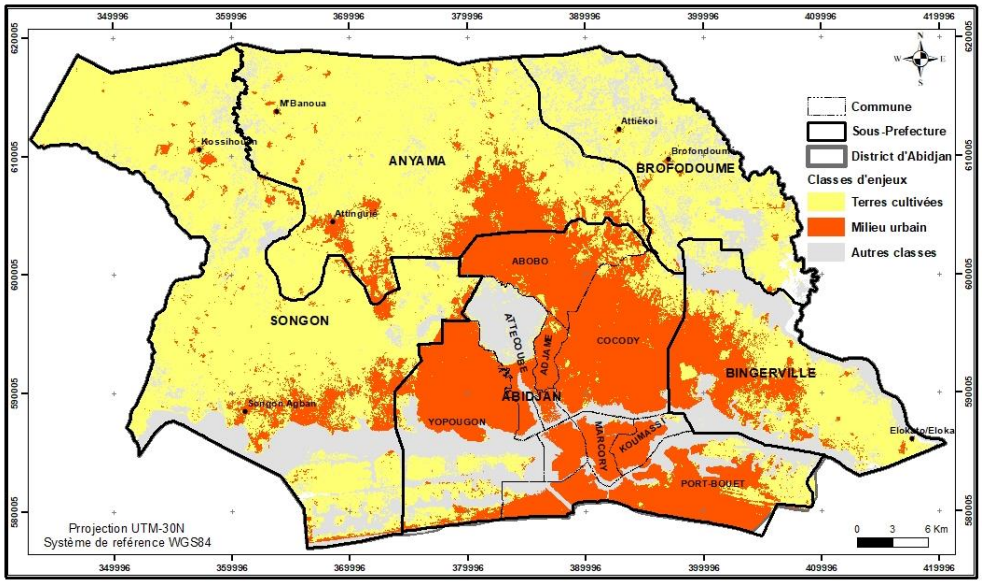

Figure 14. Carte des classes d'enjeux dans le District d'Abidjan repartis en milieu urbain et terres cultures

Les enjeux du District d'Abidjan occupent une superficie de 172186,55 ha soit 80,52% de la superficie totale (Tableau 3). Ces classes d'enjeux se décomposent en Milieu urbain et en terres cultivées, essentiellement composées des classes Aménagement agricoles, plantation de palmier à huile, Hévéa et Bananeraie.

Tableau 3. Répartition des classes d'enjeux liés à l'occupation du sol de 2020 du District d'Abidjan

	Classe d'Occupation du sol	Superficie (ha)	Proportion (%)
ENJEUX	Terres cultivées	119152,47	55,72%
	Milieu urbain	53034,08	24,80%
	Total enjeux	172186,55	80,52%
Autres classes		41667,54	19,48%
TOTAL		213854,09	100,00%

Les terres cultivées couvrent 119,152,47 hectares, ce qui équivaut à 55,72% de la superficie totale du District, tandis que la zone urbaine s'étend sur 53,034,03 hectares, représentant ainsi 24,80% de la superficie totale d'Abidjan. Les autres catégories de terres couvrent moins de 20% du district, totalisant environ 41667,54 hectares, soit 19,48%.

3.1.3 Évaluation des dommages causés par les inondations

3.1.3.1 Enjeux affectés par les inondations

La figure 15 présente la répartition des classes d'enjeux impactées par la crue du 25 juin 2020 dans le District d'Abidjan.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

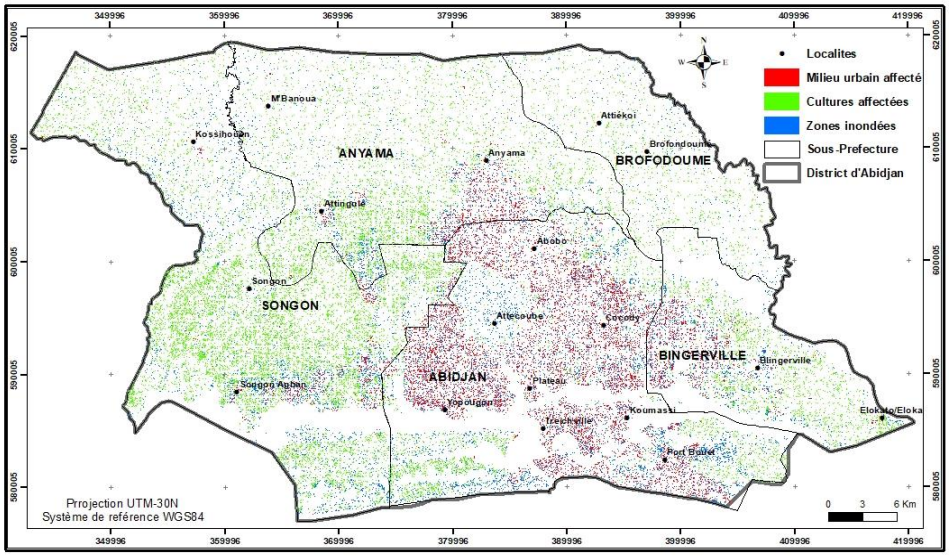

Figure 15. Carte des enjeux affectés par la crue du 25 juin 2020 dans le District d'Abidjan, repartis en classe : milieu urbain affecté et cultures affectées

Sur une superficie totale de 25 219,23 hectares inondée le 25 juin 2020, 22 307,53 hectares (soit 88,45 %) sont occupés par des zones sensibles. Ces zones sensibles se divisent en terres cultivées, qui couvrent 13 538,49 hectares (soit 53,68 %), et en zones urbaines, représentant 8 769,04 hectares (soit 34,77 %). Il est important de noter que 2 911,67 hectares (soit 11,55 %) des terres inondées du district ne sont pas vulnérables aux inondations (Tableau 4).

Tableau 4. Proportion des cultures et milieu urbain affectés dans le District d'Abidjan par la crue du 25 juin 2020 déterminée depuis GEE

Enjeux	Superficie (ha)	Proportion (%)
Culture inondée	13538,49	53,68%
Milieu urbain inondé	8769,04	34,77%
Reste	2911,67	11,55%
Superficie inondée	25219,23	100%

Cependant, le nombre de personnes affectées sur la base de la densité de la population est estimé à 64877 habitants.

3.1.3.2 Analyse statistique des dommages causés par les inondations dans les communes du District d'Abidjan lors de la cure du 25 juin 2020

Pour mieux évaluer l'impact des zones inondées sur les enjeux des communes de la zone d'étude, les superficies calculées ont été comparées et résumées dans le tableau 5.

L'analyse du graphe de la tableau 5, permet de comprendre que les terres cultivées affectées par la crue du 25 juin 2020 sont beaucoup plus

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

reparties dans les communes de Songon et Anyama. Par contre le milieu urbain de la commune de Cocody est le plus impacté par la crue du 25 juin 2020.

Tableau 5. Répartition des enjeux affectés par la crue du 25 juin 2020, dans les différentes communes du District d'Abidjan

	ENJEUX								
Commune	Zone inondée	Milieu urbain affecté		Cultures affectées		Total enjeux		Reste	
Commune	Superficie (ha)	Superficie (ha)	Proportion (%)	Superficie (ha)	Proportion (%)	Superficie (ha)	Proportion (%)	Superficie (ha)	Proportion (%)
PLATEAU	65,34	55,6	0,22	1,48	0,01	57,08	0,23	8,26	0,03
TREICHVILL	140,96	136,5	0,54	0,02	0,00	136,52	0,54	4,44	0,02
MARCORY	231,18	224,26	0,89	2,53	0,01	226,79	0,90	4,39	0,02
ADJAME	145,97	132,58	0,53	9,36	0,04	141,94	0,56	4,03	0,02
KOUMASSI	173,30	154,59	0,61	6,45	0,03	161,04	0,64	12,26	0,05
COCODY	1775,90	1548,96	6,14	186,57	0,74	1735,53	6,88	40,37	0,16
ABOBO	995,05	854,62	3,39	133,72	0,53	988,34	3,92	6,71	0,03
ATTECOUB	512,36	131,3	0,52	58,33	0,23	189,63	0,75	322,73	1,28
YOPOUGON	2161,77	1314,84	5,21	623,37	2,47	1938,21	7,69	223,56	0,89
PORT-BOUET	1630,98	1182,56	4,69	394,7	1,57	1577,26	6,25	53,72	0,21
ANYAMA	4770,84	991,97	3,93	3289,98	13,05	4281,95	16,98	488,89	1,94
BINGERVIL	2489,80	970,84	3,85	1314,54	5,21	2285,38	9,06	204,42	0,81
SONGON	8725,33	1036,29	4,11	6517,07	25,84	7553,36	29,95	1171,97	4,65
BROFODOUME	1400,44	34,13	0,14	1000,37	3,97	1034,50	4,10	365,94	1,45
TOTAL	25219,2	8769,04	34,77	13538,9	53,68	22307,3	88,45	2911,70	11,55

❖ Milieu urbain affecté

La figure 16 illustre la répartition spatiale de l'enjeu milieu urbain impacté par la crue du 25 Juin 2020 dans le District d'Abidjan.

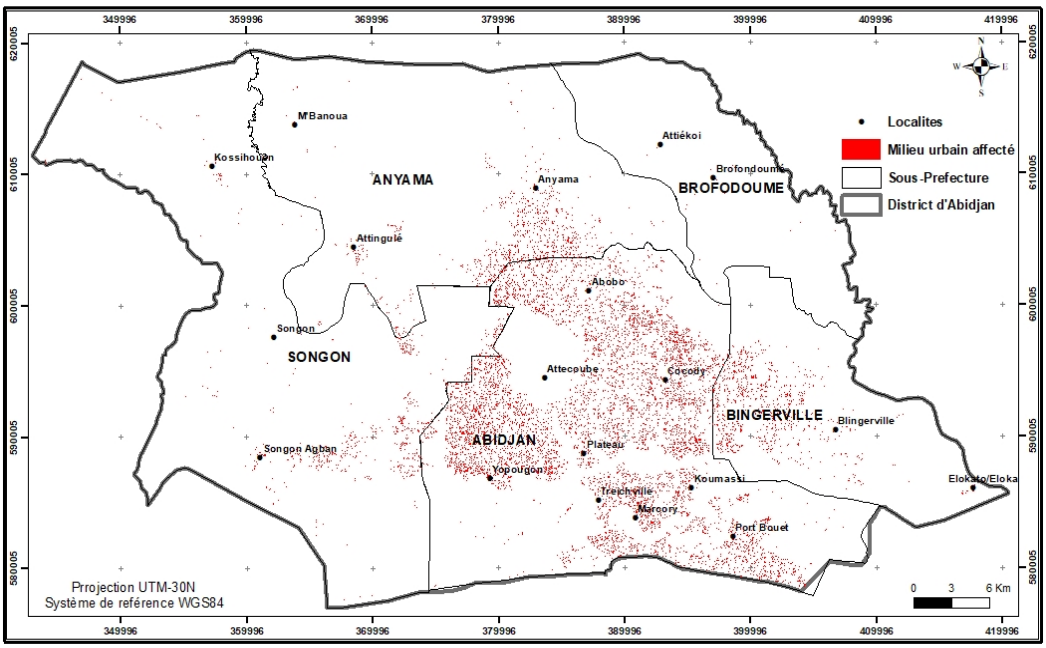

Figure 16. Carte de l'enjeux milieu urbain affecté par les inondations dans le District d'Abidjan issue du traitement des images Sentinel-1 depuis GEE, lors de la crue du 25 juin 2020

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

L'analyse de la répartition des 8 769,04 hectares de zones urbaines affectées (représentant 34,77% de la superficie inondée), dans les diverses communes du District d'Abidjan, permet de faire le constat suivant : les communes les plus touchées sont Cocody, avec 6,14% ; suivie de Yopougon, avec 5,21% ; Port-Bouët, avec 4,69% ; Songon, avec 4,11% ; Anyama, avec 3,93% ; Bingerville, avec 3,85% ; et Abobo, avec 3,39%. En revanche, les communes moins touchées sont Marcory, Koumassi, Treichville, Adjamé, Attecoube, Brofodoume et Plateau, avec des proportions inférieures à 1%.

❖ Terres cultivées affectées

La Figure 17 illustre la répartition spatiale des terres cultivées exposées aux inondations lors de la crue du 25 juin 2020 dans le District d'Abidjan. En observant la distribution des 13 538,49 hectares de terres cultivées affectées (soit 53,68% de la superficie inondée) dans différentes communes, on constate que Songon, Anyama, Bingerville, Brofodoume, Yopougon, Port-Bouët, Cocody, Abobo et Attecoube regroupent les proportions les plus importantes, représentant respectivement 25,84%, 13,05%, 5,21%, 3,97%, 2,47%, 1,57%, 0,74%, 0,53% et 0,23% de la superficie totale inondée. En revanche, la part de terres cultivées touchées dans les autres communes est inférieure à 0,04%.

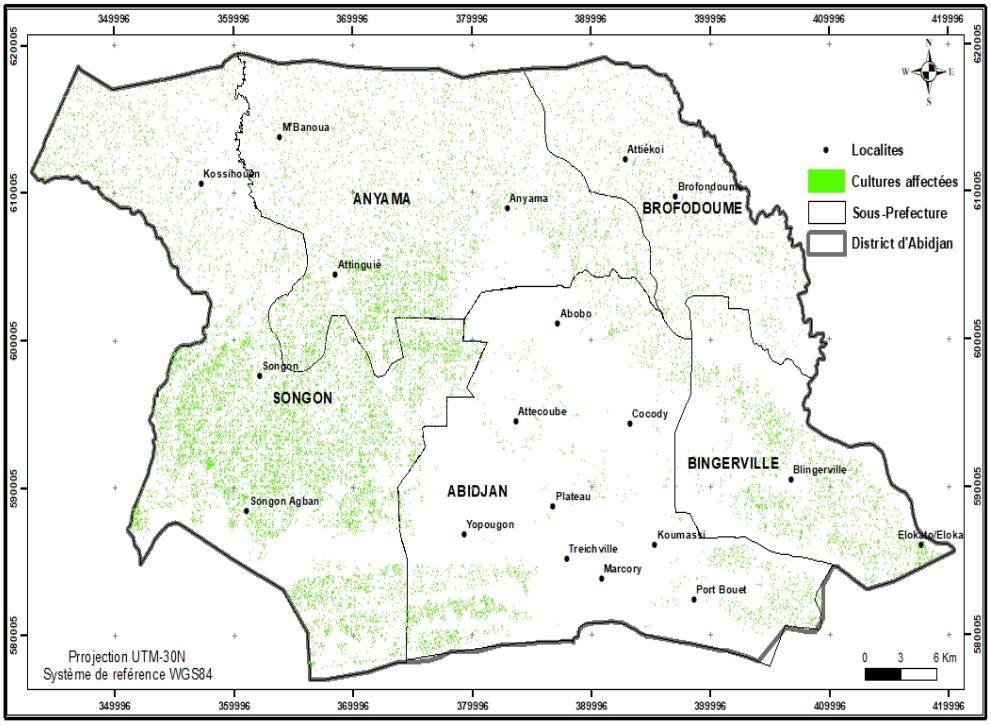

Figure 17. Carte de l'enjeux terres cultivées affecté par les inondations dans le District d'Abidjan issue du traitement des images Sentinel-1 depuis GEE, lors de la crue du 25 juin 2020

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

❖ **Population impactée**

La figure 18 illustre la répartition de la population affectée par la crue du 25 juin 2020 dans le District d'Abidjan. Le nombre approximatif de personnes touchées en fonction de la densité de la population est estimé à 35 065 habitants. La Sous-préfecture d'Abidjan abrite le plus grand effectif avec des valeurs comprises entre 47 à 1005 habitants impactés au km^2.

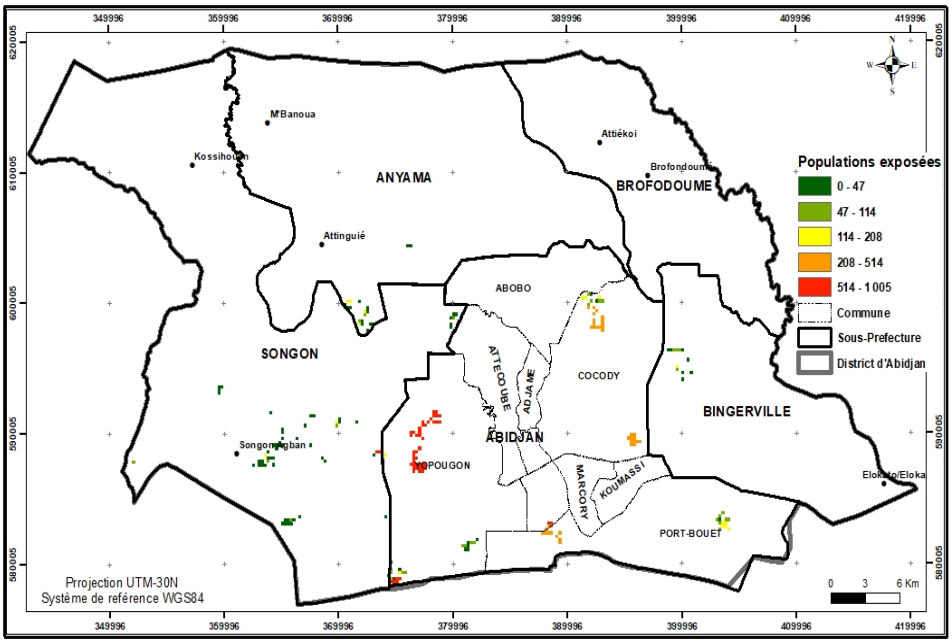

Figure 18. Carte de l'enjeu densité de la population affectée par les inondations dans le District d'Abidjan issue du traitement des images Sentinel-1 depuis GEE lors de la crue du 25 juin 2020

3.1.4 Mission de validation de l'étendue des inondations

La mission de validation a permis de valider les zones inondées cartographiées dans le district d'Abidjan (Figure 19). Les visites effectuées sur différents sites du district d'Abidjan, pendant la saison de pluie, ont révélé que plusieurs communes du District sont impactées par les inondations.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

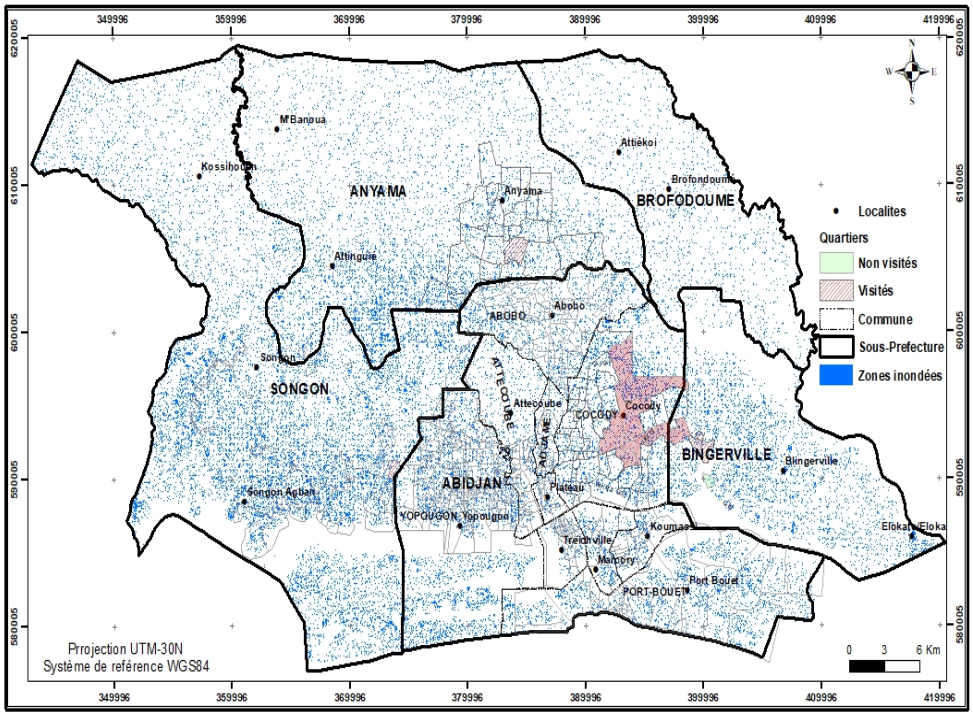

Figure 19. Visite de terrain pour la validation de l'emplacement des zones inondées du District d'Abidjan, lors de la crue du 25 juin 2020.

Plusieurs sites inondés correspondent également aux emplacements cartographiés (Figure 20), notamment :

- Riviera Palmeraie : rue Ministre ; rue Marie Rose Guiraud ; Université Islamique ;
- Riviera 3 : Réconciliation ; COPRACI ; SYNACASS-CI 1 ; SIDECI ; SCI CIAD PRIMO ; le Triangle ; boulevard François Mitterrand entre le rond-point de la Riviéra 3 et le carrefour 9 kilos ; Saint Viateur Promogim; Allabra ;
- Riviera Bonoumin : les chevaux ; Riviera Digue de Bonoumin ; Bonoumin Est (CHIC SHOP) ; Bonoumin (derrière COOPEC) ; bassin de rétention de crue ;
- Riviera golf 4 SCI Verdoyante ; Riviera Laurier 17 et SICOGI (route Bingerville) ;
- Riviera Attoban Zinsou; Angre Star 9 B+ ; Angre SCI Fondasso; Angre cité Latrille (Manguier 1 et 2) ;
- Angre : château fin goudron ;
- II Plateaux : carrefour ZOO ; Bassin du Vallon ;
- Lotissement Djorogobite ; Lotissement de Bessikoi ;
- Quartier Ran à Anyama.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

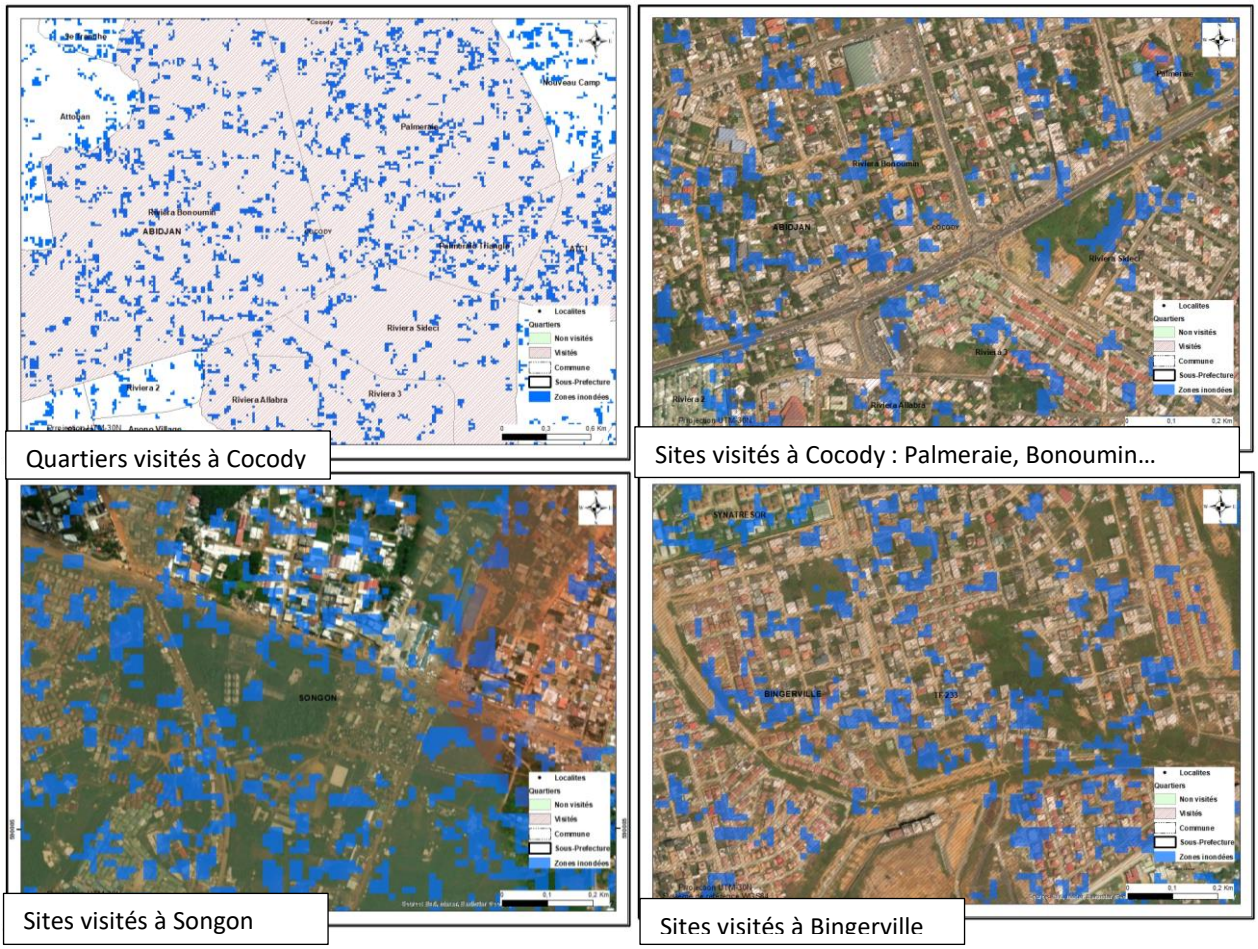

Figure 20: Quelques sites visités pour la validation de l'emplacement des zones inondées du District d'Abidjan, lors de la crue du 25 juin 2020

Ces inondations sont principalement attribuables au débordement des canaux de drainage aménagés dans les zones fortement urbanisées, à l'urbanisation intense des terrains en amont, au dépassement des capacités des ouvrages hydrauliques de drainage, et à l'augmentation de la fréquence des pluies extrêmes. Dans ces divers sites inondés, les niveaux d'eau les plus élevés ont été observés avec une moyenne variante entre 2 et 1,25 mètres lors de l'événement pluvieux du 25 juin 2020.

Cette mission de validation terrain organisées principalement durant la saison pluvieuse de juin 2020 sur le district d'Abidjan, a permis de recueillir des informations passées et actuelles sur les inondations.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

3.1.5 Automatisation du processus et développement de l'application web

L'interface de l'application web, développée à partir de Google Earth Engine, offre la possibilité de visualiser de manière précise, à une date au choix, les données associées à une crue historique antérieure ayant survenue dans le District d'Abidjan (Figure 21).

L'utilisateur a la flexibilité de sélectionner une date à partir de 2015 et, pour cette date de crue spécifique, de produire automatiquement les éléments suivants :

- l'emplacement des zones inondées et une estimation de leur superficie ;
- les cartes des enjeux affectés et une estimation de leurs superficies, en termes de terre cultivées inondées, zones de cultures inondées, routes inondées et bâtiments affectés ;
- et une estimation de la population affectée,

Les valeurs statistiques visualisables au niveau de l'application, sont des valeurs arrondies et ont une précision de 99,88 %. Pour la crue du 25 juin 2020, la superficie des zones inondées, calculée à partir de Google earth engine est estimée à 25250 ha. La superficie à la même date de crue est estimée à 25219,23ha, après l'export au format raster et l'analyse via un logiciel SIG. L'accès à l'application web se fait en utilisant le lien suivant depuis un navigateur connecté :
https://essai1.users.earthengine.app/view/flood-sianys2023.

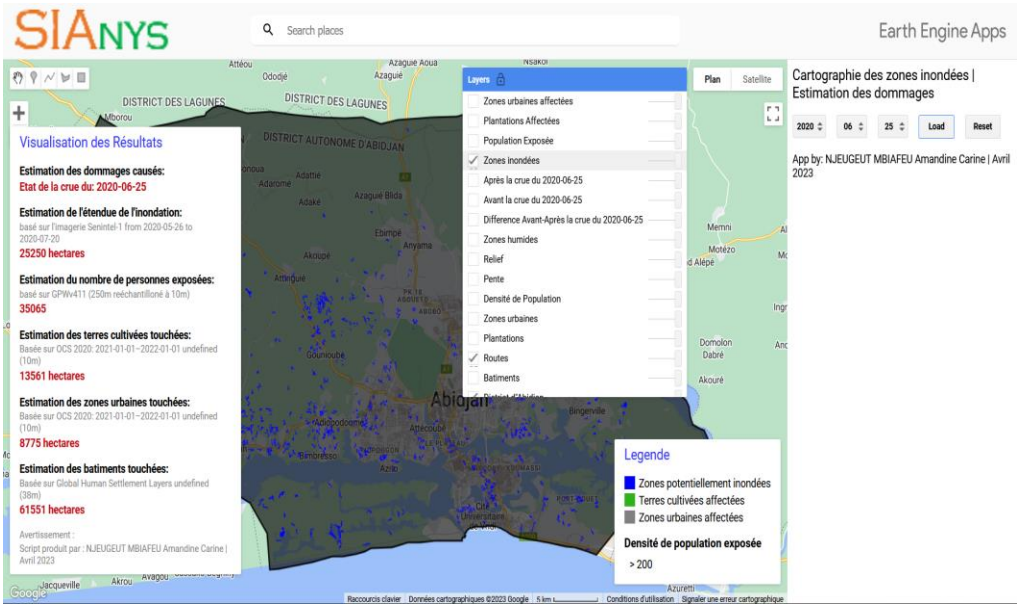

Figure 21. Interface SIANYS de visualisation automatique des zones inondées et des enjeux affectés lors de la crue historique du 20 juin 2020, survenue dans le District d'Abidjan.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

3.2 Discussions

La télédétection est une technique pertinente pour la cartographie des zones qui sont touchées par les inondations. Elle permet de collecter des données précises et de haute résolution qui sont indispensables pour une gestion efficace des risques d'inondation. En utilisant des images satellites, il est possible de surveiller l'évolution des zones inondées au fil du temps, d'identifier les zones à risque et de localiser les zones touchées par les inondations. Plusieurs études ont été menées sur la télédétection et la cartographie des zones inondées, et elles ont toutes obtenu des résultats significatifs (Bi et al., 2014; Danumah et al., 2016; Kouamé et al., 2013; Z. A. Ouattara et al., 2021).

Les données satellitaires à haute résolution spatiale, en particulier celles obtenues grâce au RADAR, présentent des avantages similaires à ceux des données aériennes, en permettant de produire des images avec une couverture spatiale importante sur de longues sections de cours d'eau. Plusieurs auteurs ont également utilisé des données radar pour cartographier les zones inondées (Benzougagh et al., 2021; Jo et al., 2018; Kurapati et al., 2020).Ces études ont démontré l'efficacité des données radar, en particulier celles obtenues avec Sentinel-1, pour cartographier avec une grande précision les zones inondées, grâce à sa capacité à éviter les effets climatiques tels que les nuages et l'obscurité.

La configuration de la polarimétrie partielle VH de Sentinel-1 a été retenue car elle permet de fournir des résultats précis peu importe la saison ou la condition nuageuse. De nombreuses études ont également confirmé l'efficacité de la polarisation VH de Sentinel-1 pour la cartographie des zones inondées (Benzougagh et al., 2021; Kumar, 2019).

La capacité de GEE à traiter de grandes quantités de données selon le secteur d'étude permet d'effectuer des analyses plus complexes. Ces études ont montré que GEE est une plateforme fiable pour la cartographie des éléments de surface y compris les zones inondées, grâce à sa capacité à utiliser différentes sources d'images satellites et d'indices pour améliorer la détection des zones inondées (Njeugeut et al., 2023; Shahabi et al., 2020; Vanama et al., 2020).

L’approche par détection des changements sur une image sentinel-1 avant et après une crue historique, a permis de cartographier l’étendue des zones inondées en milieu urbain (De Almeida Pereira et al., 2019; Kefi et al., 2018; Shahabi et al., 2020). Le modèle numérique de terrain (MNT) de haute résolution Alos Polsar et la couche des cours d'eau permanents ont été utilisé pour améliorer la précision de la cartographie des zones inondées. Le MNT a permis d'affiner les résultats de détection des zones humides en aidant à distinguer les zones planes des zones vallonnées. En utilisant la différence d'altitude entre les deux zones, il a été possible de détecter les zones qui sont

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

susceptibles d'être inondées et de cartographier avec plus de précision l'étendue des zones touchées.

L'automatisation du processus complet (extraction des zones inondées et estimation des dommages causées) sur la période allant de 2014 à la date actuelle, est l'une des particularités de la méthodologie utilisée. Elle met à profit la forte répétitivité temporelle des images satellites fournies par les capteurs Sentinel notamment, et la combinaison des informations extraites des MNT et spatio-cartes. Cette méthodologie permet de tirer parti des données satellites multi-dimensionnel et multi-source et les algorithmes d'intelligence artificielle disponibles dans GEE pour aller au-delà de la simple cartographie de l'aléa.

Les résultats obtenus montrent que les images satellites radar Sentinel-1, permettent de détecter les zones inondées. Les zones inondées cartographiées sont localisées et concentrées dans les quartiers situés le long des cours d'eau, dans les zones périurbaines, ainsi que dans les zones basses de la ville. Ces résultats sont appréciables au regard des réalités terrain et corroborent avec les résultats de plusieurs auteurs dans la zone d'étude (Danumah, 2016; Kangah & Alla, 2015; Konan, 2018). Ils permettent de mieux comprendre la répartition spatiale des zones inondées dans le District d'Abidjan et mettent en évidence l'efficacité de GEE et la capacité des images S1 à discriminer les zones humides.

Conclusion

La présente étude portant sur la cartographie des zones inondées et l'estimation des dommages causés dans le District d'Abidjan a montré que la télédétection et les technologies innovantes permettent de cartographier avec précision les éléments de surface. L'utilisation combinée des données satellitaires (radar Sentinel-1 et MNT ALOS) et des bases de données libres d'accès, a permis de cartographier avec une précision satisfaisante l'étendue des zones inondées, et d'estimer les dommages causés sur le milieu urbain, les terres cultivées, la population et les biens (routes et bâtiments). De même, l'éventail de possibilité qu'offre Google Earth Engine a permis de développer une application de suivi qui permet d'automatiser le processus à une date historique au choix. L'étude menée sur la crue du 25 juin 2020 a permis de cartographier une superficie de 25219,23 hectares de surface inondée, soit 11,50% de la superficie totale du District. La zone inondée cartographiée est répartie en 172186,55hectares d'enjeux (soit 80,52 %) et 41667,54 hectares de secteur non vulnérable (soit 19,48 %). L'analyse des dommages causés indique que les zones sensibles affectées se subdivisent en terres cultivées, qui couvrent 13 538,49 hectares (soit 53,68 %), et en zones urbaines, représentant 8 769,04 hectares (soit 34,77 %). La population impactée pendant cette crue est estimée à 35065 habitants. Une application web permet à l'utilisateur de

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

superposer la couche des zones inondées sur différentes couches d'enjeux afin de visualiser les zones affectées par les inondations (terres cultivées inondées, milieu urbain inondé, population exposée, routes exposées, équipements affectés) avec une estimation des superficies et des effectifs, à une date choisie. En raison de la menace significative qui pèse, il est impératif que les responsables portent une attention particulière à ces zones. En conséquence, les autorités compétentes devraient mettre en place des mesures rigoureuses pour prévenir des dommages plus graves, à l'image de ceux constatés après les inondations de juin 2020 dans les différentes communes du District d'Abidjan. La carte des zones potentiellement inondées élaborée représente un outil essentiel dont les décideurs pourront se servir pour orienter d'éventuelles décisions. Dans l'ensemble, il convient de noter que l'utilisation des technologies innovantes a été d'un grand apport pour l'automatisation de la cartographie des zones inondées et l'estimation des dommages depuis le cloud GEE sur la base des images radar sentinel-1 et de l'intelligence artificielle, en termes de gain de temps, d'espace de stockage, de process de traitement et d'automatisation.

Conflit d'intérêts : Les auteurs n'ont signalé aucun conflit d'intérêts.

Disponibilité des données : Toutes les données sont incluses dans le contenu de l'article.

Déclaration de financement : Les auteurs n'ont obtenu aucun financement pour cette recherche.

Remerciements

Nos remerciements vont à l'endroit de Dr. KOUAME KAN Jean, Directeur du Centre Universitaire de Recherche et d'Application en Télédétection (CURAT), pour nous avoir accordé l'accès à ses locaux et équipements précieux.

References:

1. Adje, N. P., & Kouadio, K. F. (2021). Résilience des populations des zones a risque face aux inondations : le cas de la commune d'attecoube. *International Journal of Humanities and Cultural Studies (IJHCS) ISSN 2356-5926*, *8*(1), Article 1.
2. Alla, D. A., Atta, K. J.-M., & Yassi, G. A. (2018). Les risques naturels et leurs manifestations dans une ville secondaire : érosion et inondation à daloa (centre- ouest de la côte d'ivoire). *Revue de Géographie Tropicale et d'Environnement*, *2*, Article 2.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

3. ALLA, D. A., DOS SANTOS, S., & Zahiri, E.-P. (2019, juin). Penser les vulnérabilités aux inondations par le prisme de la justice environnementale : cas du projet evidence à Abidjan". *Cyberséminaire Justice Environnemental - Justice environnementale et sanitaire au Nord et au Sud Quels apports heuristiques de l'interdisciplinarité ?* https://hal-amu.archives-ouvertes.fr/hal-02481276
4. Ambroise, B., Beven, K., & Freer, J. (1996). Toward a Generalization of the TOPMODEL Concepts : Topographic Indices of Hydrological Similarity. *Water Resources Research*, *32*(7), 2135-2145. https://doi.org/10.1029/95WR03716
5. Benzougagh, B., Frison, P.-L., Meshram, S. G., Boudad, L., Dridri, A., Sadkaoui, D., Mimich, K., & Khedher, K. M. (2021). Flood Mapping Using Multi-temporal Sentinel-1 SAR Images : A Case Study—Inaouene Watershed from Northeast of Morocco. *Iranian Journal of Science and Technology, Transactions of Civil Engineering*. https://doi.org/10.1007/s40996-021-00683-y
6. Bi, V. H. N., Saley, B., Wade, S., Valere, D. E., Kouame, F., & Affian, K. (2014). *Cartographie du risque d'inondation par une approche couplée de la télédétection et des systèmes d'informations géographiques (sig) dans le département de sinfra (centre-ouest de la cote d 'ivoire)*. 22.
7. Danumah, J. H. (2016). *Assessing Urban Flood Risks under Changing Climate and Land Use in Abidjan District, South Cote d'Ivoire* [Doctor Of Philosophy In Climate Change and Land-use]. Kwame Nkrumah University Of Science And Technology A.
8. Danumah, J. H., Odai, S. N., Saley, B. M., Szarzynski, J., Thiel, M., Kwaku, A., Kouame, F. K., & Akpa, L. Y. (2016). Flood risk assessment and mapping in Abidjan district using multi-criteria analysis (AHP) model and geoinformation techniques, (cote d'ivoire). *Geoenvironmental Disasters*, *3*(1), Article 1. https://doi.org/10.1186/s40677-016-0044-y
9. De Almeida Pereira, G. H., Cechim Júnior, C., Fronza, G., & Deppe, F. A. C. (2019). multitemporal analysis of sar images for detection of flooded areas in pantanal. *Raega - O Espaço Geográfico Em Análise*, *46*(3), 88. https://doi.org/10.5380/raega.v46i3.66988
10. Eba, A. E. L., Ake, G. E., Gouadou, D. F., & Jourda, J. (2021). Evaluation de la Vulnérabilite à l'Inondation des Communes à Proximité des Grandes Villes Ouest Africaines : Cas de la Commune de Bingerville (Est d'Abidjan – Côte d'Ivoire). *European Scientific Journal ESJ*, *17*(14). https://doi.org/10.19044/esj.2021.v17n14p277
11. Fulbert, Y. (2022, juillet 8). *Côte d'Ivoire / Inondations : 19 morts enregistrés à Abidjan (bilan)*. Agence Anadolu.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

https://www.aa.com.tr/fr/afrique/côte-divoire-inondations-19-morts-enregistrés-à-abidjan-bilan/2632800

12. Habal, T. K. (2021). Appréhender l'urbanisation en milieu tropical humide. *Le 4 pages*. https://hal.univ-lorraine.fr/hal-03472004
13. Hauhouot, C. (2008). Analyse du risque pluvial dans les quartiers précaires d'Abidjan. Etude de cas à Attécoubé. *Geo-Eco-Trop, 32*, 75-82.
14. INS. (2014). *Recensement Général de la Population et de l'Habitat 2014* (p. 49) [Rapport d'exécution et présentation des principaux résultats].
15. Jo, M.-J., Osmanoglu, B., Zhang, B., & Wdowinski, S. (2018). Flood extent mapping using dual-polarimetric sentinel-1 synthetic aperture radar imagery. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLII-3*, 711-713. https://doi.org/10.5194/isprs-archives-XLII-3-711-2018
16. Jourda, J. P., Kouamé, K. F., Soro, N., Kouamé, K. J., Kouadio, B. H., Saley, M. B., Kouamé, K., & Ahoussi, E. (2003). *Gestion et protection des eaux souterraines urbaines : Apports d'un système d'information géographique à la réalisation de la carte de vulnérabilité de la nappe du continental terminal au niveau de l'agglomération d'Abidjan.* 11.
17. Kangah, A., & Alla, D. A. (2015). Détermination des zones à risque d'inondation à partir du modèle numérique de terrain (MNT) et du système d'information géographique (SIG) : Cas du bassin-versant de Bonoumin-Palmeraie (commune de Cocody, Côte d'Ivoire). *Geo-Eco-Trop.*, *39*(2), Article 2.
18. Kefi, M., Mishra, B. K., Kumar, P., Masago, Y., & Fukushi, K. (2018). Assessment of Tangible Direct Flood Damage Using a Spatial Analysis Approach under the Effects of Climate Change : Case Study in an Urban Watershed in Hanoi, Vietnam. *ISPRS International Journal of Geo-Information*, *7*(1), Article 1. https://doi.org/10.3390/ijgi7010029
19. Konan, A. N. (2018). *Urban Flood modelling and Floodplain Mapping using ArcGIS, HEC-HMS and HEC-RAS in Abidjan city, Côte D'Ivoire – West Africa : Case study of the watershed of Bonoumin - Rivièra Palmeraie*. http://repository.pauwes-cop.net/handle/1/372
20. Konaté, L., Kouadio, B. H., Djè, B. K., Ake, G. E., Gnagne, L., Kouame, M. K., & Biémi, J. (2016). *Caractérisation des pluies journalières intenses et récurrences des inondations : Apport des totaux glissants trois (3) jours à la détermination d'une quantité seuil d'inondation (District d'Abidjan au Sud-Est de la Côte d'Ivoire) (Heavy daily rainfall characterization and flooding repeating: contri*.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

21. Kouamé, K. A., Biemi, J., & Kouame, K. F. (2013). *Application du modèle hydrologique distribué hydrotel à la simulation des écoulements des eaux en milieu tropical humide soumis aux pressions anthropiques cas du bassin versant du bandama en Côte D'Ivoire* (UFR Sciences de la Terre et des Ressources Minières). Article UFR Sciences de la Terre et des Ressources Minières.
22. Kumar, R. (2019). Flood Inundation and Hazard Mapping of 2017 Floods in the Rapti River Basin Using Sentinel-1A Synthetic Aperture Radar Images. In P. Kumar, M. Rani, P. Chandra Pandey, H. Sajjad, & B. S. Chaudhary (Éds.), *Applications and Challenges of Geospatial Technology : Potential and Future Trends* (p. 77-98). Springer International Publishing. https://doi.org/10.1007/978-3-319-99882-4_6
23. Kurapati, P. V., Babu, A., Rajosarimalala, S. T., & Pyla, K. R. (2020). *Flood mapping and damage assessment using sentinel – 1 & 2 in google earth engine of port berge & mampikony districts, sophia region, madagascar*. 9.
24. Long, S., Fatoyinbo, T. E., & Policelli, F. (2014). Flood extent mapping for Namibia using change detection and thresholding with SAR. *Environmental Research Letters*, *9*(3), 035002. https://doi.org/10.1088/1748-9326/9/3/035002
25. Mahaman Bachir, S., Kouamé, F., Penven, M. J., & Biémi, J. (2005). *Cartographie des zones à risque d'inondation dans la région semi-montagneuse à l'Ouest de la Côte d'Ivoire : Apport des MNA et de l'imagerie satellitaire.*
26. Njeugeut, M. A. C., Ta, M. Y., Jean-Robert, K. S., Armel, K. K., Vincent, A. T., & Patrice, J. J. (2023). Mapping of land use units in the District of Abidjan using Google Earth Engine cloud, based on Sentinel-2 optical images and Machine Learning algorithms. *International Journal of Innovation and Applied Studies*, *40*(1), Article 1.
27. Ouattara, T., Kouamé, F., Zo-Bi, C., Vaudry, R., & Grinand, C. (2021). Changements d'occupation et d'usage des terres entre 2016 et 2019 dans le Sud-Est de la Côte d'Ivoire : Impact des cultures de rente sur la forêt. *Bois & Forets Des Tropiques*, *347*, 91-106. https://doi.org/10.19182/bft2021.347.a31868
28. Ouattara, Z. A., Kablan, A. K. M., Gahi, N. Z., Ndouffou, V., & Dongo, K. (2021). Analyse des facteurs anthropiques et des risques sanitaires associés aux inondations par débordement d'un canal d'évacuation des eaux à Abidjan. *Environnement, Risques & Santé*, *20*(5), 467-482. https://doi.org/10.1684/ers.2021.1583

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

29. PopulationStat. (2021). *Abidjan, Ivory Coast Population (2021) — Population Stat*. https://populationstat.com/ivory-coast/abidjan
30. Savane, I., Coulibaly, K. M., & Gioan, P. (2003). Étude comparative de trois méthodes de calcul du coefficient de tarissement des cours d'eau. *Science et changements planétaires / Sécheresse*, *14*(1), 37-42.
31. Shahabi, H., Shirzadi, A., Ghaderi, K., Omidvar, E., Al-Ansari, N., Clague, J. J., Geertsema, M., Khosravi, K., Amini, A., Bahrami, S., Rahmati, O., Habibi, K., Mohammadi, A., Nguyen, H., Melesse, A. M., Ahmad, B. B., & Ahmad, A. (2020). Flood Detection and Susceptibility Mapping Using Sentinel-1 Remote Sensing Data and a Machine Learning Approach : Hybrid Intelligence of Bagging Ensemble Based on K-Nearest Neighbor Classifier. *Remote Sensing*, *12*(2), Article 2. https://doi.org/10.3390/rs12020266
32. Vanama, V. S. K., Mandal, D., & Rao, Y. S. (2020). GEE4FLOOD : Rapid mapping of flood areas using temporal Sentinel-1 SAR images with Google Earth Engine cloud platform. *Journal of Applied Remote Sensing*, *14*(3), 034505. https://doi.org/10.1117/1.JRS.14.034505

ESJ Humanities Peer-reviewed

Cyberbullying Experiences and Coping Strategies in Ibadan Metropolis, Ibadan, Nigeria

Ayodeji M. Kehinde
Isaac O. Dipeolu
Department of Health Promotion & Education, Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria

Doi:10.19044/esj.2023.v19n32p89

Submitted: 16 May 2023
Accepted: 22 November 2023
Published: 30 November 2023

Cite As:
Kehinde A.M. & Dipeolu I.O. (2023). *Cyberbullying Experiences and Coping Strategies in Ibadan Metropolis, Ibadan, Nigeria.* European Scientific Journal, ESJ, 19 (32), 89. https://doi.org/10.19044/esj.2023.v19n32p89

Abstract

Introduction/Aim: Cyberbullying of influential personalities or celebrities is a media menace. Psychological, depressional, and emotional suicidal ideation effects are some of the impacts on celebrities. A few studies have investigated celebrities' coping mechanisms against this, with the majority from developed countries. There is a dearth of information on this among celebrities in Nigeria. This study investigated the experience, effects, and coping mechanisms of cyberbullying among celebrities in the Ibadan metropolis, Oyo State, Nigeria. Material and method: A descriptive cross-sectional purposive sampling method was adopted. An in-depth interview guide was used for data collection among 14 consented celebrities. Data were manually analysed thematically. Results: Most participants were 25-35 years old and were comedians. All have experienced cyberbullies, such as popularity attacks and defamation of character. The effects of cyberbullying on the victims include low self-esteem, mental stress, depression, substance abuse, and financial crisis. Jealousy, hatred, envy, and quest for popularity among the perpetrators fuelled this menace. However, some celebrities have overcome these effects through technical, preventive, corrective, social support, and spiritual approaches. Conclusion: Cyberbullying is prevalent among celebrities and many experienced psychological effects. Awareness, interventions aimed at its prevention, and adequate coping strategies are

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

needed to solve this menace.

Keywords: Cyberbullying, Celebrities, Online harassment, Social media platforms, Coping mechanism

Introduction

Cyberbullying is coercing or harassing an individual to do something or to stop doing something with repeated coercion, such as verbal, relational, physical (social exclusion) and indirect rumour spreading[1] through electronic or digital means, such as mobile phones or the Internet.[2] It is an aggressive, intentional act or behaviour carried out by a group or an individual repeatedly against a victim who cannot easily defend him or herself"[2]. The likelihood of individuals being cyberbullied has increased tremendously with the growing accessibility to enabled internet computers and smartphones.[3] This can happen to anyone irrespective of profession, age, race, sexual orientation, gender, status or religious affiliation. Online harassment and hatred are personally and societally harmful phenomena many social media users experience daily.[4] With social media, millions can be reached by cyberbullies such as hate, derogatory comments or messages,[5,6;] hence, it is more prevalent via this channel.[7] Celebrities with a high degree of recognition by the general public through their success in their line of work and social media visibility are more likely to experience cyberbullying in a worse form than unpopular individuals[8,9]. These include comedians, musicians, actors, bloggers etc. Disclosure of information about or by celebrities always increases online curiosity among internet users, thereby increasing the spread of information.[10] Fans and followers often cause these; sometimes, artists or entertainers take on one another on social media whenever they have issues.

Given this, entertainment plays a pivotal role in the lives of Nigerians, and it is challenging to imagine life without an ounce of entertainment. Nigeria is on the right track with diverse, entertaining strategies, giving room for the sporadic development of these industries. With the surge in the growth of the Nigerian entertainment industry, there has been a tremendous increase in the influx of new and upcoming entertainers and media practitioners. Unfortunately, entertainers and/celebrities are experiencing the opposites of what they portray or play out: many are victims of cyberbullies who are being consistently victimised online; these they experience from the moment they wake up, check their various smartphone or even their electronic mail, till they go to bed and turn off their computer or smartphone. An example of the effect of cyberbullying is the aftermath of the dispute between a famous Nigerian musician, Ayodeji Balogun, also known as 'Wizkid', and a famous Nigerian blogger, Linda Ikeji, in January 2016. This incident made Linda Ikeji feel threatened about her safety and plunged her into an emotional state. According

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

to a trendy Nigerian entertainment news website, *bellanaija.com.com*,[11,] the famous blogger published a story about Wizkid's alleged eviction notice from his rented apartment. In response, Wizkid showed off his new place of abode, and many people assumed he had bought the house. But the blogger revealed to the public that Wizkid only rented the place. This public revelation did not go well with Wizkid, as he took to social media and lashed out at the blogger.[12] The famous musician further went ahead in uttering more derogatory words in showing his anger at the popular blogger, which sparked more outrageous comments from her fans.

Cyberbullying, especially among entertainers, is a menace that warrants urgent attention[13]. The prevalence of this menace ranged between 25.0%[14] to as high as 72%[15]. Cyberbullying experiences hinge on socio-demographic characteristics and psychosocial and socio-ecological factors emanating from social interactions.[16] Victims suffer negative emotions such as frustration, anger, hopelessness, and even feelings of sadness.[15,17] Depression, anxiety and low self-esteem levels are higher among cyberbullied.[18,15,19] More direct attacks or celebrity 'bashing' are targeted at famous personalities,[20] causing them undesirable, negative and uncomfortable feelings and experiences.[21] It is often difficult for victims to escape independently, but with the right coping strategies coupled with social support as part of their coping strategy guide,[22] many escape from this trauma.

Cyberbullies are members of society; hence, awareness of and identifying forms and factors influencing cyberbullying and taking necessary actions to discourage the act is one of this study's motivating factors. Stakeholders in the entertainment industry will be informed on why this action should be combatted more aggressively. This research's findings will foster the eradication of this deviant act expressed as cyberbullying among Nigerian youths. This study revealed issues and the psychological effects of cyberbullying on celebrities in Ibadan, Nigeria. As such, it will create awareness about the negative impact of chastisement and criticisms of practitioners in the Nigerian entertainment industry on the Internet.

Aim: This study was designed to investigate the experience, effects, and coping mechanism of cyberbullying among celebrities in the Ibadan metropolis, Oyo state, Nigeria.

Materials and Methods:

A descriptive cross-sectional qualitative study was conducted among 14 celebrities in the Ibadan metropolis. The metropolis comprises five Local Government Areas (LGAs) in Ibadan, Oyo State, Nigeria. This allowed the researcher the opportunity to get enough participants for the study. Ibadan had been a Nigerian divisional capital city in the past and was once the capital of Western Nigeria. Over the years, it has grown to become Nigeria's largest

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

urban centre, especially with its proximity to Lagos, Nigeria's economic centre. The city is one of Nigeria's largest metropolis by geographical area, situated in the South Western part of Nigeria, 128 km inland North of Lagos State and 530 km South West of Abuja, Nigeria's capital. It is a popular and prominent transit point between the coastal region and the areas in the country's hinterland. Ibadan city, established in 1829, has a population with a growth rate of 3% per year, as seen in the increase from 2,118,391 as recorded in 1996 to 3,598,475 in 2005 (Nigerian Population Commission, 2006). Ibadan is home to some federal establishments, institutions, and research institutes. Nigeria's Premier University (established in 1948), University College Hospital (established in 1957) and Africa's first television broadcast station, Nigeria Television Authority (established in 1959), are all situated in the city of Ibadan.

The study population comprised celebrities in the Nigerian entertainment industry in Ibadan, mostly comedians, perfumers, music producers, brand influencers, bloggers, on-air personalities and models. Those who consented to participate in this study were recruited. However, participants who are celebrities in Ibadan but unwilling to participate in this study were exempted from the study. Individuals who were not celebrities or were indisposed when conducting the study were also excluded.

Sample Size Determination: A priori 13 interviews were set from a previous qualitative study on cyberbullying among celebrities.[23] Data saturation criterion was used to determine the sample size. Data saturation was achieved and applied after conducting ten interviews when three additional interviews yielded no discovery. For this study, saturation was reached before the end of the 14th interview, and the interview was concluded at that point.

Sampling technique: Participants were hard to reach due to the nature of their jobs; hence, a purposive (snowballing/networking) sampling technique was used. A multistage sampling technique was adopted for the selection: *1.* The entertainment sectors in Ibadan were categorised into TV/radio hosts, musicians, actors, comedians, social media influencers, Disc Jockeys, and makeup artists. *2.* The number of members in each entertainment sector was determined by conducting a record review through the Association of Entertainment Stakeholders (AESOS) Oyo State, Nigeria officials. The records showed only 262 registered members. *Stage 3:* The random sampling technique was used to select the eligible celebrities.

Data Collection Instrument: The qualitative data were collected using an in-depth interview (IDI) guide harnessed on information on the views, experiences, effects and perceptions of cyberbullying. To ensure the instrument's validity, literature was reviewed to acquire the knowledge and ideas needed to develop the IDI guide. The researcher's supervisor also reviewed the guide, making necessary corrections and adjustments. To

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

establish the instrument's reliability, a pre-test was conducted among 10% of the total study population in Lagos state, a similar population group. Prospective participants were contacted before the study's commencement to explain its purpose in detail before obtaining it. Participants were also informed about the chance to revoke their consent freely at any point in the course of the interview. The confidentiality of each participant was maintained during and after collecting their information. Information collected from the participants was kept in the computer for analysis by the primary researcher with no access to unauthorised persons. Translation and back translation of the instrument and interviews conducted in Languages other than English were done. This ensures that the study participants understand the questions in the instruments. Once consent was obtained, interviews were scheduled.

Data Management and Analysis: The responses from the IDI were tape-recorded after due permissions were taken. The recorded responses were transcribed word for word and typed accordingly. Significant statements were underlined, extracted and labelled accordingly. The transcript fragments with significant statements were marked and labelled for additional analysis. The manual qualitative thematic analysis method was used to summarise the informational contents of the data[24]. Themes and categories were generated after the first few numbers of interviews. At the same time, information was subsequently grouped, and new groups were formed when new theme(s) emerged (s). The themes were used for data interpretation and narration.

Results:

1. Socio-demographic characteristics of participants

The majority, 78.6%, of the participants fall within the age of 25-35 years, with a mean age of 31. A total of 57.1% were male. Most (64.3%) were Christians, and 71.4% of the participants were Yoruba. Comedians had the most percentage of the group (21.4%). The majority (78.6%) have been in the industry for more than three years, with 50.0% being more active on Twitter (Details in Table 1).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Table 1. Socio-demographic characteristics of participants (N=14)

Demographic characteristics	№	%
Sex		
Male	8	57.1
Female	6	42.9
Ethnicity		
Yoruba	10	71.4
Edo	2	14.3
Igbo	1	7.1
Fulani	1	7.1
Age (in years)		
25-30	9	64.3
31-35	2	14.3
36-40	2	14.3
41-45	1	7.1
Religion		
Christian	9	64.3
Muslim	5	35.7
Social media Platforms most used		
Twitter	7	50
Instagram	5	35.7
Facebook	2	14.3
Occupation		
Comedian	3	21.4
Blogger/Online reporter	2	14.3
Brand influencer	2	14.3
Actor	2	14.3
On-Air Personality	1	7.1
Actress	1	7.1
Perfumer	1	7.1
Model	1	7.1
Music Producer	1	7.1
Number of years in the industry		
≤ 3	3	21.4
> 3	11	78.6

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

2. Experience of Cyberbullying among Celebrities

Celebrities experience a lot of cyberbullies via social media, blog post or reposts; the majority have been antagonised, harassed, criticised or defamed through offensive comments and content: many may be appraising, others defamatory. Perpetrators could use any derogatory or comparison to describe their victims. When asked, all participants agreed to have been cyberbullied; as such, it is a daily occurrence,

"*This could be done by leaving comments or even by publishing a negative post about the celebrity."* **(40-year-old; Male On-Air Personality).**

"Celebrities get a lot of positive comments, so some people leave negative comments just to get their attention since…they do that to stand out and as such, the celebrity can reply or do something to them." **(25-year-old Male Skit maker).**

Another supported,

"*They are also called internet trolls. There was a time when I put my product on the Internet for sale. I mostly got positive reviews until someone called my product 'sub par' and the person tried to convince people not to patronise me…"* **(44-year-old Female Perfumer).**

Trolls hope to leverage the emotions of others in the comment sections of social media platforms to make or get more attention. Depending on the issue, this act usually starts on the comment page, which eventually gets publicised by blogs, television channels and radio. The ripple effect of the activities of trolls makes the severity of cyberbullying on celebrities overwhelming as more people join in attacking the victims. As described by one of the celebrities,

"…someone commented that I was gay the way I was standing in the comment section, and then after he said it, others joined in and started supporting the guy." **(37 years-old; Male Comedian).**

There are several reasons why celebrities get bullied online: these are done by attacking entertainers' popularity, taking controversial offline issues online, cyberbullying through dressing, body shaming, and defamation of character.

a. Popularity attacks: Entertainers' popularity is the major reason why many were being targeted. This is because their work overexposes them to public scrutiny. Hence, it is a demand of the profession. As narrated by one of the participants,

"I am of the opinion that people like us who have a lot of attention from fans and the media are always victims of cyberbullying. It is the price one has to pay for fame…" **(29 year old, Female Blogger).**

"The price to pay for being famous is the constant attacks we get from our so-called fans, and there is little or nothing we can do about it. People

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

can say whatever they want on the internet…" **(44-year-old Female Perfumer).**

b. Taking controversial offline issues online: Cyberbullying has its roots in controversial offline issues, which may be personal rifts between celebrities and individuals, who, in turn, may take this to the Internet. For example, one participant said,

"I was once engaged in a misunderstanding with a client, and this guy went on Twitter to pay some people to attack me. How can you take a physical battle online? Something that completely happened offline, how can you then take that online to people that completely were unaware of the situation in the first place?" **(34-year-old Male Actor).**

c. *Cyberbullying through dressing pattern:* Most participants experienced bully due to what they do and how they dress online. One celebrity posit,

"Like there was a time I wore blue pants and a black shirt, and someone commented that I was gay (due) to the way I was standing in the comment section, and then after he said it, others joined in and started supporting the guy" **(37-year-old Male Comedian).**

Another participant said,

"*I wore a nice shirt and made a video of me walking in the streets, and then the person had put a nasty comment on that post. He called me a faggot. I didn't even see the comment but noticed more comments of others bashing this person in my comment section on my behalf, so I checked. I ended up deleting that post and blocking the person"* **(29-year-old Male Actor).**

Yet another participant said:

"Well, I was out of the country with a few of my girls, so we went to the pool in bikinis and posted these videos on our social media pages. I started seeing awful comments that the trip was sponsored by a sugar daddy and that I was involved in prostitution. They called me and my girls names like 'opo', 'olosho' (prostitute)" ***(*****28-year-old Female Actor).**

These names, however, are quite offensive to these celebrities, and it is one of the major ways they are being bullied online by the perpetrators.

D. Body Shaming: Female celebrities usually experience body shaming more; nevertheless, this has become the major aspect through which bullies attack celebrities. Regardless, perpetrators would make unpleasant comments. To some, a thin-shaped body is the benchmark of beauty; hence, individuals with different body shapes are cyberbullied through name-calling. A few participants said,

"…I went shopping and got myself some nice outfits. I loved those clothes and posted some videos on my Instagram stories. (Within a short while) I started seeing responses of people pointing out how big my tummy is, and some even asked if I was pregnant…." **(29-year-old Male Brand Influencer).**

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

"*The way I look now wasn't me in the past; I got so many body-shaming comments on my posts in the past ehn, people will pointed out that my legs are big. I had to hit the gym: those things were becoming quite unpleasant"* (**34-year-old Male Actor**).

Another interviewed participant said,

"*For the fact that I walk like a girl and talk like a girl, this has been a major reason why I have been bullied because apparently, that I look gay..."* **(29-year-old Male Actor).**

Society views beauty from different perspectives, and when celebrities deviate from the 'cultural standard', this becomes a reason for celebrities to get bullied. Therefore, the way and manners through which they talk, look, walk, and post pictures are often used against them.

3. Effects of cyberbullying on celebrities

All participants reported varying effects of cyberbullying. Psychological trauma has been the prevailing outcome of bullies; this has caused 'excruciating' and 'painful' experiences on the health and lives of victims:

"Well, due to the fact I was cyberbullied, I was affected psychologically for a short moment…bullies need to know, people get…psychologically down due to bullying..." **(29-year-old Male actor).**

And a similar experience was shared by another participant,

"I couldn't sleep that night because I was so worried… I thought about stopping my job since people could not handle the truth about what I had posted…the fans wouldn't stop insulting me online…" **(27-year-old Female blogger).**

Through this, many reported stopped posting content, closed up social media for a while, lost jobs and left the industries; others, on the other hand, have run into debt or lived a 'fake' life to satisfy fans or avoid internet bullies. A participant pointed out that,

"Once beaten, twice shy. I stay safe these days: no more videos of me walking or talking on my feeds. I can't stand being constantly called gay because of how I walk and talk. It's not my fault I was created that way." **(29-year-old Male Actor).**

Therefore, low self-esteem, mental stress, depression, loss of professional interest, social neglect, substance abuse and financial crisis emerged as the sub-themes reported.

a. Development of low self-esteem: Bullies have made respondents develop self-esteem; therefore, many reported feeling sad most of the time when these trollies are made. According to some participants,

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

"For a while, every time I share links to my blog releases, I get bashed because it is probably annoying to some fans of other celebrities; it made me question the kind of content I put out" **(29-year-old Male Blogger).**

"I simply posted a joke about a viral issue to ease tension…I was attacked, called talentless, 'boring' comedian…and so many other annoying names. Yeah, I felt bad: I started questioning myself… I had to keep questioning myself. And then it almost ruined my day …." **(30-year-old Male Comedian).**

"…since someone called me a Turtle, now when people tweet at me out of excitement that they saw me on TV or whatever, I get sceptical because they might be messing with me again, and now, I don't think of myself as a fine boy …" **(26-year-old Brand influencer).**

b. Mental stress crisis: Cyberbullying has caused some celebrities a lot of mental stress; this is prevalent to the extent of attempting suicidal; hence, some considered taking/ending their own lives to end the shame:

*"Everyone was so sure I did something wrong and took turns attacking me, calling me names, names 'wey my mama and papa no call me'(pidgin English)… after a while, I just wanted to die, I thought if I maybe drink Sniper… they will see how crazy their acts are…"****(30-years-old; Comedian).***
Another celeb expressed his opinion in pidgin English,

"…thank God for the phone call from my mum, 'I for don dey under 6 feet by now' (I would have died now). 'I don already plan to go Eleyele River to drown' (I have decided to commit suicide at Eleyele River)…those words were harsh from my online haters: how can someone say a whole me is a fag…That they could have gotten me killed or even arrested by the police. Being gay is a crime here o…" **(27-year-old Male Model).**

c. Depression: Depression was another aftermath of bullies recorded among celebrities; all reported to have experienced this:

"The 'gbas gbos' (confusion) was quite a lot for me to handle: I was depressed at some point. I just wanted to be all by myself, I didn't want to talk to anyone, my friends,family, no one…I felt really low..." **(28-year-old Female Actor).**
Another reported that,

"I went through quite a lot in the hands of the cyberbullies who came after my product then. I was always buried in thoughts, always thinking, and I won't be able to sleep because of this constant thinking; drugs were even working…it was that bad…" **(44-year-old; Female Perfumer).**

d. Loss of interest and low service outcomes*:* Depression, if not managed, may result in loss of control in the acts or a chosen profession. Many were almost plunged into this,

"While anchoring my radio show, I was so shocked when people dragged me on the station's Facebook page that I was trying hard to shrug

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

it off, but it was quite a difficult task… I just couldn't continue because of all the negativities…how do you concentrate on dishing out content to people while you fight online?" **(40-year-old Male On-Air-Personality).**

This was corroborated thus:

"Having one's mind fixated on negative thoughts actually brings bad vibes; it was so hard to concentrate on set and remember my lines for a sequel I was shooting after my incident, I just took permission to leave that set because I couldn't stop thinking about all what the internet people were saying about me……" **(28-years- old Female Actor).**

e. Resulted in substance abuse: Some participants used substance abuse to escape the bullying experiences. According to a few participants,

"… anytime my guys left me after they have spent the whole day trying to cheer me up, I somehow pick up my phone and see nasty comments all over again, I just drink myself to sleep…." **(25-year-old Male Comedian).**

Another narrated how he prevented the effect of bullying through substance use,

"'Weed' (Marijuana) was of great help when I was being called horrible names on the Internet, and cybercriminals were castigating my skills. Then, 'once you hit a blunt' (the moment you smoke marijuana), you'd be too happy to be bothered about what anyone had to say...." **(31-year-old Male Music Producer).**

f. Financial crisis ensued celebrities through bullies

Some other effects of cyberbullying cost celebrities a lot of financial crises due to loss of jobs, endorsements, customers, patronage, referrals, etc. A bad review, false allegations, derogatory comments, etc, on a product, service or personality could destroy a reputation built with much effort, creating a financial crisis. Some participants reported that,

"...I lost quite a number of readers that visit my blog after they endlessly made my blog not credible with their harsh words, this traffic loss reduced my revenue…" **(27-year-old Female Blogger).**

In addition, a comedian put it thus,

"…My agents couldn't get me shoots any more, no money, all this because someone decided to accuse me of impregnating her. I was eventually exonerated, but before then, the cyberbullying tore a big hole in my pocket…" **(25-year-old Male Comedian).**

A blogger also added to the assertions thus,

"*A lady once said my products were too expensive and went ahead to call them sub- standard. This somehow managed to get my attention, which had a negative effect on my sales....* **(27-year-old Female Blogger).**

These acts sabotage celebrities' businesses.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

g. Social and societal neglect: Some celebs were abandoned during travails with online trolls. Society has no structure to rescue victims of cyberbullying, and this has caused them more emotional harm, loneliness, social and societal neglect and disconnections and opportunities.

"When I was being bullied, my colleagues just did like they didn't see anything happening, they just stayed quiet and acted blind. None of them came helping…." **(28-year-old Female Actor).**

Another celeb said,

"*The society we are in doesn't really protect celebrities because abroad, just a false message can get you in trouble or jail, or even to pay a lot of money you are attacking online. But down here, they don't care; there are more important things to care about. It's free publicity for bullies . . ."* **(25-year-old Male Comedian).**

4. Factors responsible for cyberbullying among celebrities

All participants mentioned several reasons for cyberbullying, including clout chasing, fun-play, punishment, discrimination, jealousy, revenge, hatred and envy. Others are conspicuous lifestyles, the quest visibility, sponsorship, endorsement, connections and media influence. All these may emanate from both the co-celebs and their fans. As pointed out below,

" . . . the fact that I am posting my lifestyle on the internet makes some disgruntled people come after me, like when I change my car or buy new shoes and I post it, some haters start saying is it this same music production he is doing that he is always lavish . . . " **(40-year-old Male On-Air Personality).**

A few participants also shared similar thoughts,

"*Hatred causes this thing mostly. Again, gender causes it; you can wonder why someone of the same gender is doing better, especially females, and they link it with prostitution…."* **(26 year old Male Brand influencer).**

"*Well, one can also say the way I flaunt my lifestyle on social media, especially when I travel, makes me a target. Remember my Dubai trip story I told you earlier…"* **(29-year-old Male Actor).**

5. Coping mechanisms employed by the participants in overcoming cyberbullying

All participants narrated a series of coping mechanisms employed in overcoming their cyberbullies, presented in theme and sub-themes shown below.

a. **Solace from friends/family:** Findings revealed that friends, family and colleagues were of help during their travails.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

"*I got a lot of support, people reported the pages that kept victimising me, and thankfully Instagram deleted them, and I had my peace…"* **(25-year-old Male Comedian).**

"I got calls, suggestions, sometimes friends even scold the person, like the look, you shouldn't be doing this. My colleagues on the radio call me up and offer suggestions and what and what they feel I should do. My GM even called to calm me down and asked me to be strong…" **(A 40 year old male OAP).**

***b*. Some, on the other hand, have adopted avoidance/ignoring offensive messages or chats by deleting personal social media handles**. For instance,

"I deleted my social media accounts o… Basically, that was what I did…" **(27-year-old Male Model).**

***c*. The tech-savvy also adopted a technical coping system:** this involves taking advantage of social media tools such as report/complaints forms, privacy settings, blocking, comments filtration, etc, to help curb communication from assailants. In their words,

"There is the option to delete comments, there is the option to filter comments, and also you can block and report internet bullies…" **(44 year old; Female Perfumer).**

An actor described this thus**:**

"I know you can report certain tweets on Twitter, and they (Twitter authorities) look into it and take steps to curtail it. That way, I end the nonsense before it even starts…" **(29-year-old Male Actor).**

Privacy settings and blocking of unwanted fans were also adopted as an approach.

"I've learnt to start blocking people; it's good for my mental health…." **(29-year-old Female Blogger).**

***d*. Preventive and corrective coping methods**: To avoid being a victim, celebs put *preventive measures* in place.

"You just have to watch what you let these people see, and due to that, I post only what I think won't trigger negative vibes on my page. It's been safe for me that way, no negative vibes around my page…" **(26-year-old Male Brand influencer).**

Those who were once a victim tends to 'ignore' bullies or seek help through counselling to help remediate and overcome subsequent occurrence, using a corrective coping method. A male actor narrated his corrective strategy thus,

"I have just learnt to overlook things and ignore negative comments since I know some just need to ride on my wave to get viral. I won't allow anyone to use me for cheap publicity again, once beaten twice shy…" **(29-year-old Male Actor).**

Other celebrities shared a similar view,

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

"I did some counselling, yes, after my cyberbullying experience that lasted a week. That one was hell, and there are two people I go to, I go there to tap some ideas and get counsel; I got motivated after my sessions and somehow, bounce back on my feet…" **(37-year-old Male Actor).**

"…I had to find a way to be proud of my body again: my therapist really did a good job in restoring my self-confidence after those jobless idiots succeeded in ruining my self-confidence…" **(29-year-old Male Brand influencer).**

e. Spiritual supports: Nigeria is a country where people resort to spiritual support for solutions. Some participants have to adopt this method, and according to a few,

"So after someone castigated me for my music production skills on the Internet, and it affected my business, I went to seek the face of God, in church, and mountains…I felt I had to report them to God, and I did; somehow, it stopped the bullies' effects from getting to me. I became empowered, more at peace, and mostly unbothered…" **(31-year-old Male Music Producer).**

"The fact that my family and I, including my daughter, prayed about it at the mosque and in the house, I simply asked God to direct me and end the bullying cycle. Somehow, I felt relieved and great that my family members joined me in praying: it made me and my family stronger…." **(27-year-old Female Blogger).**

In addition, a perfumer added her experience thus:

"After my ordeal with my online hater who criticised my products, I was sure some evil forces wanted to end my business…. I had no choice but to say some silent prayers now and then; this made me feel at peace, and I had a sense of calmness…" **(44-year-old Female Perfumer).**

Almost all prayed to end their bullying cycle; unfortunately, no one sought legal redress against the bullies because of the lack of structures to arrest or prosecute cyberbullies or offenders in Nigeria.

Discussion

Participants' socio-demographic characteristics

The major age group (25-30 years) is a characteristic of the tech-savvy population who uses social media for adventures. This is similar to the characteristics of the study populations by Anderson and Jiang[25] and Derbyshire, Lust, Schreiber, Odlaug, Christenson et al.[26], were young adults spend more time on the Internet due to their age.

Cyberbullying Experiences among Celebrities

Celebrities in this study revealed a lot about becoming the target of cyberbullying. A few celebrities wondered why they had been targeted and concluded that it was primarily due to their fame and being out there in the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

public eye[20]. Being in public gives rise to thorough scrutiny by fans, friends, and assailants. As such, it has exposed them to many negative comments about their work, body, sexual orientation, how they go about their day-to-day activities and many other things. Popularity and a large friendship base increase the risk for cyberbullying; this idea of being a target due to fame posited in this study was supported by Straksud.[27] As such, cyberbullies used means such as name-calling, body shaming, clout chasing, and even trolling to bully celebrities.[28] An increase in the number of online friends such as Facebook, which do not have any connection to the participants in real life, can further increase the chance of being a victim of cyberbullying.[29]

Factors responsible for cyberbullying among celebrities

A study by Schacter, Greenberg and Juvonen[30] revealed that more personal disclosures on social networking sites increased the risk of cyber victimisation. This assertion is very similar to the factors cited by the participants in this study. People have unprecedented access to a wealth of information and millions of people online. This is dangerous because this, in turn, gives everyone access to individuals on social media platforms. As such, they can do or say whatever they want under the guise of anonymity. As observed, one of the factors responsible for cyberbullying included media influence: people (celebrities and non-celebrities) engage in cyberbullying for media buzz or frenzy. Cyberbullying a celebrity often, is hidden under the guise of making jokes. This is usually done to get a lot of attention from the media, generating a tone of buzz.

Effects of Cyberbullying on Celebrities

Cyberbullying affects people from any age or walk of life, including celebrities, who all feel distressed and alone when bullied online. Cyberbullying can overwhelm someone, resulting in many celebrities feeling embarrassed, devasted and helpless. Effects described here are in tandem with those of Hoff and Mitchell[31,] which include physical, emotional and psychological, in addition to increased levels of depression, anxiety and psychosomatic symptoms. Our study found out that many have ideated suicidal attempts; this is in agreement with the study of Coelho, Marchante and Romão[32], Wright, Wachs and Gamez-Guadix[33] and Lee[34] where anxiety, social anxiety, and suicidal ideation were on the increase. This is, therefore, an area of interest for further investigations.

Coping Mechanisms Employed by Celebrities in Overcoming Cyberbullying

In this study, one important question the researcher asked the participants was how they managed or coped during and after these cases of

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

cyberbullying. Their coping mechanisms include technical coping, spiritual support, preventive and corrective coping and solid social support: participants interviewed revealed that friends, family and colleagues were immensely helpful during their ordeal with cyberbullying. They could find comfort in their friends, family and colleagues and, as such, could deal with and move past the ordeal. Kochenderfer-Ladd and Skinner [35] affirmed that while dealing with cyberbullying, celebrities could either try avoidance techniques of coping or approach the problem. Approach coping strategies are attempts to change the stressful situation, including problem-solving and seeking social support. The problem-solving strategy encompasses the victim's coping through independent action, the seeking social support strategy involves the victim's inclusion of others in the coping process, and the seeking social support strategy consists of the victim's inclusion of others in the coping process.

Conclusion

Cyberbullying among celebrities has become a norm perpetrated by bullies on notable personalities, celebrities, etc. Many have and are still experiencing this menace, which has various interwoven factors. There was a high prevalence of cyberbullying among celebrities, with many undergoing high psychological effects. Prompt awareness, effective policy, legislation and adequate coping strategies are urgently needed from policymakers to help address the prevailing menace among celebrities in Ibadan, Oyo State, Nigeria.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All of the data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

Declaration for Human Participants: This study was approved by the Oyo State Research Ethical Review Committee, Ministry of Health, Secretariat, Ibadan, Nigeria (Ref № AD 13/479/1459) and the principles of the Helsinki Declaration on research involving human subjects were followed.

Author Contributions

AMK conceptualised the idea, collected and analysed the data, wrote the first project report, corrected the revised report, and reviewed the manuscript.
IOD reviewed the proposal, supervised data collection and report writing, reviewed the project report, and developed the manuscript.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Acknowledgments

Special appreciation to the study participants who provided the information for the research work and the qualitative data analyst, Sam Akande. The authors acknowledge everyone who provided intellectual and technical assistance in developing the manuscript.

References:

1. Smith PK, Madsen KC, Moody JC. What causes the age decline in reports of being bullied at school? Towards a developmental analysis of risks of being bullied. *Educ Res*. 1999;41(3):267-85.
2. Olweus D. Bullies on the playground: The role of victimisation. Children on playgrounds: *Res. Perspect & App.*1993:85-128.
3. Smith PK, Mahdavi J, Carvalho M, Fisher S, Russell S, Tippett N. Cyberbullying: Its nature and impact in secondary school pupils. *J Child Psychol Psychiatry*. 2008;49(4):376-85.
4. Celuch M, Savela N, Oksa R, Latikka R, Oksanen A. Individual factors predicting reactions to online harassment among Finnish professionals. *Comput Human Behav*. 2022; 1;127: 107022.
5. Kilvington D, Price J. Tackling social media abuse? Critically assessing English football's response to online racism. *Commun. Sport*. 2019;7(1):64-79.
6. Klein A. Fanaticism, racism, and rage online: Corrupting the digital sphere. *Springer;* 2017.
7. Zhu C, Huang S, Evans R, Zhang W. Cyberbullying among adolescents and children: A comprehensive review of the global situation, risk factors, and preventive measures. *Front Public Health*. 2021; 11; 9:634909.
8. Auriemma V, Iorio G, Roberti G, Morese R. Cyberbullying and empathy in the age of hyperconnection: an interdisciplinary approach. *Int J front Sociol*. 2020; 16; 5:551881.
9. Maity SK, Chakraborty A, Goyal P, Mukherjee A. Opinion conflicts: An effective route to detect incivility in Twitter. *Proceedings of the ACM on Human-Computer Interaction*. 2018;1;2(CSCW):1-27.
10. Juthe RH, Zaharchuk A, Wang C. Celebrity disclosures and information seeking: the case of Angelina Jolie. Genetics in medicine. *Am J Med Genet.* 2015;17(7); 545–553. https://doi.org/10.1038/gim.2014.141
11. 11.BellaNaija. 2016. Celebrity Feuds of 2016 continue with Wizkid vs Linda Ikeji. https://www.bellanaija.com/2016/04/celebrity-feuds-of-2016-continue-with-wizkid-vs-linda-ikeji/. Accessed May 15, 2022.
12. 12.BellaNaija. *Here's Why Linda Ikeji Reported Wizkid to the Nigerian Police* https://www.bellanaija.com/2016/04/heres-why-

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

linda-ikeji-reported. Accessed May 15, 2022.
13. Williams KR, Guerra NG. Prevalence and Predictors of Internet Bullying. *J Adolesc Health*. 2007; 41 (6): s14-s21
14. Patchin JW, Hinduja S. School-based efforts to prevent cyberbullying. *Prev Res.* 2012; 19(3):7-10.
15. Juvonen J, Gross, EF. Extending the school grounds? Bullying experiences in cyberspace. *J Sch Health.* 2008; 78(9):496-505.
16. Onditi, HZ, Law, DM, Baitz R, Shapka JD. The relationship between self-concept and cyber-bullying behavior in adolescents. *Presented at the conference of Society for Research on Adolescence* (SRA). 2014. Austin-Texas, USA.
17. Patchin JW, Hinduja S. Bullies move beyond the schoolyard: A preliminary look at cyberbullying. *Youth Violence Juv Justice*. 2006; 4(2):148-69.
18. Hay C, Meldrum R. Bullying victimisation and adolescent self-harm: Testing hypotheses from general strain theory. *J Youth Adolesc.* 2010; 39: 446-59.
19. Ybarra ML, Mitchell K. Online aggressor/targets, aggressors, targets: a comparison of associated youth characteristics. *J Child Psychol Psychiatry*. 2004;45 (7): 1308-1316
20. Marwick A, Boyd D. To see and be seen: Celebrity practice on Twitter. *Convergence*.2011;17(2):139-158.https://doi.org/10.1177/1354856510394539
21. Ouvrein G, Vandebosch H, De Backer CJ. Celebrity critiquing: hot or not? Teen girls' attitudes on and responses to the practice of negative celebrity critiquing. *Celebr Stud*. 2017; 3:8(3):461-76.
22. Na, H. 2015. *The effects of cyber-bullying victimisation on psychological adjustments among college students. ProQuest Dissertations and Theses*.
23. Ouvrein G, Hallam L, JS De Backer C, Vandebosch H. Bashed at first sight: The experiences and coping strategies of reality-TV stars confronted with celebrity bashing. *Celebr Stud*. 2021; 3:12(3):389-406.
24. Braun V, Clarke V. Using Thematic Analysis in Psychology. Qualitative Research in *Psychology*. 2006*;* 3: 77-101.
25. Anderson M, Jiang J. Teens, social media & technology. *Pew Research Center*. 2018; 31(2018):1673-89.
26. Derbyshire KL, Lust KA, Schreiber LR, Odlaug BL, Christenson GA, Golden DJ, Grant JE. Problematic Internet use and associated risks in a college sample. *Compr Psychiatry*. 2013;54(5):415-22.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

27. Staksrud E, Ólafsson K, Livingstone S. Does the use of social networking sites increase children's risk of harm? *Comput Hum Behav*. 2013;29(1),40-50.
28. Tayo, A.O. 2016. *Should celebrity trolling be punishable by law?* http://pulse.ng/celebrities/cyber-bullying-should-celebrity-trolling-be-punishable-by-law-id5025946.html the-wizkid-threat-to-the-nigerian-police/ . Accessed May 15, 2022.
29. Wegge D, Vandebosch H, Eggermont S, Walrave. The strong, the weak, and the unbalanced: The link between tie strength and cyberaggression on a social network site. *Soc Sci Comput Rev.* 2015; *33*(3): 315–342.
30. Schacter HL, Greenberg S, and Juvonen J. Who's to blame? The effects of victim disclosure on bystander reactions to cyberbullying. *Comput Hum Behav*. 2016; 57: 115-21.
31. Hoff DL, Mitchell SN. Cyberbullying: Causes, effects, and remedies. *J. Educ. Adm.* 2009;47(5):652-65.
32. Coelho VA, Marchante M, Romão AM. Adolescents' trajectories of social anxiety and social withdrawal: Are they influenced by traditional bullying and cyberbullying roles? *Contemp Educ Psychol*. 2022; 69:102053.
33. Wright MF, Wachs S, Gámez-Guadix M. The role of perceived gay-straight alliance social support in the longitudinal association between homophobic cyberbullying and LGBTQIA adolescents' depressive and anxiety symptoms. *J Youth* Adolesc. 2022;51(7):1388-96.
34. Lee J. Pathways from childhood bullying victimisation to young adult depressive and anxiety symptoms. *Child Psychiatry Hum Dev.* 2021;52(1):129-40.
35. Kochenderfer-Ladd B, Skinner K. Children's coping strategies: Moderators of the effects of peer victimisation? *Dev Psychol*. 2002; 38(2):267.

ESJ Humanities Peer-reviewed

The Impact of Providing Chatbot Content on Developing the English Communication Skills Among Al-Azhar Kindergarten Teachers

Ghada Mohamed Ahmed Tawfik
The National Egyptian E-Learning University (EELU),
Faculty of Educational Studies (FES), Egypt
Mohamed Elsayed Elnagar
Associate Professor of Education Technology, The National Egyptian E-Learning University (EELU), Faculty of Educational Studies (FES), Egypt
Gehan Sedky Alazab
Associate Professor of English Curricula and Methodology,
Faculty of Graduate Studies for Education, Cairo University, Egypt

Doi:10.19044/esj.2023.v19n32p108

Submitted: 08 October 2023
Accepted: 13 November 2023
Published: 30 November 2023

Cite As:
Ahmed Tawfik G.M., Elnagar M.E. & Alazab G.S. (2023). *The Impact of Providing Chatbot Content on Developing the English Communication Skills Among Al-Azhar Kindergarten Teachers.* European Scientific Journal, ESJ, 19 (32), 108.
https://doi.org/10.19044/esj.2023.v19n32p108

Abstract

This paper focuses on investigating the impact of using Chatbot content on improving the English communication skills of Al-Azhar Al-Sharif kindergarten teachers. The researcher used a quasi-experimental design to explain the differences that occurred in the teachers` performance before and after the intervention of the Chatbot content. This design required the researcher to develop a performance observation checklist, which is the main tool of this research. In addition, the researcher constructed the Chatbot content and the e-training programme. After the research design was completed, thirty-three (33) female Azhari kindergarten teachers participated in this experiment. The performance observation checklist was used for evaluating the teachers` performance before and after the intervention of the Chatbot content and for measuring the teachers` retention of the acquired skills. At the end of the research, a statistical analysis of the results was applied. The results showed a statistically significant difference at the level of

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

0.05 on the performance observation checklist`s mean scores of the sample teachers' pre-and post-application of the Chatbot content in favour of the post-application. The second statistical analysis of the performance observation checklist showed that there is no significant difference between the sample teachers` mean scores in the post- and follow-up application of the Chatbot content. These results are proof that validate the research`s main assumption that Chatbot content can improve the English communication skills of kindergarten teachers.

Keywords: Chatbot application, training kindergarten teachers, English communication skills, teaching English as ESL teachers, Al-Azhar Al-Sharif teachers

Introduction

Currently, digital technology plays a vital role in our daily lives as its applications integrate into all walks of life. It is used in social services, engineering, healthcare, commerce, and education. Education 2.0, the new education system that was first introduced to some stages in the school year 2018-2019, is based on technology and digital resources in achieving its main objectives of developing students` scientific knowledge, as well as the life skills needed for future generations (Discover, 2018). This education system was first introduced to the pre-primary stage (kindergarten stage) with the aim of preparing those young children for their future lives in a world that depends on digital technologies. In this context, kindergarten teachers play a vital role in the holistic development of children`s social, emotional, and scientific knowledge (UNESCO, 2019).

However, various training programmes were developed with the aim of improving kindergarten teachers` abilities. From a critical point of view, those training programmes were restricted to classroom management, introduction to 21st-century skills, introduction to digital skills, resourceful/innovative teaching pedagogies, and life-long learning skills (Teachers First, 2020) that would help teachers to run a good class in Arabic language only. However, this does not give any guidance in running classes of teaching English as a Second Language (ESL). The case of neglecting English communication skills, which shapes the language inside students` brains, is very common among Arab nations (El-Kabsh, 2005).

Teacher communication skills are important for a teacher in the delivery of education to students (McCarthy & Carter, 2001), as well as for a student to acquire the four skills of English. However, communication skills are usually restricted to listening and speaking skills, but teachers need to master English classroom management as well as good pronunciation and speaking skills (Spratt et al., 2011).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

In this context, communication skills consist of two main fields namely: classroom management and classroom language. Classroom management plays a vital role in running a good English-language class. Although kindergarten teachers receive adequate training in classroom management in Arabic, there is little or no emphasis being made on English classroom management (El-Kabsh, 2005). This implies that kindergarten teachers may feel inadequately prepared to manage their classrooms effectively. Moreover, they are likely to have doubts about their ability and competence to maximize proactive classroom management practices to promote young children's learning (Kadry, 2018).

Classroom language, the second field of communication skills, requires more attention as it plays a vital role in the students` acquisition of language. Speaking is the most important skill required by teachers in order to help their students communicate in English. Without proper pronunciation and conversation skills, students will not be able to speak or communicate in English. Parupalli (2019) admitted that "in the English as a Foreign Language (EFL) teaching environment, oral skills are completely neglected, and more concentration has been given to reading and writing skills". There is no exception among Kindergarten teachers as they usually use Arabic translations of vocabulary, do not encourage students to speak, and do not have conversations with students.

From this point of view, communication skills need more attention and require more training and CPD programmes (Reimers et al., 2022; El-Kabsh, 2005). Although kindergarten teachers are active learners, some teachers lack the interest in training and prefer to neglect the new interactive methods of teaching and use the old methods that focus on knowledge-based objectives (Teachers First, 2020).

In finding another alternative training method that can attract teachers` attention, the researcher referred back to several studies about the usage of Artificial Intelligence (AI) technology in education and found that training teachers can help them benefit from technologies such as: Messenger, Chatbot, and Learning Management Systems (LMS). In 2016, Chatbot started to gain familiarity among users due to its interactive user interface (Wizu, 2018). As a result, the researcher decided to use Chatbot to develop the training content. In this research, the researcher investigated the effect of using Chatbot as a medium for providing an English communication skills training programme to kindergarten teachers in Al-Azhar Al-Sharif.

Research Question

As a researcher, I started to investigate the teachers` previous experience regarding English communication skills and found that they did not learn suitable ways of running English classes in college, where they

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

received teaching methodologies in Arabic only (El-Kabsh, 2005). Consequently, teachers run their English classes in Arabic instead of running the classes in English in order to engage their students in the learning of their respective subject matter disciplines (Low et al., 2014). Moreover, they encourage their students to memorize vocabulary by translating instead of following the three steps of learning such as: understanding the meaning, pronouncing the word, and spelling the letters (Galal, 2021).

From this point of view, El-Kabsh (2005) stressed the importance of proper training programmes for kindergarten teachers to help them improve their English communication skills since they are the ones responsible for teaching English inside their classes. The most important decisions teachers has to make is on how to create a positive and supportive classroom environment that is based on a clear and well-organized management plan (Norris, 2003).

Chatbots have a growing presence in modern day society. It has become an integral parts of everything ranging from personal assistants on mobile devices to technical support over telephone lines, and it is even being used for health interventions (Serban et al., 2017). Messenger Chatbots are used to link customers with service providers. The major advantage of using a Messenger Chatbot is the low barrier of entry for the creator and his target audience. The benefits for the users are the use of a familiar interface, no need to download and install extra applications, and 24/7 availability. In addition, many international conferences recommended using Chatbot as a medium for delivering education and training. The recommendations of the fifth Information Technology for Education and Development (ITED) (2022), the Asian Conference on Innovation in Technology (ASIANCON) (2021), and the IEEE International Conference on Engineering Technology, and Education (TALE) (2019) aim to encourage and support the integration of Chatbot with traditional education methods in educational institutions to promote education.

With the needed approvals, the researcher performed a pilot study to determine the skills needed for KG teachers to run their classes as ESL teachers. The researcher designed a questionnaire of ten questions that were offered to teachers to answer. Thirteen teachers were chosen randomly to answer the questionnaire. The findings disclosed that teachers have difficulties dealing with classroom management and classroom language, while the majority showed abilities to write a suitable lesson plan, use different methodologies, and use different ways of evaluation.

As a result, this study can be formulated in the following question as follows:

- What is the impact of providing Chatbot content on developing English communication skills among AlAzhar kindergarten teachers?

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Subsequently, this main question is branched into four questions that can be defined as follows:

1. What are the English communication skills required for kindergarten teachers to run English classes as ESL teachers?
2. What is the proposed design of Chatbot content that can be used to improve the teachers` English communication skills?
3. What is the impact of providing Chatbot content on kindergarten teachers` performance as ESL teachers?
4. How far is providing Chatbot content helpful in teachers` retention of English communication skills?

Importance of the Study

This study aimed at using AI (Chatbot) technology to provide a training programme for kindergarten teachers in Al-Azhar Al-Sharif to improve their classroom communication skills. Therefore this study is significant in:

1. Dealing with kindergarten teachers` skills, as there are a few studies dealing with them in general.
2. Dealing with Al-Azhar kindergarten teachers as ESL teachers, as there are few studies dealing with this subject.
3. Using Chatbot as a medium to provide e-training content to kindergarten teachers.
4. Encouraging kindergarten teachers to use e-content as a means for receiving and delivering professional development programmes.

Relevant Literature

Chatbot is a mobile phone and computer application that attempts to simulate conversations of human beings via text or voice interactions (Rouse, 2017). In other words, a Chatbot is a software application used to conduct an online chat conversation via text or text-to-speech interaction, which provides direct contact with a live human agent. Technically, Chatbot is an artificial intelligence application and a Human-Computer Interaction (HCI) model (Bansal & Khan, 2018). The fundamental objective of HCI is to make systems more usable and useful, and to provide users with experiences that fit their specific background knowledge, and objectives. Designers of human-computer systems write one piece of software for millions of users (at design time) and make it work as if it was designed for each individual user (only known at use time) (Fischer, 1999). As a result, Chatbots use Natural Language Processing (NLP) and sentiment analysis to communicate in human language by text or oral speech with humans or other Chatbots (Khanna et al., 2015). Natural language processing (NLP) gathers linguistics, computer science, and artificial intelligence together to create an interaction between

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

human language and machine language. It is a programme that processes and analyzes large amounts of natural language data. The main goal of this process is to create a computer capable of understanding the contexts of languages used within them accurately, and extracting and categorizing information before producing suitable responses. Chatbots try to simulate your way of communicating, and the more you communicate with a Chatbot, the more it understands your responses and imitates your style of communication (Neff & Nagy, 2016).

The development of artificial intelligence and Chatbot technologies has led to the creation of mobile personal assistants. By 2014, Microsoft had launched its personal assistant called "Cortana" (Cortana, 2019). Cortana is considered as a more advanced digital assistant (Cortana, 2018). In the same year, Amazon launched its own personal assistant called "Alexa" (What exactly is Alexa?, 2019). Alexa is built into devices for home automation and entertainment. Alexa created what we now call the Internet of Things (IoT). This means that developers can use the Alexa Skills Kit (ASK) to create and publish free or paid Alexa skills. In addition, Alexa introduces security issues. The elevation of artificial intelligence technology due to the development of social media manufacturers' platforms in 2016 has brought a rapid change in the way people communicate with manufacturers. Social media platforms allow developers to create Chatbots for their brand or service to help customers communicate with vendors within their messaging applications. At the end of 2016, 34,000 Chatbots covered a wide range of users in fields like marketing, supporting systems, health care, entertainment, education, and cultural heritage (Wizu, 2018). As for education and training, Chatbots are now used on a wide scale and are believed to increase connectivity and efficiency and reduce uncertainty in interactions (Ondas et al., 2019). In addition, they can easily provide a focused, personalized, and result-oriented online learning environment (Cunningham et al., 2019).

Starting with the possibility of using Chatbot in training teachers, the researcher had to decide upon the suitable Chatbot structure that could be used to deliver the training content. Based on its structure, Chatbot can be classified into three types. The first is Flow Chatbot, which is a tree-based chatbot. This chatbot has fixed responses set by the developer and only responds to questions that are already in the database. Flow chatbots include buttons, keywords, and catchphrases instead of free writing to drive the client down a predefined path. Many applications can help in developing a flow Chatbot such as; Dialogflow, ManyChat, Chatfuel, and many others. The second type is the artificially intelligent Chatbot. Chatbots with artificial intelligence have the ability to update their knowledge and perceptions from previous conversations and users' experiences, and this helps the users to engage with it more freely. The third type is a hybrid type. This type of Chatbot combines

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

the concepts of flow and AI Chatbots. This Chatbot can understand and communicate with users but remains in the pattern determined by the developer (Haristiani, 2019).

Conclusively, the researcher admitted that using flow Chatbot can help in creating the training course as it has a low cost, less time to create, better interaction, creative learning, and improved efficiency when instructing users (Llic & Markovic, 2016; Bii, 2018). However, users find mobile Chatbots to be safe and easy to chat online (Cameron et al., 2017) with the ability to operate as a 24/7 support service. It also provide responses to repetitive or frequently asked questions and it give access to learning contents when required (Garcia-Brustenga et al., 2018; Winkler & Söllner, 2018). Consequently, the researcher used the ManyChat application to develop a flow chat that can provide suitable training Chatbot content.

Facebook Messenger was used by the researcher as the social platform needed for the Chatbot. The researcher used Facebook Messenger as it is more familiar to users and keeps the user`s data and interaction history with the content. Moreover, it increases users` autonomy to finish the training by providing trainees with notifications of what they have done and what they have to finish (Elnagar & Habib, 2020).

In addition, the researcher used the Moodle platform to deliver the Chatbot content. The Learning Management System (LMS) was used to deliver Chatbot content in providing several tools that can control the training process. Moodle keeps records of trainees` data and information about their development. Interestingly, it also helps the trainer by presenting the training content, which keeps trainees willing to finish the training until the last moment. Additionally, Moodle provides different ways of assessing trainees` development by providing quizzes, questionnaires, and tests. It also provides the trainer with detailed results for each trainee (Al-Ajlan & Zedan, 2008).

Several studies have shown that Chatbot can be successfully implemented in an educational context (Durall & Kapros, 2020; pp. 13–24; Hien et al., 2018, pp. 69–76; Ho et al., 2018; Kumar et al., 2016; Mikic-Fonte et al., 2018; Mor et al., 2018, pp. 94–101; Ndukwe et al., 2019, pp. 365–368; Nguyen et al., 2019; Okonkwo & Ade-Ibijola, 2020; Ranoliya et al., 2017; Ureta & Rivera, 2018).

Chatbot can be of benefit in the following ways:

- **Integration of Content:** The use of Chatbot in education facilitates the integration of subject content for easy access to the students anytime and anywhere (Akcora et al., 2018, pp. 14–19; Wu et al., 2020; Yang & Evans, 2019, pp. 79–83). Content integration means that a teacher/trainer can upload any needed digital information to his students/trainees on an online platform to be accessed by authorized students/trainees.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

- **Quick Access:** Chatbots promote quick access to educational information (Ciupe et al., 2019; Murad et al., 2019; Wu et al., 2020).
- **Time-Saving:** Having easy and quick access to required information helps to save time (Ranoliya et al., 2017).
- **Maximize Abilities:** Chatbots can maximize student learning abilities and achievement (Clarizia et al., 2018, pp. 291–302; Murad et al., 2019).
- **Motivation and Engagement:** Currently, students are kept motivated and engaged by interactive systems such as Chatbot, which allow them to study in an exciting and comfortable environment (Chen et al., 2020; Pham et al., 2018; Rooein, 2019; Troussas et al., 2017). Learning with a conversational agent does not bore students but allows them to acquire knowledge more conveniently. As a result, the use of Chatbot in education aids in increasing student engagement (Molnar & Szuts, 2018; Lam et al., 2018, pp. 18–19; Adamopoulou & Moussiades, 2020).
- **Allow Multiple Users:** Chatbots can allow multiple users to access the system at the same time. This implies that many students from different locations can interact with a particular Chatbot without interruptions and obtain the required information. Wu et al. (2020) pointed out that one of the major benefits of using a Chatbot for educational purposes is that it allows multiple users to access it at the same time. Rooein (2019) agreed and stated that a Chatbot can handle multiple questions at the same time, saving the user time to do other tasks.
- **Immediate Assistance:** The usage of Chatbot in education enables academia and students to obtain rapid replies to their queries and activities (Alias et al., 2019, pp. 263–270). A Chatbot can provide instant support during individual classwork. It helps students to automate their activities such as submitting homework and responding to emails (Molnar & Szuts, 2018; Murad et al., 2019).
- **Adaptive Responses:** Chatbots can respond to learners' actions and emotions (Graesser, 2016), as well as find instant answers to their questions (Sreelakshmi et al., 2019).

As a researcher, I find these benefits of great importance, as they help teachers and instructors improve their lessons and help increase engagement in classes. Moreover, these benefits were tested throughout this research. The researcher used Chatbot as a medium for training kindergarten teachers. Using Chatbot in training allowed the trainer to send the training material once, and the trainees had the chance to review, interact, and learn as much as they needed.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

As for the English language communication skills, the researcher referred back to several previous pieces of literature and references to find out the most needed skills for kindergarten teachers. In this context, the researcher concluded that communication skills are a critical component of teaching. If there is any gap between what was intended by the teacher and the conveyed message, all the teacher`s efforts are in vain (Pelly, Tan & Zhang, 2009).
In order to learn, students must understand what is right and what is wrong, and this depends upon the teaching skills that the teacher adopts in the classroom. Good communication minimizes the potential for unkind feelings during the process of teaching. For learning, students must be motivated to learn. Loss (2000) highlighted the importance of communicating with students in a clear and understandable manner. Communication is a dynamic process that requires courage and mind to face each other.

The communication process must be carried out in a clear and understandable manner. Effective communication must convey and accept the uttered message in all kinds of situations and circumstances. Communication is considered to be a powerful tool for efficiency in the classroom (Srivastava, 2011). Numerous studies have demonstrated an important correlation between communication skills and teaching success. According to a study conducted by Ehindero and Ajibade (2000), the key to effective teaching is good communication skills, good classroom management, updating knowledge, and maintaining personality. It is impossible to teach effectively until one has these basic skills.

Moreover, a student's character-building and academic background is totally dependent on the teacher's attitude. When teachers adopt a positive professional attitude towards their students' academic and social accomplishments, students can easily raise their academic level. Educators have the responsibility to prepare students for all types of situations by teaching and preparing them practically. Furthermore, it is also the teacher's responsibility to act as a role model for the students to achieve well-behaved character (Honby, 2006).

Accordingly, the researcher concludes that the needed English communication skills for kindergarten teachers are divided into two main fields namely: classroom management and classroom language. Kindergarten teachers should administer these skills to run their English classes as ESL teachers.

Methods

This research used descriptive analysis to describe the current case of teaching English in Al-Azhar kindergarten institute. The descriptive analysis is used to analyze the studies related to the independent variable of the research, which is using Chatbot in training teachers. It also included a

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

literature review and studies conducted on the English communication skills of kindergarten teachers.

The researcher also used a quasi-experimental approach to test the effectiveness of using Chatbot content (the independent variable) on developing the English communication skills (the dependent variable) of Al-Azhar Al-Sharif kindergarten teachers.

Table 1. The Research Design

Pre-Course	**Process**	**Post-Course**	**Follow-Up**
Performance Checklist	Chatbot Content	Performance Checklist	Performance Checklist

In addition, the researcher used the following instruments to achieve the final results:

1. A questionnaire was prepared by the researcher to determine the most English communication skills needed for kindergarten teachers to run their classes in English as Second Language (ESL) teachers.
2. A detailed list of ESL skills required for kindergarten teachers was prepared by the researcher as a pre-step towards creating the main tool of the study and the performance observation checklist.
3. The performance observation checklist that was developed by the researcher was used three times. The first time was before applying the Chatbot content to identify the current communication skills that the teachers possess, the second time was after the Chatbot application to measure the development that happened after finishing the Chatbot content, and the third time was using it as a follow-up tool.
4. The training programme based on Chatbot content was developed by the researcher to be applied by the teachers. A Moodle cloud site was built to host the Chatbot content, which was finally made available for teachers to review and interact with.

Having prepared the research instruments, the researcher started to apply the tools to the research sample of kindergarten teachers who teach English as a Second Language in their classrooms. Thirty-three kindergarten teachers participated in the experiment. This research took place in the Al-Maadi Azhari Directorate, during the second term of the school year 2022-2023.

The first step towards applying the research tools to the selected teachers` sample was applying the questionnaire. The aim of this pilot study is to determine the skills needed for kindergarten teachers to run their classes as ESL teachers. The researcher designed a questionnaire of ten questions that were offered to teachers to answer. Thirteen teachers were chosen randomly to answer the questionnaire. The findings disclosed that teachers have

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

difficulties in dealing with classroom management and classroom language, while the majority showed abilities to write a suitable lesson plan, use different methodologies, and use different ways of evaluation.

This questionnaire presented some of the teachers` roles inside a classroom and the teachers` beliefs about these roles. Calculating the percentage of the teachers` attitudes towards classroom management and classroom language showed that teachers feel uncomfortable with these roles. Eight (8) teachers from the sample (62%) felt uncomfortable about managing classes in English and said that they are used to doing this in Arabic, while only five teachers (38%) expressed their abilities to manage their classes in English. As for classroom language, nine teachers (69%) hesitated about using English, saying that it is easier to use Arabic, while only four teachers (31%) showed that they could use classroom language as they participated earlier in a training programme about using classroom language. This remark encouraged the researcher to move on with the scientific experiment.

By deciding the skills needed to improve the teaching methods of kindergarten teachers in classes, the researcher developed a list of these needed skills. The list was divided into two main fields namely: classroom management and classroom language. Subsequently, each main field was divided into main skills and sub-skills. The list was directly used to develop the main tool of the research, the performance observation checklist, which was used to measure the development that happened in the teachers` performance after applying the digital interference of the Chatbot. The checklist was used three times as follows: before the application of the Chatbot to find out the skills of the teachers, the second time after applying the Chatbot to measure the development that happened in their practices, and the final time after three weeks of the experiment end date to measure the teachers` retention of the developed skills.

Statistical Methods

The researcher used the Statistical Package for the Social Sciences, SPSS version 25. In addition, the researcher used some statistical methods as follows:

- Cooper equation to find the percentages of agreement between the arbitrators, as well as to calculate the coefficient of agreement between the observers.
- Cronbach's alpha method for calculating the stability of the observation checklist.
- Pearson Correlation Coefficient: Pearson Machinery Estimation procedure for calculating the internal validity of the checklist.
- T-test for related groups to examine the significance differences between the degrees of the pre-and post-applications for the members

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

of the research group to determine the amount of difference in each of the pre-and post-applications on the checklist, and its significance was verified by the value of (t).

- T-test for related groups to examine the significance differences between the scores of the post- and follow-up applications for the members of the research group to determine the amount of differences in each of the post- and follow-up applications on the checklist, and its significance was verified by the value of (t).
- Effect size measure η^2 (Square ETA η^2) to show the strength of the effect of the independent variable on the dependent variables.

Results

The results of this research are divided into two parts namely: answering the research questions and proving the hypotheses of the research. As for the first part, the researcher answered the research questions as follows:

Findings Related to Question 1

Question 1: What are the English communication skills required for kindergarten teachers to run English classes as ESL teachers?

The answer to this question is in two phases. The first phase was deciding upon the English communication skills needed for kindergarten teachers to run their classes as ESL teachers. After revising many references, the researcher summarized the English communication skills needed for kindergarten teachers into two main fields namely: classroom management and classroom language. These two main fields were divided into nine (9) main skills. Each of the nine skills was divided into sub-skills, with a total number of thirty-three (33) sub-skills. The list was reviewed by several experts and modified according to their comments to create the final list. Finally, the researcher had a list of the English communication skills needed for ESL kindergarten teachers ready to be used.

The second phase was building the main tool of the research. This is the performance observation checklist that was directly derived from the English communication skills list. As a result, this checklist consists of thirty-three sub-skills with four levels of evaluation for each sub-skill. This checklist was used as a tool for assessing teachers` performance before and after applying digital intervention (the Chatbot content). It was also used for a third time to assess the teachers` retention of the English communication skills that they had learned through the experiment. The checklist was reviewed by several experts and checked to prove its validity and stability. After checking the availability of psychometric conditions (validity and stability), the researcher used them to observe and record teachers` performance and used their results to prove the hypotheses of the research.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

- **Findings Related to Question 2**

Question 2: What is the proposed design of Chatbot content that can be used to improve the teachers` English communication skills?

In order to answer this question, the researcher referred to studies that compare different types of Chatbot applications. Finally, the researcher used a low-code Messenger Chatbot with Many Chat to design the content. Many Chat made it easier for the researcher to develop the content, contact a larger number of users, connect it to a Facebook page, and connect it to a Moodle site. The researcher used the English communication skills list in creating the content of the Messenger Chatbot. The researcher added videos that describe each sub-skill individually with some written explanation for each video to make them more clear to the users. In addition, the researcher used the ADDIE model as an instructional design model that was used to design the final form of the Chatbot by connecting the Chatbot to a Moodle site in order to create an environment that increased the availability of usage for the Chatbot. The researcher embedded more videos and descriptions in the Moodle site to increase the resources of information presented to the users. Although those videos were downloaded from online educational pages, the explanation provided with them added more information to the users. Moodle also allowed the researcher to add different evaluation methods such as: quizzes, questionnaires, tests, and even social forums that helped the teachers make full use of the Chatbot content provided throughout the scientific experiment.

- **Findings Related to Question 3**

Question 3: What is the impact of providing Chatbot content on kindergarten teachers` performance as ESL teachers?

To answer the third question, which is the main question of this research, the researcher examined the results of the performance observation checklist in the pre- and post-applications to prove the improvement in the teachers` performance after applying the Chatbot content. The answer to this question is proved thoroughly by proving the validity of the third hypothesis of the research.

- **Findings Related to Question 4**

Question 4: How far is providing Chatbot content helpful in teachers` retention of the English communication skills?

To answer the fourth question, the researcher used the performance observation checklist to follow up on teachers` performance three weeks after the experiment`s end date that was done by mid-April. During the end-of-year revisions and assessment of the students, the teachers assisted the researcher through brainstorming sessions in their classrooms during the researcher`s visits as their supervisor.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

In addition to answering the questions of the research, the researcher examined the research hypotheses in order to prove the validity of the hypotheses. This is to further interpret and discuss these results in light of the theoretical framework of the research and previous studies.

- **Hypotheses**

In order to prove the validity of the research`s hypotheses, the researcher used the statistical package for the social sciences, SPSS version 25. This is shown in the following procedures.

Verifying the Validity of the First Hypothesis

- There is a statistically significant difference between the mean scores of the sample teachers' pre- and post-application of the performance observation checklist at the level of 0.05, regarding the main field of classroom management in favour of the post-course application.

In order to verify the validity of this hypothesis, the t-value was calculated for the two related averages of the classroom management field and its significance difference between the mean scores of the teachers in the pre- and post-applications of this field. This is shown in the following table.

Table 2. Comparing the Teachers` Scores in the Classroom Management Field Pre/Post-Applications of Chatbot

application	N	Mean	Average Difference Between the Applications	Deviation	Standard Deviation	Degrees of Freedom	t-Value	Indication	Value $^2\eta$	d. value
pre	33	41.03	11.73	9.163	7.950	32	8.474	(0.000) function at level (0.05)	0.692	1.475
post	33	52.76		5.345						

t-value at level (0.05) and degree of freedom (32) = 2.037

It is clear from the table that the average score of the post-application is higher than the average score of the pre-application for the parameters of the research sample in the field of class management. The parameters in the pre-application obtained an average of 41.03 with a standard deviation of 9.163. In the post-application, the average rose to 52.76 with a standard deviation of 5.345, and the average difference between the pre- and post-applications of the field of class management scored 11.73 degrees. In addition, the t-value calculated to signify the difference between the mean scores of the research group parameters in the pre- and post-applications of the field class management amounted to 8.474, which is statistically significant at the level of 0.05. This means that there is a statistically significant difference between the mean scores of kindergarten teachers in the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

pre- and post-applications of the field class management in the performance observation checklist in favour of the post-application.

Verifying the Validity of the Second Hypothesis

- There is a statistically significant difference between the mean scores of the sample teachers' pre- and post-course performance observation checklist at the level of 0.05, regarding the main field of classroom language in favour of the post-course application.

In order to verify the validity of this hypothesis, the t-value was calculated for the two related averages and its significance difference between the mean scores of the teachers in the pre-and post-applications of the classroom language field. This is shown in the following table.

Table 3. Comparing the Teachers` Scores in the Field of Classroom Language Pre/Post-Application of Chatbot

application	N	Mean	Average Difference Between the Applications	Deviation	Standard Deviation	Degrees of Freedom	t-value	Indication	value $^2\eta$	d. value
pre	33	38.18	20.64	7.342	8.325	32	14.240	(0.000) function at level (0.05)	0.864	2.479
post	33	58.82		4.838						

t-value at level (0.05) and degree of freedom (32) = 2.037

It is clear from the table that the average score of the post-application is higher than the average score of the pre-application for the parameters of the research sample in the field of class language. The parameters in the pre-application obtained an average of 38.18 with a standard deviation of 7.342. In the post-application, it has an average of 58.82 with a standard deviation of 4.838, and the average difference between the pre- and post-applications of the field class language were 20.64 degrees. In addition, the t-value was calculated to indicate the difference between the mean scores of the research group parameters in the pre- and post-applications of the field class language, which amounted to 14.240. This is statistically significant at the level of 0.05, and this means that there is a statistically significant difference between the mean scores of kindergarten teachers in the pre- and post-applications of the field class language in favour of the post-application. Therefore, this indicates that there has been a clear and significant improvement in the field of class language as a result of using Chatbot content in training kindergarten teachers.

Verifying the Validity of the Third Hypothesis

- There is a statistically significant difference between the mean scores of the sample teachers' pre- and post-performance observation

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

checklist at the level of 0.05 regarding the two fields of communication skills, as a whole, of teaching English in favour of the post-course application.

In order to verify the validity of this hypothesis, the t-value was calculated for the two related averages and its significance difference between the mean scores of the teachers in the pre- and post-applications of the performance observation checklist as a whole. This is shown in the table below.

Table 4. Comparing the Teachers` Scores in the Performance Observation Checklist Pre/Post-Applications of Chatbot

application	N	Mean	Average Difference Between the applications	Deviation	Standard Deviation	Degrees of Freedom	t-value	Indication	value $^2\eta$	d. value
pre	33	79.21	32.36	13.953	13.360	32	13.916	(0.000) Function at level (0.05)	0.858	2.422
post	33	111.58		9.427						

t-value at level (0.05) and degree of freedom (32) = 2.037

It is clear from the table that the average score of the post-application is higher than the average score of the pre-application for the parameters of the research sample in the performance observation checklist. The parameters in the pre-application obtained an average of 79.21 with a standard deviation of 13.953. In the post-application, the average rose to 111.58 with a standard deviation of 9.427, and the average difference between the pre- and post-applications of the checklist scored 32.36 degrees. In addition, the t-value was calculated to signify the difference between the mean scores of the research group parameters in the pre- and post-applications of the checklist, which amounted to 13.916. This is statistically significant at the level of 0.05. This means that there is a statistically significant difference between the mean scores of kindergarten teachers in the pre- and post-applications of the performance observation checklist in favour of the post-application. This indicates that there has been a clear and significant improvement in the performance observation checklist scores of the English communication skills as a result of using the Chatbot content with kindergarten teachers.

This result can be expressed in the following figure:

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

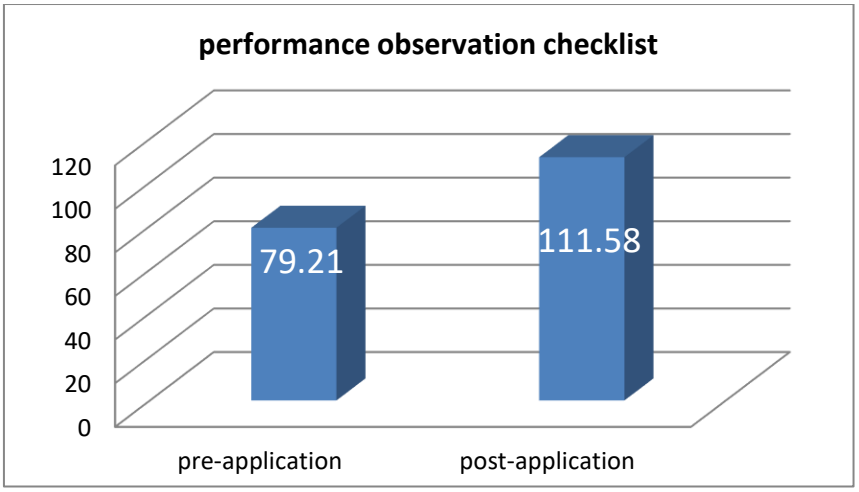

Figure 1. Arithmetic Means for the Pre-and Post-Applications of the Checklist

Verifying the Validity of the Fourth Hypothesis

- There is no statistical difference at the level of 0.05 between the mean scores of the sample teachers` follow-up performance observation checklist`s results and post-course performance observation checklist`s results regarding the classroom management field.

In order to verify the validity of this hypothesis, the t-value was calculated for the two related averages and its significance difference between the mean scores of the teachers` scores in the post- and follow-up applications of the classroom management field in the performance observation checklist. This is shown in the following table.

Table 5. Comparing the Teachers` Scores in the Classroom Management Field Post/Follow-Up Application of Chatbot

Application	N	Mean	Average Difference Between the Applications	Deviation	Standard Deviation	Degrees of Freedom	t-value	Indication
post	33	52.76	0.06	5.345	2.249	32	0.155	(0.898) Function at level (0.05)
Follow-up	33	52.70		5.175				

t-value at level 0.05 and degree of freedom (32) = 2.037

It is clear from the table that the mean scores of the follow-up application and the average scores of the post-application of the research group parameters are close in the field of class management in the performance observation checklist. The parameters in the post-application got an average of 52.76 and in the follow-up application, they got an average of 52.70. The average difference between the two applications is 0.06 degrees, and the t-value calculated to signify the difference between the mean scores of the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

research group parameters in the post- and follow-up applications of the classroom management field reached 0.155, and it is not statistically significant at the level of 0.05. This means that there is no statistically significant difference between the mean scores of kindergarten teachers in the post- and follow-up applications of the classroom management field in the performance observation checklist.

This indicates that the teachers have acquired and retained the classroom management skills due to the intervention of the Chatbot content.

Verifying the Validity of the Fifth Hypothesis

- There is no statistical difference at the level of 0.05 between the mean scores of the sample teachers` follow-up performance observation checklist`s results and post-course performance observation checklist`s results regarding the classroom language field.

In order to verify the validity of this hypothesis, the t-value was calculated for the two related averages and its significance difference between the mean scores of the teachers` scores in the post- and follow-up applications of the classroom language field in the performance observation checklist.
This is shown in the following table:

Table 6. Comparing the Teachers` Scores in the Classroom Language Field Post/Follow-Up Application of Chatbot

Application	N	Mean	Average Difference Between the Applications	Deviation	Standard Deviation	Degrees of Freedom	t-value	Indication
post	33	58.82	0.36	4,838	7,415	32	0.282	(0.780) Function at level (0.05)
Follow-up	33	59.18		4,419				

t-value at level 0.05 and degree of freedom (32) = 2.037

The mean scores of the follow-up application and the average scores of the post-application of the research group parameters are close in the field of class language in the performance observation checklist. The parameters in the post-application got an average of 58.82, and in the follow-up application, they got an average of 59.18. The average difference between the two applications is 0.36 degrees, and the t-value calculated to signify the difference between the mean scores of the research group parameters in the post- and follow-up applications of the classroom language field reached 0.282, and it is not statistically significant at the level of 0.05. This means that there is no statistically significant difference between the mean scores of kindergarten teachers in the post- and follow-up applications of the classroom language field in the performance observation checklist.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

This indicates that the teachers have acquired and retained the classroom language skills due to the intervention of the Chatbot content.

Verifying the Validity of the Sixth Hypothesis

- There is no statistical difference at the level of 0.05 between the mean scores of the sample teachers` follow-up performance observation checklist`s results and post-course performance observation checklist results regarding the two fields of the checklist as a whole.

In order to verify the validity of this hypothesis, the t-value was calculated for the two related averages and its significance for the difference between the mean scores of the teachers` scores in the post- and follow-up applications of the performance observation checklist as a whole. This is shown in the following table:

Table 7. Comparing the Teachers` Scores in Post/Follow-Up Application of the Checklist

Application	N	Mean	Average Difference Between the Applications	Deviation	Standard Deviation	Degrees of Freedom	t-value	Indication
post	**33**	**111.58**	**0.30**	**9,427**	**7,523**	**32**	**0.231**	**(0.818) Function at level (0.05)**
Follow-up	**33**	**111.88**		**5,716**				

t-value at level 0.05 and degree of freedom (32) = 2.037

The mean scores of the follow-up application and the average scores of the post-application of the research group parameters are close in the performance observation checklist. The parameters in the post-application got an average of 11.58, and in the follow-up application, they got an average of 111.88. The average difference between the two applications is 0.30 degrees, and the t-value calculated to signify the difference between the mean scores of the research group parameters in the post-and follow-up applications of the checklist reached 0.231, and it is not statistically significant at the level of 0.05. This means that there is no statistically significant difference between the mean scores of kindergarten teachers in the post- and follow-up applications of the performance observation checklist. This indicates that the teachers have acquired and retained all the skills needed for kindergarten teachers to run their English language classes as ESL teachers.

This result can be expressed in the following figure:

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

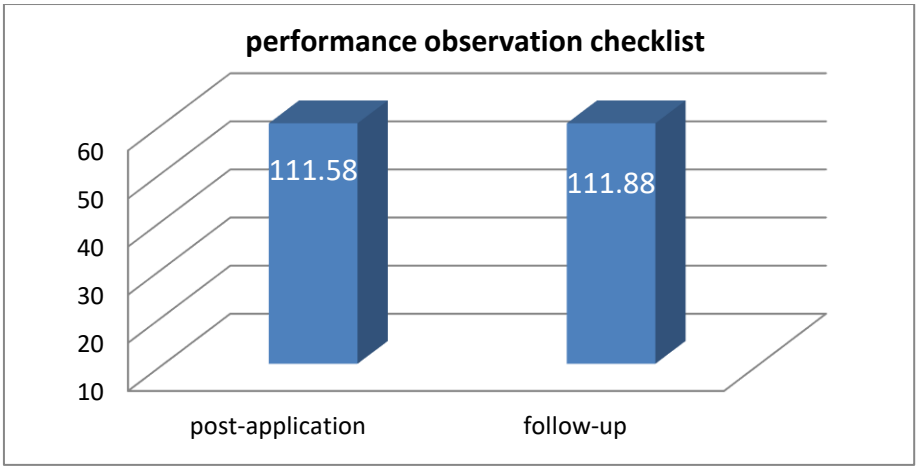

Figure 2. Arithmetic Means for the Post-Application and Follow-Up of the Checklist

Discussion

The final results of the research show that using Chatbot content has a very strong impact on the kindergarten teachers` English communication skills. This effect is a direct result of:

- **First:** Determining the English communication skills that kindergarten teachers need the most to improve their English language teaching skills.

The pilot study conducted by the researcher showed that most of the kindergarten teachers in Almaadi Azhary institute need to improve the English communication skills required for suitable classroom management and classroom language. In general, several reviews from previous studies proved that English language teachers need to master the skills related to classroom management and classroom language (McCarthy & Carter, 2001; Khan & khan, 2017; Savignon, 2007; Farrell, 2009; Kogut & Silver, 2009; Kazi et al., 2012; Briscoe et al., 2009; Srivastava, 2011; Cobbold & Boateng, 2015; Spratt, et al., 2011). In addition, many Arab researchers stressed that there is need to improve kindergarten teachers` performance in these fields (Seveen, 2011; Galal, 2021; Elkarimen & Elkhwalda, 2016; Salama, 2005; Shadefat & Ersheed, 2009; Shehata, 2017; Ghanem, 2019; Hawater, 2017; Guirgius, 2020). Finally, the researcher decided upon the skills and sub-skills that are used to build the final list of English communication skills. After proving the validity of the list, the researcher used it to build the performance observation checklist, which was used to evaluate the kindergarten teachers` performance inside classes.

- **Second:** There is need to choose the most suitable Chatbot design that could be used to deliver the training content for the teachers.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

The researcher reviewed several educational design models to finally use ADDIE in developing the Chatbot training programme which is connected to a social platform (a Facebook page) and connected to an educational learning management system (Moodle) site that added more availability of using, interacting with, and evaluation methods to the content. The importance of choosing the most suitable Chatbot design was proved through much research (Llic & Markovic, 2016; Bii, 2013; Cameron et al., 2017; Garcia-Brustenga et al., 2018; Winkler & Söllner, 2018; Elnagar & Habib, 2020). Consequently, the researcher designed the Chatbot content to be available to trainers on any device, anytime, and anywhere.

- **Third:** There is need in deciding the suitable content for the Chatbot that can improve the teachers` performance.

The researcher decided on a suitable design by adding content to the Chatbot. The researcher chose some free-access videos and educational resources that are available online to embed into the Chatbot and the Moodle site. In addition, the researcher prepared some quizzes, questionnaires, and social forums that were added to Moodle as different ways of evaluating trainees throughout the experiment. In addition, adding different ways of evaluation to Moodle is highly recommended in many researches (Al-Ajlan & Zedan, 2008; Elnagar & Habib, 2020; Laurillard, 2013; Farkash, 2018; Murad et al., 2019). As a result, the research group teachers had the ability to access a variety of digital content, repeat watching or reading it, interact through answering a quiz or a questionnaire, and express their minds in social forums. These features helped the researcher in maximizing the effect of the Chatbot content.

- **Fourth:** Using follow-up to confirm the sustainability of the Chatbot results.

In order to measure the teachers` retention of the newly acquired English communication skills, the researcher performed a follow-up procedure that started on April 15, 2023, and it continued for two weeks. The results of the follow-up of the research group teachers on the performance observation checklist were similar to the results of the post-application of the checklist. This similarity of results proves that teachers have retained the English communication skills that were provided through the Chatbot training programme. The importance of applying a follow-up procedure in measuring the retention of acquired skills is highlighted in the following research (Seveen, 2011; Galal, 2021; Parupalli, 2019; Lee & Van Patten, 2003; Nation & Newton, 2009).

- **Fifth:** Using statistical methods that helped the researcher prove the validity of the results.

In order to obtain the final results of the experiment, it was necessary to use statistical methods that helped validate results. The researcher used the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

statistical package for the social sciences, SPSS version 25. In addition, the researcher used some statistical methods that were discussed earlier.

Conclusion

In conclusion, the results of this research have been proven to be valid and stable. The researcher proved that using Chatbot content helped in improving the English communication skills of kindergarten teachers who teach English as a Second Language (ESL teachers) in Al-Azhar Al-Sharif institute. This result is similar to many research that deal with using Chatbot in training teachers (Guirgius, 2020; Elnagar & Habib, 2020; Al-Ajlan & Zedan, 2008; Laurillard, 2013; Farkash, 2018; Murad et al., 2019; Khan & khan, 2017; Savignon, 2007; Farrell, 2009; Seveen, 2011; Galal, 2021; Elkarimen & Elkhwalda, 2016; Salama, 2005; Shadefat & Ersheed, 2009; Shehata, 2017; Ghanem, 2019; Hawater, 2017).

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All of the data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

Declaration for Human Participants: This study was approved by the Egyptian E-Learning University (EELU), and the principles of Helsinki Declaration were followed.

References:

1. Adamopoulou, Eleni & Lefteris Moussiades (2020). Chatbots: History, technology, and applications. Machine Learning with Applications.2. 10.1016/j.mlwa.2020.100006.
2. Akcora, D. E., Belli, A., Berardi, M., Casola, S., Di Blas, N., Falletta, S., Faraotti, A., Lodi, L., Diaz, D. N., & Paolini, P. et al. (2018). Conversational support for education. *International conference on artificial intelligence in education*. Springer.
3. Al-Ajlan Ajlan & Zedan Hussein (2008). Why Moodle? 12th IEEE International Workshop on Future Trends of Distributed Computing Systems Conference. Pages 58-64
4. Alias, S., Sainin, M. S., Fun, T. S., & Daut, N. (2019). Identification of conversational intent pattern using a pattern-growth technique for the academic chatbot. International conference on multi-disciplinary trends in artificial intelligence. Springer. Applications in Healthcare. *Ecoforum Journal, 5*(1), 1-8

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

5. Bansal, H. & Khan, R. (2018). A review paper on human-computer interaction. International Journal of Advanced Research in Computer Science and Software Engineering, 8(53), http://dx.doi.org/10.23956/ijarcsse.v8i4.630.
6. Barcelona: eLearn Center. Universitat Oberta de Catalunya. https://doi.org/10.7238/elc.chatbots.2018
7. Bii, P. K ., Too, J. K., & Mukwa, C. W. (2018). Teacher Attitude towards Use of Chatbots in Routine Teaching. Universal Journal of Educational Research.6 . 1586 - 1597. doi:10.13189/ujer.2018.060719.
8. Cameron, G., Cameron, D., Megaw, G., Bond, R., Mulvenna, M., O'Neil, S., & McTear, M. (2017). Towards a chatbot for digital counselling. *Proceedings of the 31st British Computer Society Human Computer*
9. Chen, C.Y. (2020). Smartphone addiction: psychological and social factors predict the use and abuse of a social mobile application. Inf Commun Soc 23(3):454–467.Retrieved from: https://www.tandfonline.com/doi/abs/10.1080/1369118X.2018.1518469?journalCode=rics20 on 15/10/2020.
10. Ciupe, A., Mititica, D. F., Meza, S., & Orza, B. (2019). Learning agile with intelligent conversational agents. In *2019 IEEE global engineering education conference (EDUCON), pages 1100–1107. IEEE*.
11. Clarizia, F., Colace, F., Lombardi, M., Pascale, F., & Santaniello, D. (2018). Chatbot: An education support system for student. *International symposium on cyberspace safety and security*. Springer. com/ar/. Accessed 23rd January 2023.
12. Cortana (2018). Security flaw means your pc may be compromised. Panda Security Media center website: https://www.pandasecurity.com/mediacenter/mobile-news/ Cortana-security-flaw/. (Retrieved 27 August 2020).
13. Cunningham-Nelson, W., Boles, L., Trouton, E., & Margerison (2019). A review of chatbots in education: Practical steps forward,30th annual conference for the Australasian association for engineering education (AAEE 2019): Educators becoming agents of change: Innovate, Integrate, Engineers Australia, Motivate https://www.sciencedirect.com/science/article/pii/S2666920X21000278#bbib18S
14. Markovic, B. D. J. (2016). Possibilities, Limitations and Economic Aspects of Artificial Intelligence
15. Discover (2018). Kindergartenn1, Discover teacher`s guide 1st term.Ministry of Education. Egypt

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

16. Durall, E. & Kapros, E. (2020). Co-design for a competency self-assessment chatbot and survey in science education. *International conference on human-computer interaction*. Springer.
17. Ehindero, O.J. & Ajibade, Y.A. (2000). What our student say about how we teach. Ife J. Educ. Studies. 7(1), 1-9.
18. El-Kabsh & Zainab Abdel Rashid Muhammad (2005). The effectiveness of an English training programme in developing some of the linguistic and teaching skills of kindergarten teachers. Ph.D. Ain-Shams University
19. Elnagar Mohamed & Habib Amr (2020). An artificial intelligent programme based on Chatbot and learning style in e-training environment and its impact on developing E-learing Management System usage skills among preparatory stage. *Egyptian Society for Education Technology Journal, volume 31, version 2, Feb.2021, pp91-201*https://tesr.journals.ekb.eg/article_149030.html
20. Reimers, F. M., Alysha Banerji, Uche Amaechi, & Margaret Wang (2022) (eds.). *Education to Build Back Better*. Springer imprint. Pp. 51-74.https://doi.org/10.1007/978-3-030-93951-9_1 Accessed 23rd January 2023.
21. Fischer, G. (1999). "User Modeling: The Long and Winding Road." In J. Kay (Ed.) Proceedings of UM99: User Modelling Conference (Banff, Canada), Springer Verlag, Wien New York, pp. 349-355.
22. Galal & Rabab Adel (2021). Developing the English language teaching skills of kindergarten teachers during the pandemic crisis of Corona virus. Future Social Sciences Journal, Issue 5, April 2021, Page 93-112 https://journals.ekb.eg/article_160451.html
23. Garcia-Brustenga, G., Fuertes-Alpiste, M., & Molas-Castells, N. (2018). *Briefing paper: Chatbots in education*.
24. Graesser, A. C. (2016). Conversations with the autotutor help students learn. Ternational Journal of Artificial Intelligence in Education, 26(1), 124–132
25. Haristiani &Nuria (2019). Artificial Intelligence (AI) *Chatbot* as Language Learning Medium: An inquiry. *J. Phys.: Conf. Ser.* 1387 012020
26. Hien, H. T., Cuong, P. N., Nam, L. N. H., Nhung, H. L. T. K., & Thang, L. D. (2018). Intelligent assistants in higher-education environments: The fit-ebot, a chatbot for administrative and learning support. *Proceedings of the ninth international symposium on information and communication technology*.
27. Ho, C. C., Lee, H. L., Lo, W. K., & Lui, K. F. A. (2018). Developing a chatbot for college student programmeme advisement. In *2018 international symposium on educational technology (ISET), pages 52–*

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

56. IEEE. Interaction Conference (pp. 1-7). https://doi.org/10.14236/ewic/HCI2017.24

28. Kadry & Halima (2018). Difficulties of learning the English language from the point of view of teachers and parents, Journal of the Generation of Scientific Research Center. Page 39. University of Oran, Algeria https://jilrc.com/archives/9805
29. Khanna, A., Pandey, B., Vashishta, K., Kalia, K., Bhale, P., & Das, T. (2015). A study of today's A.I. through chatbots and rediscovery of machine intelligence. International Journal of U- and e-Service, Science and Technology, 8, 277–284. HTTP: //dx.doi.org/10.14257/ijunesst.2015.8.7.28.
30. Kumar, M. N., Chandar, P. L., Prasad, A. V., & Sumangali, K. (2016). Android based educational chatbot for visually impaired people. In *2016 IEEE international conference on computational intelligence and computing Re- search (ICCIC), pages 1–4. IEEE*.
31. Lam, C., Chan, L., & See, C. (2018). Converse, connect and consolidate– the development of an artificial intelligence chatbot for health sciences education. *Frontiers in medical and health sciences education conference*. Hong Kong.
32. Loss, J. (2000). The communications contract. *The Internal Auditor, 57*(6), 88.
33. Low, E., Chong, S., & Ellis, M. (2014). Teachers' English communication skills: Using IELTS to measure competence of graduates from a Singaporean teacher education programme. *Australian Journal of Teacher Education, 39*(10).
34. McCarthy, M. R. & Carter, R. (2001). Ten Criteria for a Spoken Grammar in E. Hinkel and S. Fotos (eds). New Perspectives on Grammar Teaching in Second Language Classrooms. Mahwah, NJ:Lawrence Erlbaum Associates.
35. Mikic-Fonte, F. A., Llamas-Nistal, M., & Caeiro-Rodrıguez, M. (2018). Using a chatterbot as a faq assistant in a course about computers architecture. In *2018 IEEE frontiers in education conference (FIE), pages 1–4. IEEE*.
36. Molnar, G. & Szuts, Z. (2018). The role of chatbots in formal education. In 2018 IEEE 16th international symposium on intelligent systems and informatics (SISY), pages 000197–000202. IEEE.
37. Mor, E., Santanach, F., Tesconi, S., & Casado, C. (2018). Codelab: Designing a conversation-based educational tool for learning to code. *International conference on human-computer interaction*. Springer.
38. Murad, D. F., Irsan, M., Akhirianto, P. M., Fernando, E., Murad, S. A., & Wijaya, M. H. (2019). Learning support system using a chatbot in the" kejar c package" homeschooling programme. In 2019

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

international conference on in-formation and communications technology (ICOIACT), pages 32–37. IEEE

39. Ndukwe, I. G., Daniel, B. K., & Amadi, C. E. (2019). A machine learning grading system using chatbots. *International conference on artificial intelligence in education*. Springer.
40. Neff, G. & Nagy, P. (2016). Talking to bots: Symbiotic agency and the case of Tay. International Journal of Communication, 10, 4915–4931.
41. Nguyen, H. D., Pham, V. T., Tran, D. A., & Le, T. T. (2019). Intelligent tutoring chatbot for solving mathematical problems in high school. In *2019 11th international conference on knowledge and systems engineering (KSE), pages 1–6. IEEE*.
42. Norris, J. A (2003). Looking at classroom management through social and emotional learning lens: Theory into practice. *Columbus, 42*(4), 313-318.
43. Okonkwo, C. W. & Ade-Ibijola, A. (2020). Python-bot: A chatbot for teaching python programmeming. *Engineering Letters, 29*(1).
44. Okonkwo, C. W., Huisman, M., & Taylor, E. (2019). The adoption of m- commerce applications: Rural dwellers perspectives. *12th, IADIS, International conference*. Information systems.
45. Ondas, M. & Pleva Hladek, D. (2019). How chatbots can be involved in the education process In 2019 17th international conference on emerging eLearning technologies and applications (ICETA), pages 575–580. IEEE https://www.sciencedirect.com/science/article/pii/S2666920X21000278#bbib53S
46. Parupalli & Rao (2019). THE IMPORTANCE OF SPEAKING SKILLS IN ENGLISH CLASSROOMS. 2. 6-18.
47. Pelly, C., Tan, M. Y., & Zhang, D. (2009). *Communication skills for teachers*. Singapore:McGraw Hill
48. Personal digital assistant—Cortana home assistant—Microsoft. (2019). Microsoft Cortana, your intelligent assistant website: https://www.microsoft.com/en-us/cortana. (Retrieved 30 August 2019).
49. Pham, X. L., Pham, T., Nguyen, Q. M., Nguyen, T. H., & Cao, T. T. H. (2018). In *Chatbot as an intelligent personal assistant for mobile language learning in Proceedings of the 2018 2nd International Conference on Education and E-Learning, pages 16–21*.
50. Ranoliya, B. R., Raghuwanshi, N., & Singh, S. (2017). Chatbot for university-related faqs. In 2017 international conference on advances in computing, communications, and informatics (ICACCI), pages 1525–1530. IEEE.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

51. Rooein, D. (2019). Data-driven edu chatbots. In companion proceedings of the 2019 worldwide web conference, pages 46–49.
52. Rouse, M. (2018). What is a chatbot?; http://searchcrm.techtarget.com/definition/chatbot, 05 Jan.http://searchcrm.techtarget.com/definition/chatbot
53. Serban, I. V., Sankar, C., Germain, M., Zhang, S., Lin, Z., Subramanian, S., Kim, T., Pieper, M., Chandar, S., & Ke, N. R. (2017). A deep reinforcement learning chatbot. *ArXiv preprint arXiv:1709.02349*.
54. Spratt Mary, Pulverness Alan, & Williams Melanie (2011).The TKT Course Modules 1, 2 and 3. Cambridge University Press. 0521125650
55. Sreelakshmi, A., Abhinaya, S., Nair, A., & Nirmala, S. J. (2019). A question answering and quiz generation chatbot for education. In 2019 grace hopper Celebration India (GHCI), pages 1–6.
56. Srivastava & Monika (2011). Effective communication skills: need & importance for teacher and College of Education, Unit of Sharda Group of Institutions (SGI), AgraMember, Play India Play
57. Teachers First (2020). Teachers first: An initiative of the MOETE. https://teachersfirstegypt.
58. Troussas, C., Krouska, A., & Virvou, M. (2017). Integrating an adjusted conversational agent into a mobile-assisted language learning application. In *2017 IEEE 29th international conference on tools with artificial intelligence (ICTAI), pages 1153–1157. IEEE*.
59. UNESCO (2019). Early childhood care and education . https://en.unesco.org/themes/early-childhood-care-and-education
60. Ureta, J. & Rivera, J. P. (2018). *Using chatbots to teach stem related research concepts to high school students*.
61. What exactly is Alexa? Where does she come from? And how does she work? (2019). Digital Trends website: https://www.digitaltrends.com/home/what-is-amazonsalexa-and-what-can-it-do/. (Retrieved 30 August 2021).
62. Winkler, R. & Söllner, M. (2018). Unleashing the potential of chatbots in education: A state-of-the-art analysis. In *Academy of Management Annual Meeting (AOM)*. https://www.alexandria.unisg.ch/254848/1/JML_699.pdf
63. Wizu (2018). A visual history of chatbots. Medium website: https://chatbotsmagazine. Com/a-visual-history-of-chatbots-8bf3b31dbfb2. (Retrieved 24 February 2020).
64. Wong, H. & Wong, R. (2009). The *first days of school: How to become an effective classroom manager*. Mountain View, CA: Harry K. Wong Publications.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

65. Wu, E. H. K., Lin, C. H., Ou, Y. Y., Liu, C. Z., Wang, W. K., & Chao, C. Y. (2020). Advantages and constraints of a hybrid model k-12 e-learning assistant chatbot. IEEE Access, 8, 77788–77801.
66. Yang, S. & Evans, C. (2019). Opportunities and challenges in using AI chatbots in higher education. *Proceedings of the 2019 3r d*International Conference on Education and E-Learning.

ESJ Humanities Peer-reviewed

Le Défi d'Une Gouvernance Territoriale de l'aménagement en République du Congo Entre Approche Descendante et Processus de Décentralisation

Mohamadou Mountaga Diallo
Maitre-Assistant en Géographie-aménagement,
Laboratoire de Géographie Humaine,
Université Cheikh Anta Diop de Dakar, Sénégal

Doi:10.19044/esj.2023.v19n32p136

Submitted: 13 October 2023
Accepted: 20 November 2023
Published: 30 November 2023

Cite As:
Diallo M.M.(2023). *Le Défi d'Une Gouvernance Territoriale de l'aménagement en République du Congo Entre Approche Descendante et Processus de Décentralisation*. European Scientific Journal, ESJ, 19 (32), 136.
https://doi.org/10.19044/esj.2023.v19n32p136

Résumé

Depuis la fin de la crise sociopolitique de 1997, la République du Congo a entamé un renouvellement de ses politiques territoriales à travers une relance de l'aménagement du territoire et de la décentralisation. La loi n°10-2003 du 6 février 2003 portant transfert de compétences aux collectivités locales fixait les grandes orientations de la décentralisation et transférait plusieurs domaines de compétences aux collectivités locales que sont les départements et les communes. Dans la même dynamique, sont adoptés, en 2004 le Schéma National d'Aménagement du Territoire et, en 2014 la loi n°43-2014 du 10 octobre 2014 d'orientation pour l'aménagement et le développement du territoire. Ainsi, cet article vise à analyser l'approche d'élaboration et de mise en œuvre des politiques d'aménagement et de développement territorial au Congo. La méthodologie repose sur la recherche documentaire et la réalisation de 67 entretiens semi-directifs auprès de divers acteurs. Elle a permis d'obtenir trois principaux résultats. D'abord, l'aménagement du territoire est toujours centralisé en dépit des réformes sur la décentralisation. Aussi bien dans sa définition que la mise en œuvre, l'Etat reste le principal acteur bénéficiant en cela de la forte présence de ses différents démembrements à toutes les échelles territoriales. Ensuite, le

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

processus de décentralisation reste inachevé empêchant aux collectivités locales de jouer pleinement leurs rôles. Enfin, il apparait que c'est en articulant les différentes échelles que l'aménagement du territoire atteindra son but. Cela passe par le renforcement de la décentralisation, notamment par la communalisation intégrale du territoire national et une plus grande implication des collectivités locales et des populations dans les initiatives locales.

Mots-clés: Gouvernance territoriale, Aménagement du territoire, Décentralisation, Approche descendante, République du Congo

The Challenge of Territorial Planning Governance in the Republic of Congo between a Top-Down Approach and the Decentralization Process

Mohamadou Mountaga Diallo
Maitre-Assistant en Géographie-aménagement,
Laboratoire de Géographie Humaine,
Université Cheikh Anta Diop de Dakar, Sénégal

Abstract

Since the end of the socio-political crisis in 1997, the Republic of Congo has initiated a renewal of its territorial policies through a revitalization of regional planning and decentralization. Law no. 10-2003 of February 6, 2003, which transferred powers to local authorities, set out the broad outlines of decentralization and transferred several areas of responsibility to local authorities, namely departments and communes. In the same vein, the National Spatial Planning Scheme adopted in 2004, which was followed in 2014 by the Law no. 43-2014 of October 10, 2014, provided guidelines for regional planning and development. This paper focuses on analyzing the approach to formulating and implementing regional planning and development policies in Congo. The methodology relied on documentary research and by conducting 67 semi-structured interviews with various stakeholders. This approach yielded three main results. Firstly, territorial planning remains centralized despite reforms in decentralization. In terms of its definition and implementation, the state remains the primary actor, benefiting from the strong presence of its different branches at all territorial levels. Secondly, the decentralization process remains incomplete, preventing local authorities from fully performing their roles. Lastly, it becomes evident that achieving the goals of regional planning involves articulating different scales. This necessitates strengthening decentralization, particularly through the comprehensive

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

municipalization of the national territory and increased involvement of local authorities and communities in local initiatives.

Keywords: Territorial governance, Regional planning, Decentralization, Top-down approach, Republic of Congo

Introduction

Depuis la fin de la crise sociopolitique de la décennie 1990, la République du Congo a entamé un processus de renouvellement de ses politiques territoriales à travers la relance de l'aménagement du territoire et de la décentralisation. La Constitution du 20 janvier 2002 puis le Document Stratégique de Réduction de la Pauvreté (DSRP) faisait de la décentralisation un important instrument de promotion de la démocratie et de lutte contre la pauvreté tandis que la gouvernance constitue un des piliers fondamentaux des Plans nationaux de développement (PND 2012-2016, 2018-2022). Les lois n° 3-2003 du 17 janvier 2003 et n°10-2003 du 6 février 2003 fixant respectivement l'organisation administrative territoriale et portant transfert de compétences aux collectivités locales lancent le processus de décentralisation (Chavallard, 2016). Dans la même dynamique, le Congo se dote dès 2004 d'un Schéma National d'Aménagement du Territoire (SNAT) et adopte près de dix ans plus tard la Loi n°43-2014 du 10 octobre 2014 d'Orientation pour l'Aménagement et le Développement du Territoire (LOADT) qui « fixe le cadre légal de la politique d'aménagement du territoire, dans le respect des objectifs et principes de base du développement durable » (Article 1). Ainsi, aussi bien pour la décentralisation que l'aménagement du territoire, un cadre institutionnel et réglementaire favorable existe et traduit l'engagement du gouvernement en faveur des politiques territoriales.

La relance de l'aménagement du territoire et de la décentralisation au Congo, qui s'inscrit dans le contexte général du renouveau de l'aménagement du territoire en cours en Afrique Subsaharienne depuis les années 1990 (Alvergne, 2008), se fait concomitamment avec le renforcement de la déconcentration et du rôle de l'Etat dans la définition et la mise en œuvre des politiques territoriales de développement (Chavallard, 2016). En effet, l'Etat est présent à tous les échelons territoriaux à travers des démembrements ayant compétences en matière de développement socio-économique. En revanche, la décentralisation en dépit de l'existence d'un cadre réglementaire reste timide avec des collectivités locales qui peinent à s'autonomiser alors que la participation à la base souffre d'une absence de démocratie locale et d'un tissu associatif assez structuré. En effet, alors que les collectivités locales, départements et communes, peinent à exercer les compétences reçues de l'Etat faute de ressources humaines et surtout financières, l'implication des acteurs locaux dans la gouvernance locale reste encore timide.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Aujourd'hui, au regard de la nécessaire articulation entre approche étatique et dynamiques locales en matière d'aménagement et de développement du territoire (Baudelle et al., 2011), il est important de documenter l'approche de mise en œuvre de la politique d'aménagement du territoire au Congo. En effet, si de nombreuses études et recherches se sont intéressées aux questions territoriales au Congo comme l'urbanisation et ses conséquences (Pourtier, 2000 ; Moutsara, 1986), les enjeux territoriaux et le développement local (Ziavoula, 2005), l'accès aux services sociaux de base (Dorier & Erwan, 2012 ; Ofouémé-Berton, 2010 ; Ngouari, 2006), l'organisation de l'espace (Ngouma, 2012), etc. il n'en demeure pas moins que les stratégies de mise en œuvre des politiques d'aménagement du territoire n'ont pas été suffisamment abordées. Ainsi, l'objectif de cet article est d'analyser l'approche d'élaboration et de mise en œuvre des politiques d'aménagement et de développement territorial au Congo à partir des questionnements suivants : quels sont les défis de la mise en œuvre de la décentralisation et de l'aménagement du territoire dans un Etat centralisé mais à fortes recompositions territoriales ? Quelles sont les approches en matière d'aménagement et de développement du territoire ?

L'article part du constat que les réformes entreprises dans le cadre de la relance de l'aménagement et du développement territorial au Congo n'ont pas encore permis la promotion d'une véritable approche territoriale de l'aménagement du fait de plusieurs contraintes relevant de la gouvernance territoriale. Ici, la gouvernance territoriale est définie comme un mode de coordination entre acteurs situés à différents niveaux en vue de mettre en œuvre des projets d'aménagement et de développement (Gilly & Wallet, 2005).

L'article est structuré en trois parties. La première présente le cadre d'étude et la méthodologie puis les résultats à travers l'approche descendante de l'aménagement du territoire au Congo, les limites de la décentralisation et les défis de la gouvernance territoriale et, enfin, la discussion des résultats.

1. Données et méthode

Cette partie porte sur la présentation du site d'étude et de la méthode.

1.1. Présentation de la zone d'étude

La République du Congo, située en Afrique centrale, partage des frontières avec le Cameroun au Nord-ouest, la République Centrafricaine au Nord, l'Angola au Sud, le Gabon à l'Ouest et la République Démocratique du Congo (RDC) au Sud-est (*Figure 1*). Ouvert sur l'Océan Atlantique au Sud-ouest, le pays dispose d'un littoral de 170 km et bénéficie de la présence du fleuve Congo, deuxième plus grand bassin fluvial du monde, qui l'offrent d'importantes opportunités de développement économique.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Le pays couvre une superficie de 342 000 km^2 pour une population de 5,7 millions d'habitants en 2023[1], soit une densité de 17 habitants au km^2, l'une des plus faibles en Afrique. Il est administrativement organisé en 12 départements, eux même répartis en districts, communes, arrondissements, communautés urbaines, communautés rurales, villages et quartiers (Loi n°3-2003 – Article 2).

Près de 60% du territoire national est occupé par les forêts et la population se concentre principalement dans la partie Sud du pays. Les villes de Brazzaville et de Pointe-Noire abritent 55% de la population totale, l'essentiel de la population urbaine et la quasi-totalité de l'activité économique alors que les départements forestiers du Nord (Likouala, Sangha, Cuvette) constituent un vide démographique (Chavallard, 2016). En plus de ces forts déséquilibres territoriaux et d'un réseau d'infrastructures déficient, le Congo doit faire face à la forte urbanisation du pays avec une population urbaine représentant 67,4% de la population totale et un taux d'urbanisation de 3,28% par an, l'un des plus élevés en Afrique[2]. Les indicateurs démographiques sont aussi marqués par l'extrême jeunesse de la population puisque 47% sont âgés de moins de 18 ans, en 2023.

Figure 1. Situation géographique du site d'étude

[1] https://www.banquemondiale.org/fr/country/congo/overview

[2] Worldometers. Congo Population. https://www.worldometers.info/world-population/congo-population/(Accédé 29 July 2019).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Sur le plan économique, la croissance économique a été pendant longtemps tirée par l'activité pétrolière qui a permis de tenir les finances publiques et de réaliser des investissements publics. Cependant, la crise de cette économie pétrolière consécutivement à la réduction des ressources pétrolières et de la volatilité des cours mondiaux a eu de graves conséquences socioéconomiques amenant l'Etat a pensé à une stratégie « après pétrole ». L'accent est désormais mis sur le développement des secteurs agricole et minier qui se traduit par un énorme besoin en terres. Ce qui constitue un autre défi pour la politique d'aménagement du territoire. La relance de l'activité économique devra se traduire par une amélioration des conditions de vie des populations d'où le slogan du nouveau PND (2022-2026), « le tout économique pour le tout social ».

Cette analyse situationnelle met en évidence les forts déséquilibres territoriaux qui caractérisent le Congo et les énormes défis en matière de développement économique. Il s'agit là de deux principaux enjeux de la politique d'aménagement et de développement territorial du pays.

1.2. Méthode de collecte des données

L'approche utilisée est essentiellement d'ordre qualitatif. Elle combine recherche documentaire, entretiens semi-directifs et observations participantes.

La recherche documentaire a permis d'exploiter plusieurs sources bibliographiques constituées de documents scientifiques, de rapports techniques et de textes réglementaires traitant des problématiques d'aménagement, de développement et de gouvernance territoriale. Elle a abouti à l'élaboration du cadre théorique et conceptuel de l'article et du choix méthodologique.

Dans un second temps, plusieurs données qualitatives ont été collectées à travers 67 entretiens semi-directifs avec les acteurs de l'aménagement du territoire au niveau central, départemental et local à Brazzaville, Pointe-Noire, Dolisie, Mossendjo, Ouesso, Ewo, Mandingo-Kayes, Gamboma, Loango, Engana, Inkouele, Yaba Mbéti, Bokombo. Les entretiens avec des agents des services et directions de l'aménagement du territoire et développement local, des élus locaux, des responsables de services techniques départementaux, d'organisations de la société civile, chefs locaux et d'organisations socioprofessionnelles ont porté sur le cadre institutionnel et réglementaire de l'aménagement du territoire, les initiatives étatiques de développement territorial, les relations entre acteurs (Etat-département notamment), les incidences de la loi n°43-2014 d'orientation de l'aménagement du territoire, etc.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Enfin, des observations participantes ont été faites à travers la participation à plusieurs réunions départementales et nationales sur l'aménagement du territoire à Brazzaville, Loango et Dolisie.

Les données collectées ont été traitées grâce à l'utilisation de la technique de l'analyse de contenu[3]. Les propos des personnes interrogées les plus illustratifs de la problématique sont présentés sous forme de verbatim. Le logiciel ArcMap a permis de réaliser les cartes à partir de l'exploitation des données sur le découpage administratif.

2. Résultats

Le traitement des données a permis d'obtenir trois principaux résultats. Ils montrent la prédominance d'une approche centralisée de l'aménagement du territoire, un processus de décentralisation inachevé et soulignent les enjeux d'une gouvernance territoriale.

2.1. Le temps de la régulation centralisée : l'approche descendante de l'aménagement du territoire

L'approche descendante de l'aménagement du territoire au Congo peut être étudiée à travers la logique étatique de contrôle et de marquage territorial et d'autre part par l'interventionnisme de l'Etat.

2.1.1. Contrôle et marquage territorial : une omniprésence de l'Etat

S'il est vrai que de son indépendance en 1960 à la fin de la guerre civile en 1997, le Congo a été marqué par une forte instabilité politique avec une alternance de plusieurs régimes politiques incarnés essentiellement par des militaires (Ngouari, 2006 ; Pourtier, 2000 ; Dorier-Apprill & Ziavoula, 1996) le contrôle territorial par l'Etat est resté une constance. En effet, tous les régimes, civils et militaires, se caractérisent par la centralisation des pouvoirs avec l'Etat comme principal voire unique décideur en matière de développement territorial.

Le contrôle territorial s'inscrit dans la longue durée. La mise en rétrospective de l'histoire du Congo permet de voir qu'à l'époque coloniale déjà, le contrôle des Hommes et des ressources était au cœur de la stratégie politique de l'administration coloniale. D'abord, dans le cadre du moyen Congo, le territoire actuel était subdivisé en villages à la tête desquels il y'avait un chef de village, en terres dirigées par des chefs de terres issus des chefferies traditionnelles Téké, Kongo et Ngalla et, enfin en cantons sous le contrôle d'un administrateur colonial. Cette subdivision administrative va durer jusqu'au lendemain de la première guerre mondiale. En effet, avec l'arrêté du 1er

[3] Technique consiste à analyse le contenu d'un entretien par l'identification des mots clés et la description de leur sens dans le contexte de la recherche.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

décembre 1919, des changements majeurs seront introduits dans le découpage territorial colonial. Les circonscriptions au nombre de 15 remplacèrent les cantons, les terres devinrent des districts, les villages furent transformés en Postes de Contrôle Administratifs (PCA) et, les hameaux obtinrent le statut de village.

Ensuite, l'Arrêté du 15 novembre 1934, apporta de nouvelles modifications dans la hiérarchie territoriale avec la création de 4 départements (Niari-Ogoué, Kouilou, Poul et Oubangui-Alima-Sangha) à la place des 15 circonscriptions et le maintien des districts et des PCA. Cette hiérarchie territoriale se maintint jusqu'à la veille de l'indépendance quand le décret 58/188 du 31 août 1959 fixa quatre niveaux de circonscriptions administratives avec la commune comme entité administrative en plus de la préfecture (département), de la sous-préfecture (district) et du PCA.

Tout au long de la période coloniale, les découpages administratifs obéirent à une logique de surveillance des hommes et de contrôle des richesses. Il s'agissait, pendant cette période, d'asseoir un véritable contrôle territorial afin de satisfaire la demande de la métropole en matière première pour assurer le fonctionnement de l'industrie naissante comme l'illustre ce témoignage d'un cadre de la DGAT :

> *La logique d'organisation territoriale actuelle est une continuité de celle de l'époque coloniale. Les colonisateurs ont toujours mis en avant l'objectif de maitrise du territoire pour une meilleure exploitation des ressources*[4].

Ce processus de contrôle territorial loin de s'estomper s'est au contraire poursuivit après l'indépendance du Congo. Dès 1964, les régions sont créées[5] en remplacement des préfectures puis l'architecture territoriale est renforcée par la multiplication des niveaux de gestion administrative. Ensuite, à la faveur du décret 67/243 du 23 juin 1967, le Congo passe de quatre à six échelons administratifs à savoir la région, district, commune, commune d'arrondissement, PCA et village qui sont tous gérés par des représentants de l'Etat.

Aujourd'hui, le pays compte huit niveaux de circonscriptions administratives contre deux ordres de collectivités locales (département et commune). Il s'agit du département, district, commune, arrondissement, communauté urbaine, communauté rurale, village et quartier (loi n°3-2003 – Article 2). Ces circonscriptions administratives sont gérées par des

[4] Entretien avec un cadre de la DGAT, janvier 2019.

[5] Il s'agit de six régions : Le Kouilou, la région forestière du Niari, la Vallée du Niari, Brazzaville, Alima-Léfini-Likouala-Massaka et Sangha-Likouala. Le nombre passera ensuite à dix avec les régions de Likouala, Sangha, Cuvette, Cuvette-Ouest, Plateaux, Pool, Lekoumou, Bouenza, Niari et Kouilou. Le nombre sera maintenu jusqu'à l'adoption de la Constitution du 20 janvier 2002 qui remplace la région par le département.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

administrateurs nommés par l'Etat (respectivement Préfet, Sous-préfet, Maire, Administrateur-maire, Chef de village, Chef de quartier). Il faut, cependant, préciser que la communauté rurale n'est pas encore effective.

2.1.2. Le temps de l'interventionnisme : l'Etat, seul acteur à bord

Le nouvel Etat indépendant, dans le cadre de la construction de l'Etat-nation, renforce le contrôle territorial et se positionne en même temps comme le principal voire l'unique décideur en matière de développement socioéconomique. La période euphorique des indépendances allant de 1963 à 1993, est marquée par l'adoption du socialisme et, par la suite, du marxisme léninisme comme régime politique. L'accent est mis sur la construction de l'Etat-nation dont le parti unique se trouve au cœur du fonctionnement. Le gouvernement se confond avec le parti-Etat, le Parti Congolais du Travail (PCT, fondé en 1969) et promeut une gestion descendante. Les administrateurs des circonscriptions territoriales assurent en tant que représentant du gouvernement, le relais des activités étatiques. C'est l'ère de l'interventionnisme de l'Etat sur les politiques publiques. Au Congo, comme d'ailleurs un peu partout en Afrique, il y'a une hégémonie du gouvernement dans la gestion publique. Il définit les politiques, les programmes d'actions, gère l'agenda et maîtrise les ressources de mise en œuvre des projets. Ces différents atouts lui permettent d'être le seul maître à bord et de piloter la politique d'aménagement et de développement territorial. D'ailleurs, pendant longtemps le ministère de l'aménagement du territoire dépendait de la présidence de la république.

Ainsi, l'Etat, joue un rôle de premier plan en matière d'aménagement du territoire à travers ce ministère qui a en charge la réalisation des projets (voir *Photo 1 et 2 ci-dessous*). Il a porté le programme phare en matière d'aménagement et de développement territorial à savoir le programme de municipalisation accélérée. Il a été lancé en 2004 et est exécuté chaque année dans le département devant abriter les festivités marquants la fête de l'indépendance, les 15 août. Il s'inscrit dans la vision du gouvernement de moderniser le pays par une politique forte d'appui à la réalisation d'infrastructures modernes. En effet, l'objectif poursuivi par le programme est de mailler le pays en infrastructures économiques, administratives, sociales et sécuritaires et d'atténuer les disparités entre Brazzaville, Pointe Noire et les autres villes de l'intérieur. Le programme s'inscrit donc dans la dynamique d'aménagement et de développement territorial comme le confirment les propos ci-dessous :

Le programme de municipalisation accélérée est d'une importance capitale. Il a permis d'équiper plusieurs villes de l'intérieur en divers équipements

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

administratifs, sociaux mais aussi en infrastructures routières. Le programme contribue ainsi à l'atténuation des disparités territoriales[6].

Photo 1. Forage de Madingo-Kayes réalisé par l'Etat

Photo 2: Hôpital général du Kouilou en construction à Loango

Clichés : auteur, janvier 2019

En dépit de son importance pour les populations locales et de la nécessité d'un ancrage territorial, le programme de municipalisation accélérée reste une affaire de l'administration centrale. Sa conception, son financement et sa mise en œuvre relèvent du ministère de l'aménagement du territoire qui s'appuie sur les différents services techniques et démembrements de l'Etat. Le programme de municipalisation accélérée, importante composante de la politique nationale d'aménagement du territoire, est ainsi mis en œuvre de façon verticale sans implication des populations à la base et des collectivités locales. Pourtant, la planification, le développement et l'aménagement du territoire relèvent de la compétence des collectivités locales en vertu de la loi n°10-2003 du 6 février 2003 portant transfert de compétences aux collectivités locales.

D'ailleurs, l'analyse des réalisations faites dans le cadre de la municipalisation montre l'importance voire la prédominance des projets relatifs à l'administration au détriment des secteurs économiques et sociaux. Il s'agit de la construction et/ou la réhabilitation de bâtiments administratifs (préfecture, sous-préfecture, résidence préfet et sous-préfet, hôtel de ville). Par exemple, dans le département du Niari, les projets relatifs à l'administration représentent 32,9% de l'enveloppe globale et occupent ainsi la première place

[6] Entretien avec un cadre de la DGAT, janvier 2019.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

du panorama des secteurs financés. La réalisation de grands équipements administratifs illustre la puissance de l'Etat qui imprime une forte empreinte en termes de marquage territorial.

Les administrateurs-maire nommés par décret présidentiel à la tête des communautés urbaines ont des compétences en matière d'accès à l'eau potable, d'assainissement, d'habitat et disposent de budget dans ce sens. Ainsi, ils mettent en œuvre à l'échelle locale, parfois et le plus souvent, plus que les collectivités locales, des actions de développement socioéconomique. Cette situation illustre parfaitement la forte présence de l'Etat et sa volonté à asseoir son hégémonie dans le domaine de l'aménagement et du développement territorial. En effet, les missions des administrateurs-maire à l'échelle des communes d'arrondissement et des communautés urbaines relèvent des compétences des collectivités locales, notamment les communes de plein exercice.

Les intentions légitimes de garantir l'ordre social, dans le cadre de l'Etat-providence ont conduit à un interventionnisme à outrance du pouvoir dans la définition des politiques publiques, au détriment des acteurs de la base. Cette logique a conduit à un renforcement des agents de la fonction publique et une multiplication des ministères. L'Etat devient l'instituteur du social, assure la régulation économique et monopolise le secteur industriel. Cette approche verticale dans la définition et la mise en œuvre des actions de développement a paradoxalement annihilé les dynamiques locales ou entrepreneuriales.

Le projet lancé en 2014 de revitalisation de 50 villages à travers la mise en place d'un paquet minimum d'infrastructures et d'équipements structurants ainsi que la promotion de l'économie locale, procède toujours de cette logique interventionniste de l'Etat. En effet, la revitalisation des villages qui est un axe fondamental de la politique nationale d'aménagement du territoire devrait être, en partie, portée par les collectivités locales. Mais elle est entrain à ce jour d'être mise en œuvre sans implication directe des conseils départementaux.

> *La loi de n° 10-2003 confère plusieurs responsabilités aux collectivités locales notamment en matière de développement économique et social. Sur cette base, on devrait être impliquer dans la mise en œuvre de tous les projets de développement dans nos collectivités. Mais cette implication n'est pas totale par exemple dans le cadre du projet de revitalisation des villages*[7].

[7] Entretien avec un élu local dans le Niari, janvier 2019.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

2.2. Une décentralisation inachevée : des collectivités locales manquantes et des populations peu organisées à la base

Le caractè e inachevé de la décentralisation est illustré à travers la faiblesse des collectivités locales et des acteurs communautaires de la base.

2.2.1. Des collectivités locales insuffisantes et faiblement outillées

La centralité de l'Etat dans la politique d'aménagement et de développement territorial s'est renforcée face à des expériences de décentralisation maintes fois interrompues par des coups d'état militaires répétitifs et les nombreuses crises sociopolitiques intervenus depuis l'indépendance.

La décentralisation a revêtu plusieurs formes au Congo. En 1959, à la veille de l'indépendance, la volonté d'impliquer les populations locales dans la gestion des affaires publiques est manifeste avec le renforcement de la présence des cadres indigènes dans l'administration coloniale. La même année, est lancée la première expérience de décentralisation sur la base du décret 59/188 du 31 août 1959, qui fixe 4 niveaux de circonscriptions administratives et institue les conseils de préfecture et de sous-préfecture. Aussi, la loi n°29/90 du 22 juin 1960 portant organisation des communes rurales tentera de consolider ce processus de décentralisation. La loi 45/81 du 6 décembre 1981 portant réorganisation territoriale met l'accent sur la décentralisation administrative. Elle institue trois niveaux de collectivités locales (région, district et commune) avec des conseils populaires au niveau de chaque collectivité locale. Ces derniers sont dotés de compétences financières et économiques. Cependant, ils ne jouissent pas d'une autonomie politique car étant gérés par les commissaires politiques qui sont des représentants du pouvoir central. La décentralisation administrative vise à repartir, au niveau de plusieurs échelons de territoire, les responsabilités et les ressources financières pour assurer la fourniture des services publics. Ce type de décentralisation est une délégation de pouvoir à des représentants nommés issus du parti au pouvoir (PCT).

Cependant, la revendication sociale pour une démocratie pluraliste au Congo en 1992 remet en cause le rôle prééminent du pouvoir central dans la gestion des affaires publiques. Ainsi, la loi 8/94 du 5 juin 1994 fixant l'organisation administrative et territoriale du Congo crée des collectivités locales de plein exercice que sont la région, la commune, le district et le canton ; tandis que le niveau déconcentré s'organise autour du département avec des relais administratifs au niveau de la commune, du district et du canton. Ce mode d'administration et d'organisation territoriale de 1994 inspiré de la constitution du 15 mars 1992 a constitué jusqu'à présent, le meilleur modèle de décentralisation au Congo. En effet, les niveaux de décentralisation prévus devraient assurer la bonne coordination de l'action publique entre les

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

services décentralisés et déconcentrés. Cependant, ce processus a été freiné par le coup d'état de 1997.

Le processus de décentralisation en cours au Congo prend sa source dans la constitution du 20 janvier 2002. Cette charte fondamentale consacre, en effet, l'existence de collectivités locales distinctes de l'Etat, notamment le département et la commune qui s'administrent librement par des conseillers élus. Depuis lors, plusieurs lois et décrets sont venus offrir à la décentralisation un cadre institutionnel et réglementaire propice à l'atteinte des objectifs de la décentralisation que sont la promotion de la démocratie participative et du développement local. En effet, la décentralisation est régie par plusieurs textes dont la loi n°3-2003 qui précise, à la suite de l'article 174 de la constitution du 20 janvier 2002, que les deux circonscriptions décentralisées sont le département et la commune. Ces collectivités locales sont dotées d'une personnalité morale et d'une autonomie financière pour prendre en charge des « affaires d'intérêt local ». En effet, comme le stipule l'article 41 de la loi précitée, « les collectivités locales… s'administrent librement par des conseils élus dans les conditions prévues par la loi, notamment pour ce qui concerne leurs compétences, leurs ressources, leur mode d'organisation et de fonctionnement » (République du Congo, 2003, p.6). En outre, le gouvernement a, par la loi n°10-2003 du 6 février 2003, transféré aux collectivités locales plusieurs domaines de compétences[8].

Toutefois, la décentralisation en cours au Congo souffre d'un goût d'inachevé comme l'ont relevé plusieurs élus locaux rencontrés :

> *C'est vrai il y a eu des lois votées pour renforcer la décentralisation mais sur le terrain, nous élus sont encore confrontés à plusieurs contraintes techniques et financières dans l'exercice de notre mission de développement socioéconomique*[9].

> *Il n'y a aucun sens de mettre en place des départements et des communes sans leur donner les moyens nécessaires. La décentralisation n'est effective que sur le papier. Les collectivités locales ne fonctionnement pas normalement*[10].

[8] Il s'agit : la planification, le développement et l'aménagement du territoire ; l'urbanisme et l'habitat ; l'enseignement public ; la santé, l'action sociale et la protection civile ; l'environnement, le tourisme et les loisirs ; les sports et l'action culturelle ; les eaux, les forêts et la chasse ; l'agriculture, l'élevage et la pêche ; l'administration et les finances ; le commerce et l'artisanat ; les travaux publics et les transports ; les mines, l'énergie et l'hydraulique ; l'emploi.

[9] Entretien avec un élu local du Niari, janvier 2019.

[10] Entretien avec un élu local du Kouilou, janvier 2019.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

D'abord, la décentralisation est handicapée par l'absence de certains textes d'application des lois adoptées depuis 2003. Cette lenteur révèle, en réalité, un manque d'engouement pour l'Etat vis-à-vis de l'accélération de la décentralisation par le renforcement des pouvoirs des collectivités locales. En effet, l'absence de textes d'application fragilise les collectivités locales tout en permettant aux structures déconcentrées de poursuivre l'exercice de leurs missions régaliennes. Cette situation favorise du coup des conflits de compétence en matière de planification, d'hydraulique, d'assainissement, etc. entre les collectivités décentralisées (département et commune) et les circonscriptions administratives que sont les communautés urbaines et les communes d'arrondissement. Ensuite, la décentralisation actuelle pose problème du point de vue des ordres de collectivités locales. D'abord, avec deux ordres de collectivités (département et commune) dont seulement quelques communes sur l'ensemble du territoire national, la décentralisation reste inachevée. En effet, dans un territoire aussi vaste que le Congo avec l'une des densités démographiques les plus faibles d'Afrique, les conseils départementaux sont souvent éloignés de la base et du monde rural en particulier. Les communes rurales constituent aujourd'hui le principal palier manquant du processus de décentralisation au Congo. L'érection des communautés rurales et des communautés urbaines en collectivités locales de plein exercice[11] pourrait contribuer au renforcement du processus de décentralisation et à une meilleure gestion de la problématique du développement local. Enfin, la décentralisation au Congo est confrontée comme ailleurs en Afrique à la faiblesse des capacités des collectivités locales. L'insuffisance des ressources financières locales et le manque de compétences techniques freinent considérablement la bonne exécution des compétences transférées. Du fait de la faiblesse des finances locales, les collectivités dépendent essentiellement des transferts de l'Etat et peinent en conséquence à s'imposer comme principal acteur de la décentralisation. Grâce à ses importantes ressources financières et à son pouvoir d'influence politique, l'Etat est aujourd'hui l'acteur fort de la décentralisation. En effet, la décentralisation s'apparente parfois à un prolongement du pouvoir central ou encore du parti-Etat au niveau local. Les collectivités locales sont essentiellement contrôlées par les élus du parti au pouvoir dont le mode de gestion et d'orientation politique s'inscrit dans la vision du parti et donc de l'Etat.

Par ailleurs, l'insuffisance voire le manque de compétences techniques entraine une faiblesse du management public local. L'absence d'une fonction publique locale constitue un handicap majeur dans la gestion des collectivités

[11] Les communautés rurales et les communautés urbaines actuelles sont des circonscriptions administratives (dirigées par des représentants de l'Etat) et non des collectivités locales.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

locales. Il faut préciser que, malgré la promulgation de la loi n°5 du 11 mai 2005 sur la fonction publique territoriale, plusieurs collectivités locales ne disposent pas encore d'agents techniques nécessaires à leur bon fonctionnement.

2.2.2. Une société civile locale faiblement organisée

L'absence d'une tradition de démocratie locale matérialisée par la prédominance de l'approche descendante en matière de développement territorial et, les longues années de crises sociopolitiques et de guerres civiles ont considérablement gêné l'émergence d'une société civile locale structurée et dynamique. Dans les centres urbains et surtout en milieu rural, les populations locales sont très faiblement organisées. La faiblesse voire l'absence de tissus organisationnels dynamiques est une caractéristique majeure des villages congolais. Yaba Mbéti, Engana, Bokombo, Inkouélé, etc. illustrent parfaitement cette situation. L'analyse du tissu organisationnel villageois révèle l'existence de plusieurs contraintes qui sont autant de goulots d'étranglement à l'émergence d'une véritable démocratie locale gage de développement local. La dynamique organisationnelle souffre, en effet, de la faible application des principes de bonne gouvernance, de l'absence de reconnaissance juridique des organisations, la faible représentativité des femmes dans les instances de prise de décision, la faible capacité matérielle et financière des organisations ainsi que le défaut d'encadrement comme en témoignent les propos ci-dessus :

> *Notre association a été créée depuis 1971 mais elle n'a pas encore de reconnaissance juridique. Aussi, l'organisation ne compte pas beaucoup de membres car les gens ne sont pas trop intéressés par la vie associative puisqu'il n'y trouve pas un grand intérêt. Le bureau n'est composé que de trois personnes et ne compte aucune femme*[12].

> *Notre groupement Obiradzia compte 30 femmes et mène diverses activités socioéconomiques. Nous organisons des réunions bihebdomadaires pour discuter de la vie de l'organisation. Mais, il n'il n'y a pas de production de PV ni de comptes rendus aux membres. Le bureau n'a pas encore été renouvelé depuis sa création en 2004*[13].

> *Le Comité de Santé (COSA) a une mission de cogestion du centre de santé intégré de Inkouelé. Mais, nous n'arrivons pas à remplir notre mission du fait de malentendus avec le comité technique composé du personnel de santé qui dépend de la Fondation OBAME sur laquelle*

[12]Membre de l'Association des jeunes de Engana (village du district de Boundji, département de la Cuvette), entretien janvier 2019.
[13]Responsable du groupement des femmes de Engana, entretien janvier 2019.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

nous n'avons aucune influence. De ce fait, l'action du COSA se limite à la sensibilisation des habitants sur certaines maladies[14].

Dans ces villages, comme un peu partout dans le pays, le principal défi est ainsi celui du renforcement de la dynamique organisationnelle. De l'avis de plusieurs acteurs locaux interrogés, il s'agit de mieux structurer la société civile locale et de travailler au renforcement de ses capacités techniques. C'est seulement par cette voie que la démocratie locale pourrait être renforcée afin de permettre à la société civile de jouer son rôle en matière de développement local.

Pour faire participer les acteurs locaux au processus de décentralisation et de développement local, le gouvernement a créé par décret n°2013-280 du 25 juin 2013 le Comité de Gestion et de Développement Communautaire (CGDC) dans chaque quartier et village. Placé sous la responsabilité de l'instance décentralisée (départemental ou municipal), il est une instance de gestion de proximité. Le CGDC élabore les plans de développement du village ou quartier et met en œuvre les actions identifiées en rapport avec la collectivité locale. Cette instance est un important outil de promotion de l'implication des populations dans la gestion des affaires locales et de la gouvernance territoriale. Les CGDC sont un levier pouvant faire éclore une société civile locale dynamique et engagée sur la voie de la démocratie locale. Ils peuvent également permettre le développement de l'entreprenariat rural et urbain des citoyens qui est encore faible. Toutefois, cette loi sur les CGDC, tout comme beaucoup d'autres textes sur la décentralisation, ne fait pas pour le moment l'objet d'une application.

2.3. Le défi de la gouvernance territoriale : quelles échelles avec quels acteurs en jeu ?

Sur le plan institutionnel et juridique, le gouvernement s'est inscrit dans une perspective d'articulation des échelles de l'aménagement à travers la promotion de la gouvernance territoriale comme l'ont souligné plusieurs acteurs institutionnels interrogés et ce conformément à la LOADT qui promeut une mise en œuvre entre l'Etat et les collectivités locales. C'est dans ce sens que les contrats de plan Etat-département ont été mis en place. Il s'agit d'une contractualisation au terme duquel, l'Etat met à la disposition d'un conseil départemental (ou municipal) des dotations budgétaires nécessaires à la réalisation de projets devant concourir à la revitalisation du tissu villageois et au renforcement de l'armature urbaine conformément à la grille d'équipement contenu dans le SNAT. Les contrats Etat-départements et Etat-municipalités

[14]Membre COSA de Inkouélé (village du district de Gamboma, département des Plateaux), entretien janvier 2019.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

signés jusqu'ici ont permis la mise en place d'équipements sociaux de base et d'infrastructures économiques. Pour plusieurs acteurs interrogés, ces contrats-plans sont un bel exemple de synergie entre l'Etat et les collectivités locales :

> *A travers le contrat plan signé avec l'Etat, nous avons pu réaliser des équipements au grand bonheur des populations. Nous avons prouvé que l'Etat et le département sont des partenaires pour le développement socioéconomique*[15].
>
> *Les contrats plans sont des outils efficaces de mise en œuvre de la politique d'aménagement du territoire et de développement local. L'Etat compte multiplier ces contrats avec les collectivités locales pour les accompagner financièrement dans l'exercice de leurs compétences*[16].

Mais en dépit de leur effet très positif sur le renforcement de l'armature urbaine et rurale, les contrats de plan Etat-département ne renversent pas suffisamment la tendance en termes de gouvernance territoriale. Ils illustrent d'ailleurs la forte dépendance des collectivités locales vis-à-vis de l'Etat et l'interventionnisme toujours grandissant du pouvoir central dans la conduite de la politique d'aménagement et de développement territorial.

Par ailleurs, l'absence d'ordre de collectivités locales à la base et d'une société civile locale forte ne facilite pas l'implication des acteurs locaux dans la mise en œuvre des projets d'aménagement du territoire. Dans le cadre du renforcement de la décentralisation, l'érection des communautés urbaines et des communautés rurales en collectivités locales pourrait participer à la promotion de la démocratie locale et à une meilleure implication des populations de la base dans la gouvernance des territoires. Les propos ci-dessous sont illustratifs :

> *Il faut aller vers une communalisation intégrale. Les communes doivent être mises en place sur l'ensemble du territoire national et dotées de véritables capacités techniques et financières afin qu'elles puissent porter les initiatives de développement local*[17].

La LOADT offre les conditions institutionnelles en vue d'une meilleure gouvernance territoriale. Elle promeut, en effet, l'implication de la société civile, qui est restée longtemps absente du débat sur la gouvernance des territoires, laissant l'entière responsabilité à l'administration centrale. L'implication des acteurs de la base doit permettre de bâtir des espaces de concertation devant être une force de proposition et même de décision. Elle pourra prendre appui sur le décret 2013-180 du 25 juin 2013 instituant les

[15] Entretien avec un élu du département de Niari, janvier 2019.
[16] Entretien avec un cadre de la Direction du développement local, janvier 2019.
[17] Entretien avec un élu du département de Kouilou, janvier 2019.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

CGDC sur près de 5300 localités (villages et quartiers) de la République du Congo et les fédérations des CGDC sur les 111 localités au niveau méso (district) de l'organisation territoriale. La LOADT affirme la primauté du territoire dans l'exercice de l'action publique qui doit d'abord avoir son ancrage sur lui en privilégiant « la remontée des bases ». Ainsi, elle balise le passage de l'Etat-providence à l'Etat partenaire. L'approche top down qui a longtemps prévalu doit être articulée avec l'approche buttom up dans la définition et la mise en œuvre de l'action publique. La LOADT consacre ainsi les valeurs de la démocratie participative.

3. Discussion

Le Congo est une illustration des dynamiques de renouveau des politiques d'aménagement du territoire en Afrique Subsaharienne. Ces dynamiques résultent de changements institutionnels et de réformes territoriales dont la finalité est le passage d'un aménagement centralisé à un aménagement négocié (Alvergne, 2008). Le cas du Congo révèle les difficultés liées à cette mutation de l'aménagement du territoire.

3.1. L'Etat reste toujours l'acteur prédominant dans la mise en œuvre de la politique d'aménagement et de développement du territoire

L'aménagement du territoire reste encore très centralisé avec un fort interventionnisme de l'Etat congolais. De la conception à la mise en œuvre, l'Etat reste le principal acteur à travers ses divers démembrements. Ce constat confirme les analyses de nombreux auteurs.

Robert Edmond ZIAVOULA met en évidence le fort interventionnisme de l'Etat dans la conduite des politiques territoriales (Ziavoula, 2005). La gouvernance de l'aménagement du territoire relève exclusivement de l'Etat (Thoening & Duran, 1996). La forte présence de l'Etat dans la mise en œuvre des politiques d'aménagement et de développement est illustrée par son implication dans la conduite des programmes d'aménagement et son déploiement territorial. Ainsi, le programme de municipalisation, symbole de l'effort de reconstruction initiée à la suite des longues années de conflits qui ont secoué le pays, « est une action de redistribution fortement liée à la présidence de la république » (Dorier & Joncheray, 2011, p.6). Comme le notent Elisabeth Dorier et Erwan Morand, il y'a un monopole et un quadrillage territorial des politiques publiques par l'Etat (Dorier & Moraud, 2012) et cette tendance se maintient en dépit du processus de décentralisation enclenchée.

3.2. Des limites de la politique de décentralisation

Les résultats de l'étude soulignent les faiblesses de la décentralisation. En dépit des réformes, les collectivités locales restent handicapées par l'insuffisance de leurs ressources humaines et financières tandis que les

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

services déconcentrés de l'Etat sont encore trop présents. L'absence de certains textes d'application favorise des conflits entre Etat et les collectivités locales.

Ainsi, le mode de gestion décentralisé en cours au Congo s'apparente au modèle de la régulation croisée qui consacre l'interventionnisme de l'État et porte encore les stigmates de l'État-providence (Girardou, 2012). La régulation croisée comme mode de gestion et de relation de pouvoir entre l'administration centrale et les collectivités locales n'offre pas à ces dernières les coudées franches. En effet, ce type de relation ne permet pas aux élus locaux d'acquérir les compétences de gérer convenablement. Ce constat a aussi été confirmé par plusieurs travaux sur les processus de décentralisation en Afrique (Alvergne, 2008). Il recoupe également la synthèse de Estelle Chavallard. Elle écrit « Bien que les textes d'application pour le transfert des compétences et des ressources financières aient été publiés, le Congo peine à traduire ses engagements politiques en actions concrètes. La couverture territoriale limitée, l'absence de collectivités locales en milieu rural ainsi que les attributions restreintes et la faiblesse des ressources technique et financière de ces institutions rendent le processus de décentralisation peu effectif » (Chavallard, 2016, p.6).

3.3. La nécessaire articulation des échelles et acteurs de la gouvernance de l'aménagement du territoire

L'aménagement du territoire au Congo suppose un dialogue et une mise en relation des acteurs. L'Etat ne doit plus être le seul acteur à bord conformément à l'esprit de la LOADT de 2014 comme l'ont affirmé plusieurs acteurs interrogés. Il se pose ainsi un défi majeur au Congo celui d'asseoir la gouvernance territoriale. Celle-ci est « un processus institutionnel et organisationnel de construction d'une mise en compatibilité des différents modes de coordination entre acteurs géographiquement proches » (Gilly *et al.*, 2001, cité par Lauriol, 2008, p.90). Ce constat a été fait par Fabienne Leloup et al (2005) qui notent que l'Etat central doit davantage responsabiliser les acteurs locaux et renforcer leur implication effective dans la conception et la mise en œuvre de la politique d'aménagement.

Les efforts de régulation de l'Etat devraient converger vers la production d'un développement endogène produit et porté par des acteurs locaux (Diop, 2011). Ce n'est qu'à cette condition que l'on pourra impulser une bonne dynamique locale devant conduire au développement.

Conclusion

En dépit d'importants progrès notamment institutionnels et réglementaires en matière d'aménagement et de développement du territoire, le renouveau des politiques territoriales au Congo reste encore timide dans les

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

faits. Sur le terrain, l'Etat central est toujours le principal acteur et l'approche top-down reste privilégiée. L'absence de certains décrets d'application des lois, la faiblesse des ressources des collectivités locales, l'absence de collectivités locales de base et le faible degré d'implication des populations locales handicapent fortement la bonne marche de la décentralisation et en conséquence de plusieurs initiatives d'aménagement et de développement territorial. Dans ce contexte, la gouvernance territoriale, comme mode de coordination des différents acteurs dans le but de construire le développement est loin d'être effective. De plus, la faible coordination dans la mise en œuvre du développement territorial est réelle.

La LOADT pourrait être une alternative. Elle compte mettre fin à l'absence de cohérence et d'articulation dans les politiques d'aménagement et de développement du territoire. Il s'agit de veiller à la mise en cohérence entre les différents instruments d'aménagement (schémas d'aménagement national, schéma d'aménagement départemental, plans locaux de développement et schémas sectoriels, schémas et plans directeurs d'urbanisme et code de l'urbanisme) à tous les niveaux territoriaux pour assurer une gestion territoriale cohérente.

La matérialisation d'une telle vision passe par l'approfondissement de la décentralisation. La constitution du 20 janvier 2002 donne la possibilité de créer d'autres niveaux de décentralisation selon le besoin. Il est possible d'instaurer la mutation des communautés rurales et des communautés urbaines en collectivités locales, et les communes d'arrondissement en communes de moyen exercice, dotées de l'autonomie administrative et financière. Elles constitueront de véritables relais dans la gestion de proximité d'une part avec les départements et d'autre part avec les CGDC. Par conséquent, l'harmonisation entre les échelons de circonscriptions administratives et les échelles de la décentralisation va assurer une cohérence des politiques publiques et locales, une bonne articulation verticale et horizontale des interventions au niveau des différents territoires. Ces acteurs situés au niveau des échelles infra, méso et supra seront le socle qui va assurer une bonne gouvernance territoriale gage de la compétitivité et de l'attractivité des territoires au Congo.

Conflit d'intérêts : Les auteurs n'ont signalé aucun conflit d'intérêts.

Disponibilité des données : Toutes les données sont incluses dans le contenu de l'article.

Déclaration de financement : Les auteurs n'ont reçu aucun financement pour cette recherche.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

References:

1. Alvergne, C. (2008). Le défi des territoires : Comment dépasser les disparités spatiales en Afrique de l'Ouest et du Centre, Paris, Khartala-PDM, 263 p.
2. Baudelle, G., Guy, C. & Merenne Schoumaker, B. (2011). Le développement territorial en Europe : Concepts, enjeux et débats. Presses Universitaires de Rennes. Collection « Didact géographie », 282 p.
3. Chavallard, E. (2016). *Analyse de la politique d'aménagement et de développement du territoire au Congo-Brazzaville*, Rapport d'étude publié par Banque Mondiale (BM), le World Resource Institute (WRI) et le Ministère de l'Aménagement du Territoire et des Grands Travaux, 55 p.
4. Diop, M. (2011). Le pouvoir local : Décentralisation et développement urbain. Edition Clairafrique, Paris, 393 p.
5. Dorier, E. & Morand, E. (2012). « Accessibilité aux services de soins en situation post conflit, République du Congo ». *In Bulletin de* l'*Association des Géographes Français*, 2012-2, pp 289-312
6. Dorier, E. & Joncheray, M. (2011). « Territoires fragmentés et temporalités post-conflit. Décomposition et recompositions territoriales entre guerres et paix en République du Congo », Communication au Colloque du CTHS (CNRS), Faire la guerre, faire la paix, Perpignan, 2-7 mai 2011, 14 p.
7. Dorier-Apprill, E. & Ziavoula, R. (1996). Géographie des ethnies, géographie des conflits à Brazzaville, in Horizon-documentation, pp. 259-289
8. Gilly, J-P. & Wallet, F. (2005). Enchevêtrement des espaces de régulation et gouvernance territoriale. Les processus d'innovation institutionnelle dans la politique des Pays en France. Revue d'Économie Régionale & Urbaine 2005/5, Éditions Armand Colin, pp. 699 à 722
9. Girardou, J. (2012). Politiques d'aménagement du territoire. Mise au point. ELLIPSES. Deuxième édition, 238 p.
10. Lauriol, J., Perret, V. & Tannery, F. (2008). L'espace et le territoire dans l'agenda de recherche en stratégie, Revue française de gestion 2008/4 (n° 184), Éditions Lavoisier, pp 181 à 198.
11. Leloup, F., Moyart, L. & Pecqueur, B. (2005). « La gouvernance » Géographie Économie Société. Lavoisier | 2005/4 – Vol. 7.
12. Moutsara, A. (1986). Caractéristiques du tissu urbain de Brazzaville, Actes du colloque sur les journées d'études de Brazzaville, ORSTOM, 12 p.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

13. Ngouma Damase (2012). L'axe Brazzaville-Gamboma : le rôle de la route dans l'organisation de l'espace et le développement rural. Thèse unique, Université Marien NGOUABI, Brazzaville, 359 p.
14. Ngouari, AA. (2006). Politiques sociales et développement : le cas du Congo Brazzaville, mémoire de maîtrise, université du Québec, 151 p.
15. Ofouémé-Berton, Y. (2010). « L'approvisionnement en eau des populations rurales au Congo- Brazzaville », *Les Cahiers d'Outre-Mer* [En ligne], 249 | Janvier-Mars 2010, mis en ligne le 01 janvier 2013, consulté le 30 avril 2019. URL : http://journals.openedition.org/com/5838 ; DOI : 10.4000/ com.5838
16. Pourtier, R. (2000). Brazzaville dans la guerre : crise urbaine et violences politiques, in Annales de Géographie. 2000, t. 109, n°611. pp. 3-20
17. République du Congo (2014). Loi n° 43 - 2014 du 10 octobre 2014 d'orientation pour l'aménagement et le développement du territoire, 24 pages
18. République du Congo (2003). Loi n°3-2003 du 17 janvier 2003 fixant l'organisation administrative territoriale, 7 pages
19. République du Congo (2003). Loi n°10-2003 du 6 février 2003 portant transfert de compétences aux collectivités locales, 2 pages
20. République du Congo (2014). Loi n° 43-2014 du 10 octobre 2014 d'orientation pour l'aménagement et le développement du territoire, N° 42-2014, p.986
21. Thoenig, J.C. & Duran, P. (1996). L'État et la gestion publique territoriale, in Revue française de science politique, 46e année, n°4, 1996. pp. 580-623
22. Ziavoula, R.E. (2005). Le Congo, enjeu territorial et développement local, Etudes africaines, Paris, Harmattan, 276 p.

ESJ Humanities Peer-reviewed

Image Semiotics in the Book "Our Arabic Language" for the Third Grade in Jordan: An Analytical Study using Human and Artificial Intelligence

Khitam Ahmad Bani Omar
Curriculum and Teaching, Department of Curriculum and Teaching, Faculty of Educational Sciences, Jerash University, Jordan

Doi:10.19044/esj.2023.v19n32p158

Submitted: 19 October 2023
Accepted: 26 November 2023
Published: 30 November 2023

Cite As:
Bani Omar K.A. (2023). *Image Semiotics in the Book "Our Arabic Language" for the Third Grade in Jordan: An Analytical Study using Human and Artificial Intelligence*. European Scientific Journal, ESJ, 19 (32), 158. https://doi.org/10.19044/esj.2023.v19n32p158

Abstract

This paper focuses on identifying the image semiotics in the textbook "Our Arabic Language" for the third grade in Jordan, employing both human intelligence and artificial intelligence. To achieve the study objectives, a content and semiotic analysis method was adopted using human and artificial intelligence. The study sample consisted of 20 images, which represents the entire study population within the Arabic language textbook for third-grade students. The most prominent results revealed a male bias in terms of the number of characters, functional roles, social roles, talents, and activities. There was a convergence between the semiotic analysis using human intelligence and semiotic analysis using artificial intelligence. The results also showed that there were differences in the results of the semiotic analysis between the use of artificial intelligence and the use of human intelligence. This is because the human analysis connects images with social context and other images, while the artificial intelligence deals with every image separately.

Keywords: Image semiotic, our Arabic language textbook, human intelligence, artificial intelligence

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Introduction

Images within the school textbooks hold significant importance due to the meanings and messages they conveyed. They serve as a means of communicating specific messages to a recipient (the student). Authors, artists, and technical committees responsible for textbook preparation should consider these messages to align with both public and private educational objectives, lesson content, and the students' age.

An image, in its simplest meaning, is an attempt to convey reality where the communication process is carried out. It functions as a discourse with multiple meanings that accompany the text, clarifying the intended message. Therefore, the inclusion of clear meanings is crucial to avoid ambiguity for the student in understanding the image's theme and the intended meaning (Saed & Sabti, 2011). An image includes marks, symbols, rules and indications that have roots in the prevailed social and intellectual representations within society. The image semiotic lies in our understanding of these symbols, rules and indications, showcasing our ability to read and understand their significance (Suleiman, 2014).

The importance of an image stems from the fact that it attracts the reader’s attention because the sense of sight plays a significant role in terms of human perception and understanding. In instances where words alone may fall short in conveying content, an image becomes essential. It provides vital support to text by offering easy and clear explanations through elements such as color, shape, and lines. Sometimes, an image speaks more eloquently and powerfully than written words by vividly portraying events and embodying them as they are. Images often succeed in confirming information about an event in ways that written words cannot achieve (Suleiman, 2014).

Considered as a document with significant expressive value, an image's semantic function holds equal importance to any other form of text. There are three levels of reading an image and it begins with the enumeration level where a person sees the image and counts its contents. The second level is the description level where a person describes the elements of an image showing its parts, features, and characteristics. The third level is the interpretation level where a person creates a relationship among the elements of the image, and then links them together to form a concept (Bin El Din, 2018).

An image has two functions: a communicative function (analyzed by communication semiotics) and a semantic function examined through semiotics (Kababsa, 2018). According to structuralism, all phenomena are governed by some invisible rules whereby an image has two structures; the superficial structure and the deep one. In order to get the meaning of an image, the meaning should be revealed from a deep structure. As a result, the structuralism attempts to reveal the hidden layer through the rules by

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

organizing how people interact in a certain social context. The structural semiotics pays more attention to the relationship among elements within the image. Semiotics is often used in analyzing the text, where the text does not necessarily mean a written language. It encompasses anything conveying a message—written language, films, images, and more are all considered texts (Kılıç & Sarıkartal, 2016).

The educational image is different from images in general since it is directed to a definite purpose, which is the image in the textbook. Also, it is attached to educational texts as they perform a major role in directing the educational message and organizing the knowledge network. The educational image is also a method of introducing natural facts about education, thereby providing the viewer (student) with awareness of the difference between the previous information and comparing it to the new impression that emerged from different data (Kababseh, 2018).

Many studies have dealt with the semiotics of image in textbooks. For instance, the study of Paneru indicated that textbooks in Nepal concentrate on settings, personal details, and the use of majority of colors. Textbooks show positive changes in forming images of the book in terms of quality and gender discourses. However, the images included certain religious symbols and a regional culture, instead of cultures, regions, and various religions. It seems that religious, ethnic, and regional minorities and disagreements found in the society were not included in the textbooks. The semiotics analysis of the three textbooks to small learners showed that the textbooks need some corrections based on the child's cognitive development and his sight realization (Sovič & Hus, 2016). The results also show that textbooks that were evaluated did not have an approach or choice of "ethnic-racial" specific "location". It also shows that they are free of bias towards the mother tongue or the target language because the painter did not pay special attention to his language when selecting the images (Jam, Khiabani & Hejazi, 2021).

The semiotic analysis of the images adopted a method depending on analysis based on human intelligence (HI) through the preparation of the analysis tool. Based on this analysis, the researcher analyzed the images according to this tool and reached certain conclusions. Recently, there has been an increase in talking about Artificial Intelligence (AI) and its uses, especially in the field of education and scientific research because of the great benefits it offers. The discovery of AI has led to several controversies as it may be considered the possible rapprochement between humans and machine (Nielsen, 2016).

Although AI brought many benefits to education and scientific research, there are fears of its influence on higher institutions of education. Nowadays, AI can be used in education in various ways such as Chabot, which provide support to students and personal education algorithms that adapt with

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

every student's needs. These AI tools are also used to analyze large amounts of data in order to define patterns and visions which may be beneficial in developing new educational strategies and policies.

While there are several benefits in using AI in the field of education, there are also moral considerations that need attention. One of the biggest fears is that AI may lead to sustain bias and current discrimination in education. This, however, is in addition to fears the influence of AI will have on students' privacy and information security. Teachers indicated that Chabot is able to generate meaningful replies to the questions of evaluations and exams, and it is often not possible to refer these responses to a certain source, making plagiarism difficult to detect.

Mijwil (2023) indicated that AI became a major tool in the scientific research, and this could help researchers to accelerate data analysis and interpretation process, automate tedious tasks, and define patterns. One of the ways AI has resulted to a revolution in the research process is the acceleration process of data analysis and interpretation. For example, AI can be used to extract basic information from unorganized text such as research papers or legal summaries. It can also create summaries on main points in addition to the use of Chat GPT in helping researchers in writing and generating a scientific article.

The use of AI in scientific research would help scientists on innovations, discoveries, data analysis, and improve experiments. AI is used in scientific writing of research papers through several ways such as text generation, text summary, grammar checking, and literature review. It helps researchers in identifying related studies. It is important to note that AI models are not perfect as they can result in errors or create a text that is not of the same quality as human-written text. The text created by AI may lack creativity and critical thinking of a human researcher. However, AI when combined with human supervision and editing will serve as a useful tool in writing scientific research papers.

One of the most widely used programs in education and scientific research is the Chat GPT program, which is an AI program that generates dialogue. This chat bot uses auto-learning algorithms to process and analyze large amounts of data to generate responses to user's inquiries. This language-processing program can understand human language in both spoken and written form, which allows it to understand what information is being fed and the results it should give. For instance, when a student asks a question, Chat GPT is able to provide a straightforward answer (Bowman, 2022).

Study Problem and Questions

Images are considered a major component in textbooks as, together with the text, they play a significant role in conveying the desired meanings

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

and semantics to the recipient (student). When selecting the images to be used, it is important to take into consideration the lesson content and the targeted educational outputs (whether they are public or private). Studies related to semiotic analysis of textbooks showed that they need some corrections based on the child's cognitive development and his sight realization (Sovič & Hus, 2016). Hence, the evaluated textbooks have no specific "ethnic-racial" approach and choice of "location". This is because the person who selects the images did not pay special attention to his language during the selection process (Jam, Khiabani & Hejazi, 2021).

The results of the study of Bani Omar (2018) on the type of language books for the first three grades in Jordan showed that there was a bias towards males in the textbooks, and the professions that a woman practices are humble compared to the ones practiced by males. This study analyzed the images of the book "Our Arabic Language" for the third grade in Jordan to identify their components. However, the semiotic of these images is defined using HI and AI in light of the increasing talk about the possibility of using AI such as Chat GPT in scientific research. This is especially because of its capacity to process and analyze great amounts of data. Specifically, the study seeks to answer the following questions:

1. What are the main categories in the images of the book titled "Our Arabic Language" for the third grade in Jordan?
2. What is the semiotics of images in the book titled "Our Arabic Language" for the third grade in Jordan using Human Intelligence (HI)?
3. What is the semiotics of images in the book titled "Our Arabic Language" for the third grade in Jordan using Artificial Intelligence (AI)?

Methodology

The study adopted the descriptive method based on content analysis, as images of the Arabic language book for the third grade in Jordan were analyzed. Here, the image was adopted as a unit for analysis, and its components as categories for analysis. A form was prepared to collect data and monitor averages of categories frequency in the analyzed images. After defining the categories of analysis and its form, the analysis process began by including an analysis of the image and presenting it to the analysis list.

Then, the semiotics analysis method for the units of analysis content was adopted by analyzing them using AI of categories of analysis and Chat GPT program through putting every category in a form of a question through which it is asked to know the semiotics of the image that consists of a specific category of the categories of analysis, noting that this image is found in the book of Our Arabic Language for the third grade in Jordan. The answers of

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

the program -which were ordered according to main titles - were moved. In order to ensure the credibility of separating the analysis using human intelligence and the use of artificial intelligence, the analysis using (HI) was conducted in advance before conducting the analysis using AI to ensure that the human analyst did not see the results of the analysis using (AI).

The Analysis Process

- Reviewing the book images multiple times for understanding
  As highlighted by Saldana (2021), the data present in the images is encoded using the descriptive code method. Thus, this identifies six types of coding: similarity, difference, repetition, sequence, causality, and combinations of these types, depending on the nature of the data.
- Gathering the codes into themes
  After encoding the data in the images, the codes were grouped, summarized, and transformed into larger and fewer themes, with similar codes being combined into one group called "Themes."
- Analyzing the themes grouped in "Themes" by the researcher and extracting conclusions from them without referencing the results of artificial intelligence analysis.
- Presenting the themes grouped into "Themes" to artificial intelligence using the Chat GPT program for analysis and extracting conclusions.
- Comparing the conclusions reached by human analysis with those reached by artificial intelligence, leading to differences between the two analyses.

Study Population and Sample

The study population consisted of all the main images at the beginning of every lesson of the book “Our Arabic Language” for the third grade. This was approved by the Ministry of Education to be taught at the beginning of the year 2019. It contains 20 pictures and it came under the following titles:
School trip, which knocks at the window? Basma’s two friends, team sport, how do you love your homeland? This is not allowed, the week of the book, prince of the sea, heart, happiness in giving, on four, let us search, visual call, school activity, water and human, my health habits, heroines from my country, summer vacation, always together, and the city of shapes. The number of images including males and females was 11, images including females were 1, images including males were 4 only, and 4 images did not include people as the entirely study population was taken.

Study Tool

The study tool is represented in a list included the following categories: characters in the images including the sub-categories (according to sex, males

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

and females together, males or females only), functional roles, social roles, talents and activities and other elements. Hence, they were developed after the preliminary analysis of the images of the book. Thereafter, they were presented to a group of arbitrators to benefit from their opinions in developing the tool.

Procedures for Reliability Analysis

To verify the reliability of content analysis, the researcher conducted an evaluation of her own analysis with a time difference and also compared her analysis with that of another researcher. By employing the method and equation outlined by Azaroff and Mayer (1997), she calculated the percentage of the agreement between the two analyses. Thus, this is regarded as the percentage of agreement between the two analyses. The percentage of the researcher's analysis with herself was 94%, and the one with the other researcher was 92%. Both percentages are accepted percentages for the purposes of reliability analysis.

Results and Discussion

Results of the First Question and their Discussion: What are the main categories in the images of the book titled "Our Arabic Language" for the third grade in Jordan?

In order to identify the main elements of the images of Arabic language for the third grade in Jordan, the images were analyzed and categorized within the following main categories: characters in the images include the sub-categories (according to sex, males and females together, males or females only), functional roles, social roles, talents and activities, and other elements. Table 1 shows the analysis results of the images of the book "Our Arabic Language" for the third grade in Jordan according to the categories of analysis.

Table 1. Analysis results of the images of the book titled "Our Arabic Language" for the third grade in Jordan according to the categories of analysis

Main categories	Minor categories		
Characters in the images	According to sex	Number of males (40) with a percentage of 62.5%	Number of females (24) with a percentage of 37.5%
	Images including males and females together	Number of males (31)	Number of females (23)
	Images including males or females only	Images including males only (9)	Images including females only (1)
Functional roles	Students (19)	12 with a percentage of (63%) males	7 with a percentage of (37%) females
	A sailor (prince of the seas) standing on the ship and looking at the sea		
	Assistant sailor standing on the mast and looking with a telescope		

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

	A doctor standing behind an image containing a heart and medical symbols		
	A teacher in the classroom standing in front of students and explaining		
Social roles	Parents (7)	Fathers (4) (57%): a father holding the hand of his son and he is behind him, a father as his daughter standing in front him, a father reading to his daughter, a father searching for information on a tab	Mothers (3) (43%): a mother reading, a mother searching for information on a mobile, a mother celebrating her daughter's birthday, and performs a great role in taking care of her family in the absence of the father because he is ill
	Children (12)	Sons (7) with a percentage of 68%: one standing in the street with his father, two : one reading and the other searching for information in a book, two celebrating, one helps mother carry a plate of food	Daughters (5) with a percentage of 42%: one searching for information in a book, two daughters: one celebrating her birthday, one helps mother carry a plate of food
	Two aunts: the first doing volunteer works , the other using a smart application to contact her niece on her birthday		
Talents and activities	Athletes (12) including (10) males (83%) and (2) females (17%), basketball players 3+2, two children playing football, a boy playing scooter, a girl playing with a rope, a girl playing with a loop, two boys jogging		
	Volunteers works practitioners including three children, two boys (67%) doing volunteers works, a girl (33%) doing volunteers works		
	Children drawing including two girls (50%) and two boys (50%)		
Other categories	A girl sleeping in her room dreaming that she is playing with a deer and a bear		
	A boy eating healthy food		

Table 1 shows that the main analysis categories consisted of five categories (characters in images, functional roles, social roles, talents and activities, other categories), while the sub-category consisted of 16 categories. The first category included characters in the images and the following sub-categories: according to sex, images included males and females together, and images included males or females only. The second category included the functional roles and the following sub-categories: students, sailor, assistant sailor, doctor, and teacher. The third category included social roles and the following sub-categories: parents, children, and two aunts. The fourth category included the talents and activities and the following sub-categories: athletes, volunteer work practitioners, and children drawing. Lastly, the fifth category included the following sub-categories: a child sleeping in her room and dreaming and a child eating healthy food.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Results of the Second Question and their Discussion: What is the semiotics of images in the book "Our Arabic Language" for the third grade in Jordan using Human Intelligence (HI)?

The results related to this question revealed the following:

Characters in the Images

The semiotics analysis of the images showed an increase in the number of males over females in general by 25%, as the number of males reached 40 and the number of females 24. In addition, the images include both males and females together. Thus, the number of males was 31 and that of females was 23. For the images that included males or females only, the number of images including males was 9 and the females only are one image. The numerical superiority of males in the characters of the book's images indicates a clear masculine superiority confirmed by the excessive citation of male characters at the expense of female characters. However, this may mean to the thinker that this superiority is due to the culture of directed discourse, a culture of masculine discourse to the marginalization of the role of women in society, which launched the features of masculine repercussions and their supremacy to some extent in the textbook. This serves as a great hint at the general dominance of male images in the textbook.

As for reducing the numerical difference to 8 points in images that bring males and females together, this may mean that there is a direction towards achieving justice in the image distribution of representation of males and females. However, this direction still depends on the subjectivity of the authorship teams, and it is not governed by matrix controls or weight tables. As a result, male supremacy in the image distribution remained dominant.

Regarding the presence of 9 images that include only males and one image that includes only females, it once again confirms the repercussions of male bias among the authoring teams, whether this repercussion was intentional or unconscious. However, the authoring and drawing teams of the book are females only (Ministry of Education, 2022), which indicates that females are affected by the prevailing social context in society with the dominance of males. The population of Jordan was 11 million and 302 thousand people. Out of this number, 5 million and 984 thousand people were males with a rate of 52.95%, while 5 million and 318 thousand were females with a percentage of 47.05%. It has a difference of 666 thousand for males at a percentage of 5.9% (Department of Statistics, 2023). Therefore, these figures indicate that the difference in the number between males and females in the Jordanian society does not exceed 5.9%. Also, the reality of population distribution was not taken into consideration in the images of the book.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Functional Roles

The distribution of functional roles in the images of the textbook indicates the continuity of the dominance of the masculine role, its centrality, its importance, and its supremacy over the female role (student, sailor, assistant sailor, doctor). It also indicates the simplicity and traditionalness of female roles (student, teacher). It is probable that this reflects the stereotype in Jordanian society that the appropriate work for women is education (teacher), whereas other professions are suitable for males. Nonetheless, the social reality indicates the presence of women in all functional roles, such as doctor, nurse, engineer, airline captain, judge, policewoman, etc. The question that arises here is why there is still an insistence on showing women in the traditional roles in the textbook despite the development of social life and the change in women's roles?

Social Roles

The semiotics induction of the parents' images in the textbook indicates some intellectual semantics and reflections. This is because the emotional relationship seemed to be clear between the father and son (holding the hand), which is a closed one than the father with his daughters. Here, one of them is standing in front of him, and he reads to another. His other role indicates a shift towards benefiting from technology in researching since it requires new shift in light of the dominance of the infomedia revolution as a new environmental culture. Regarding the role of the mother, it is represented in that she is busy with the phone and organizing birthday celebrations for her children. This indicates the marginalization of the mother's interests and the limitation of her important role in one case, which is the absence of the father, as the care is limited to the father.

As for the role of parents and children, the predominance of the male role remains clear except for the son's help to his mother in carrying the dishes. Here, it is considered as a hint to depart from the usual role and participate in roles limited to females.

With regard to the two aunts, there was an image of the aunt doing volunteer works, and another one using a smart application to contact the daughter of her niece during her birthday. It is noted here that relatives on the father's side are absent, and the images are limited to the relatives on the mother's side. Therefore, this may refer to a social fact that began to appear in the Jordanian society in the recent period, which was sticking to relatives on the mother's side more than the father's side. This is an indicator that the authors of the curriculum do not work according to controls but seeks to create a type of balance among relatives both on the mother and father's side. They also aim to help the student establish a new relationship on both sides, i.e., the father's relatives and the mother's relatives.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Talents and Activities

There were 12 athletes including 10 males (83%) and 2 females (17%). Here, five of them are basketball players, two children playing football, a boy playing scooter, a girl playing with a rope, a girl playing with loop, and two children practicing jogging. The image used in the textbook, which is related to practicing various sports, confirms the predominance of mental assumptions that are not supported by scientific reference. Despite the cultural and social portrayal that perceives women as weak and lacking in abilities, impacting the distribution of sports roles—where difficult sports like basketball, football, scooter riding, and jogging are predominantly associated with males, while females are relegated to simpler and traditional activities like playing with a hoop and a rope—Jordan's social reality demonstrates extensive female participation in various sports. Women actively engage in football, basketball, and handball teams, and the country boasts world champions in karate, taekwondo, and athletics. A woman effectively participates in the various sports, as this confirms that the textbooks authors teams do not depend on specification tables that take into account the tendency to enhance the status of women in society and move away from the stereotyped image of a woman. This limits their sports roles to certain games suiting the cultural and social heritage that witnessed a remarkable change in the recent period. However, the textbook did not rise to the level of this change.

As for the volunteer works practitioners, the images included three children, two of them were boys (67%) doing volunteer works and a girl (33%) doing volunteer works. This is continuity to male bias which appeared clearly in the images of the book.

With regard to drawing talent, the images revealed a group of children drawing, as two of them were girls (50%) and the other two boys (50%). Subsequently, this reflects a balance in the distribution of this talent between males and females. Hence, this may reflect the cultural and social heritage which sees drawing as equal for males and females because it does not require great physical effort.

Other Categories

The textbook contains an image of a little girl sleeping in her room, dreaming that she is playing with a deer and a bear. The repercussions of this image indicate that there is semiotic contradiction in the semantics of images of the dream between meekness and beauty. Thus, this is expressed by the image of the deer in the given image, and the predation and brutality expressed by the image of the bear, which confirms the weakness of the semiotic awareness of the authoring teams to eliminate the contradiction in the image.
As for the image of a child eating healthy food, it shows that children should pay attention to eating healthy food in light of the spread of unhealthy food

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

among children and excessive obesity. Nonetheless, this requires concentration on targeted healthy messages, and it is calculated by the authoring team despite the modest reference to the healthy pattern compared to the size of the problem of obesity and unhealthy food.

Results of the Third Question and their Discussion: What is the semiotics of images in the book titled "Our Arabic Language" for the third grade in Jordan using Artificial Intelligence (AI)?

To identify the semiotics of images in the Arabic Language textbook for the third grade in Jordan, AI was used through Chat GPT program. The images were analyzed to identify the main themes and elements in them. Thereafter, every theme is inserted separately into the Chat GPT program by addressing the theme through a question on the semiotic of the images including the following elements in Arabic language textbook for the third grade, and receiving answers through Chat GPT program. Thus, the analysis revealed the following results:

1. Characters in the Images

A- According to Sex:

The number of the characters in the images was 64: the number of males is 40 with a percentage of 62.5%, and the number of females is 24 with a percentage of 37.5%. Here, the results of the analysis results show the following:

- Male characters occupy more presence in the images, as this representation may be important in reinforcing the positive image for males and the male modes in the society.
- Female characters are considered an important part of the book images, and these images may be an expression of the feminist representation, involving students in stories and experiments of females and reinforcing gender equality.
- Gender Balance: Although of the male characters superiority in the images, the presence of female characters with a percentage of 37.5% indicates that there is some gender balance in the representation. Thus, this could serve as an attempt to encourage students to think about the various gender models, and reinforce gender equality.
- Symbolism and Influence: Characters in the images have certain symbolism that may affect students, encourage them to develop the social skills, and reinforce social awareness and interaction between the genders.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

B- Images including Males and Females

The number of males is 31 and that of female is 23. The analysis results showed the following:

- Balanced Gender Representation: Presence of 31 males and 23 females indicates that there is some gender balance in the images, and this may aim to reinforce gender awareness, encourage students to think about the various gender models, and reinforce gender equality.
- Multiple Stories and Experiences: The presence of males and females in the images reflects diversity of characters and stories that students could identify, and the images can be designed to encourage students to develop the capacities of cooperation and interaction between genders.
- Educational Messages: The presence of males and females in the images may be to explain certain concepts or reinforce understanding and communication in the various educational subjects. The various characters can be used to show the individual and cultural differences and to reinforce the acceptance of diversity.
- Positive Representation: The positive representation of males and females in the images can be a part of efforts to reinforce the positive image of both sexes, and encourage students to develop the social and cooperative skills between both sexes.

C- T he images including only males were 9, and the images including only females were 1. The analysis results showed the following:

- -Unbalanced Sexual Representation: There are clear differences in the sexual representation in the images, as 9 images including males only and one image including one female may reflect unbalanced distribution of the male and female characters in the textbook.
- Messages of Sexual Diversity: The single image, including one female, may symbolize the weakness of concentration on the woman's role, and also the weakness of reinforcing the power and importance of females in the society.
- Educational Pattern: The use of various images may explain different concepts or reinforce interaction between both sexes in the educational context. The individual male and female images may have certain educational messages related to topics studied in the textbook.

1. Functional Roles

A. This comprises a total of 19 students: 12 of them are males students with a percentage of 63%, while 7 were female students with a percentage of 37%. The analysis results showed the following:

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

- Representation of both Sexes in the Students' Role: The presence of male and female students in the images reflects diversity of educated students, and it reinforces the balanced presence of both sexes in the students' role. The image may symbolize the power and importance of both sexes in the collective work and learning.
- Reinforcement of Recognition of Diversity: The presence of male and female students in the images can encourage students to recognize diversity and accept differences between the sexes, and the pictures can reinforce the message of cooperation and positive interaction among students regardless of their gender.
- Reinforcement of Positive Models: The representation of students of both sexes may reinforce the positive models and ideal directions in learning, and images may be employed to reinforce values of cooperation and equality, and self- confidence among students.
- Balance of both Sexes and Inclusivity: The presence of a balanced percentage of males and females in the images may contribute to reinforcing equality between both sexes. It would also encourage inclusivity and effective communication in the learning environment.

B. A sailor (Prince of the seas) standing on the ship and looking at the sea. The analysis showed the following:

- A sailor (Prince of the seas) represents a symbol of the leader or important character in the sea and it may symbolize courage, adventure, power, wisdom, and exploration.
- Determination and ability to face challenges. Thus, it may symbolize new opportunities and unlimited possibilities.
- The sea symbolizes ambiguity, depth, and freedom. It may also represent challenges and difficulties that should be overcome, and it may also serve as a symbol of life, refreshment or calm, and tranquility depending on the nature of the sea in the image.

C. The sailor assistant standing on the mast and looking into the telescope. The analysis results showed the following:

- The Sailor Assistant: He is considered a symbol for assistance and support, and he may symbolize collective work and cooperation. Thus, this may reflect the need for assistant tools to achieve the goals.
- The Telescope: It is considered a symbol for vision, research, and exploration. It symbolizes the ability to see things, challenges, and opportunities clearly from afar.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

E. A doctor behind him and an image including a heart and medical symbols.

- The Doctor: He represents a symbol for health care and medical experience, and he symbolizes science, specialization, and medical skill. He also represents taking care of peoples' health and his desire in helping and treating people.
- The Heart: It is considered a universal symbol for love, emotions, and life. In the context of the image, the heart may represent good healthcare or diseases and heart problems treated by the doctor.
- The Images related to Medicine: They may include images of medical tools such as stethoscopes or medical devices such as blood pressure or x-rays. Therefore, these images may symbolize treatment, diagnosis, and medical monitoring.

F. A teacher in the classroom standing in front of male and female students and explaining.

- The Teacher: She represents authority, knowledge, and educational guidance. She is a symbol for education, counseling, and experience. She depicts the significant role the teacher plays in conveying knowledge and directing students in the learning process.
- Male and Female Students: They represent a symbol for education, intellectual, and social development. Their presence reflects vitality and dynamism in the classroom, and they represent diversity, interaction among students, and cooperation during work.
- Classroom: It symbolizes the formal education environment and study communication. It reflects the required organization and quietness for the learning process. Meeting in the classroom represents the collective work and interaction between the teacher and students in the context of education.
- Explanation: It represents conveying knowledge, explanation, and clarification. It may symbolize the cognitive communication and interaction between the teacher and students. Explanation reinforces understanding, active learning, and exchange of knowledge in the classroom.

1. Social Roles

A. There are a total of 7 parents, comprising 4 fathers (57%) and 3 mothers (43%). Among the fathers, one is seen holding his son's hand while standing behind him, another is standing in front of his daughter, one father is engaged in reading to his daughter, and another father is searching for information on a tablet. Among the mothers, one is observed searching for information on a mobile device, another is celebrating her daughter's birthday, and a third

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

mother is playing a significant role in taking care of her family in the absence of the father due to illness.

- Family Ties: It is clear that the images show the presence of the parents, and this reflects the importance of family ties and love relationship between the parents and their children.
- The Role of the Father in the Family: There are images of fathers holding the hands of their sons and reading for them. This reflects the major role that the parents play in communication and in educating and teaching the children.
- The Role of the Mother in the Family: There are images of mothers reading, searching for information on a mobile, celebrating their daughters' birthdays or performing a great role in taking care of the family in absence of the father because he is ill. Therefore, this reflects the mother's role in providing care, emotional support, and in contributing in the children's growth.
- Balance between Work and Recreation: The image of a father searching for information on a tab and a mother searching for information on a mobile phone may reflect the importance of balance between work and recreation.

B. There are 12 children in total, comprising 7 boys (58%) and 5 girls (42%). Among the sons, one is seen standing in the street with his father, two are engaged in reading and searching for information in a book, and two boys are celebrating. Additionally, one son is assisting his mother in carrying a plate of food. Among the daughters, one is observed searching for information in a book, two are celebrating, and one is helping her mother with a plate of food.

- Family Communication: It is clear from the images the presence of fathers and sons, as this reflects the importance of family communication and interaction and reinforcement of family ties.
- Education and Searching for Information: There are images of children reading and searching for information in the book, and this reflects the importance of learning among children and encouraging them to explore knowledge.
- Participation and Cooperation: A son is seen assisting his mother carry a plate of food, while a daughter also helps her mother with a plate of food. This reflects the importance of cooperation and participation in daily tasks within the family.
- Family Celebrations: There are images of male sons celebrating and a daughter celebrating her birthday. These images can reflect the importance of family celebrations and reinforcement of joy and positive communication among family members.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

C. There are two aunts depicted: one engaged in volunteer work, and another is using a smart application to communicate with her niece on her birthday:

- The Volunteer Aunt: She represents a symbol of giving and pay attention to others, and her interaction in volunteer works symbolizes her desire to serve the society, contribute in improving others conditions, and help others. This, however, may reflect the social values and good spirit.
- The Aunt and the Smart Communication Application: It reflects the use of technology for emotional connection and special celebrations. Using a smart app can symbolize innovation and easy communication at the family level. It reflects the aunt's interest in her niece and her desire to share joy and create family ties.
- Birthday: It symbolizes a happy and festive occasion; it can reflect joy, love, and family communication; and it may symbolize care and attention for family members and respect for family ties.

1. Talents and Activities

A. There are a total of 12 athletes, consisting of 10 males (83%) and 2 females (17%). Among them are 3 basketball players, 2 children playing football, a child on a scooter, a child playing with a rope, a child playing with a hoop, and 2 children jogging.

- Gender Diversity: The presence of 10 male athletes out of 12 indicates gender diversity in the group.
- Diversity in Sports Activities: There is a variety of sports activities in the image, such as basketball, football, scooter riding, rope game, loop game, and jogging. These activities reinforce the importance of diversity and encourage children to practice different forms of physical activity.
- Sportsmanship and Team Play: It is clear from the image that there are basketball and football players, and this can reflect the importance of sportsmanship and team play in developing social skills and team play among children.
- Recreational Activities: The presence of children playing with scooters, ropes, and loops indicates that the textbook may concentrate on reinforcing recreational activities, developing movement, and coordination skills among children.

B. Children drawing, including two girls drawing (50%) and two boys drawing (50%)

- Children: They represent a symbol of innocence, creativity, and intellectual growth. Seeing children in the textbook reflects the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

importance of developing their artistic and creative skills. It may express the value of collective work and cooperation in the classrooms.

- Drawing: It symbolizes the artistic and creative expression of children. It can express their artistic and imaginary abilities and creative thinking. Drawing reinforces developing the accurate motor skills, and the ability to express thoughts and feelings.
- A Girl drawing (50%) and a Boy drawing (50%): This distribution may be equal to activity between both sexes to reinforce everyone's capacities for artistic expression. The equal distribution reflects the equivalent between boys and girls in art and creativity.

C. **Practitioners of Volunteer Work**: Three children including two boys (67%) and a girl (33%) doing volunteer works.

- Practitioners of Volunteer Work: They represent a symbol of giving, sacrifice and contribution to society, pay attention to others and the desire to help and serve them. They may reflect values such as cooperation, solidarity, and initiative.
- Children: They represent innocence, hope, and the generation to come. The presence of two children indicates that volunteer works include all age categories, and it encourages young people to participate in charitable work. Also, they may serve as a source of inspiration and reinforcement of social communication and positive spirit.
- Percentage: The use of the percentage (67% and 33%) helps in directing attention to the details of volunteer work and the distribution of participation among different groups. This symbolic use may have an educational influence, which encourages stimulating social participation and reinforces awareness of the importance of volunteer work.

Other Categories

A. A child eating healthy food

- A Child: This is a symbol of children, growth and development, and it may symbolize health, activity, and vitality. It may also be a symbol of healthcare and encouraging children to eat healthy food and living a healthy lifestyle.
- Healthy Food: It symbolizes food that is useful and nourishing to the body. It represents proper nutrition and healthcare. The image helps to reinforce the awareness of the importance of healthy foods and eating them regularly.
- Textbook: It reflects the educational and cultural context. It can symbolize providing knowledge, information, and teaching children

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

about healthy nutrition. It reflects interest in learning and developing healthy skills.

B. A girl sleeping in her room and dreaming that she is playing with a deer and a bear

- The Imaginary World and Dreams: Indeed, capturing an image of a girl sleeping and dreaming about playing with a deer and a bear often symbolizes the imaginative world that children can access. This represents the children's ability to get out of reality and create stories and adventures in their dreams. This picture can motivate imagination and creativity among children and encourage them to explore new worlds.
- Nature and Wildlife: The presence of a deer and a bear in dream may symbolize the child's desire to communicate with nature and wildlife. The image may reinforce the environmental awareness, encourage children to protect the wildlife, and keep the biological diversity.
- Happiness and Joy: The image may symbolize the girl's feeling of happiness and joy during her dream of playing with animals. This image reflects the positive and entertaining aspects of the learning experience, encouraging children to enjoy their task.
- Social Interaction and Participation: The image may symbolize the value of social interaction and joint playing among children, and how they enjoy their time together. The image may reinforce cooperation spirit and social interaction in the education environment.

Conclusion

Based on the semiotic analysis of the images in the book titled "Our Arabic Language" for the third grade in Jordan using HI and AI, the following conclusions were drawn:

1. Characters in the Images

HI: It revealed a clear male superiority confirmed by the excessive quotation of male images at the expense of females, and this is confirmed by the images including only males or females. In images featuring both males and females, efforts were made to minimize numerical disparities and ensure equitable representation. This direction could depend on the subjectivity of the painter rather than being governed by specific subjective controls.

AI: The male characters occupy more presence in the images, and this reinforces the positive image of males and male modes in the society. It also reinforces unbalanced sexual representation. The images, including males and females together, indicate a balance in sexual representation, which may reinforce sexual awareness.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Both human semiotic analysis and artificial analysis exhibit similarities, yet human analysis incorporates observations related to the painter of the images in the textbook.

2. Functional Roles

HI: The analysis revealed the superiority of male role and its centrality, importance, and dominance on the female role through the multiple of functional roles of males. Thus, this limits the female role of a student or a teacher.

AI: The focus lies on diversity by featuring both male and female students. However, regarding other functional roles, each role is addressed individually, detached from the context of the images as a whole. For instance, the sailor is symbolized as representing leadership, adventure, and power, while the sailor's assistant embodies help and support. Similarly, the doctor symbolizes healthcare, and the teacher represents knowledge and guidance.

It is noted from the human semiotic analysis that there is a tie between the functional roles and gender. While human analysis aimed at connecting these symbols to societal views, artificial intelligence addressed each image individually, interpreting them as expressing specific symbols, regardless of the number of individuals occupying functional roles or their gender.

3. Social Roles

HI: The father's image indicates semantic emotions between the father and brother, which is a more closed relationship in his dealing with the daughter while searching for information using technology. As for the mother, her role was limited to following up using the mobile phone and celebrating her children's birthdays. Her role is limited to care in the absence of the father, and this indicates the marginalization of the mother's role.

The images of the children show a son helping his mother to carry a plate of food, which may indicate getting out of the familiar role and participating in the roles limited to females. This may motivate students to share the mother's role in housework, while the focus on the two aunts reinforces bonding with relatives on the mother's side and ignores relatives on the mother's side.

AI: The images reveal family ties and show the role of father in upbringing and the role of mother in terms of care and emotional support. They point to children as a symbol for family communication, education, participation, cooperation, and family celebrations. On the other hand, the two aunts symbolize giving, paying attention to others, joy, love, and family communication.

It is noted that human intelligence is focused on linking the images to the social context of the Jordanian society in terms of caring for males more than females. This, therefore, reveals new roles for males and is focused on social relationships on the mother's side, while Artificial Intelligence dealt

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

with every image separately from the rest of the images without linking them to the nature of the Jordanian society.

4. Talents and Activities

HI: The images used in the textbook related to various sports confirmed the dominance of mental assumptions and are unsupported with scientific evidence but with a cultural and social one. This suggests a portrayal of women's weakness and a lack of trust in their abilities, influencing the distribution of sports roles. Difficult sports roles were predominantly limited to males, while easier sports roles were confined to females. Additionally, a male bias is evident in volunteer work, as the participation of females has doubled compared to males in volunteer activities.

AI: It pointed to the gender diversity in practicing various sports, various activities, sport spirit, collective games, and practicing volunteer works symbolizing the giving, sacrifice, and participation in community service. On the other hand, drawing symbolizes innocent and creativity.

It is noted that artificial intelligence dealt with the images separately without linking them to the social context of the Jordanian society.

5. Other Categories

HI: The image of the dreaming child has a semiotic contradiction in the semantics of the image. Thus, the deer indicates gentleness and beauty, while the bear indicates predation and brutality. A child consuming healthy food sends a positive message about prioritizing nutritious eating habits, especially in light of the prevalence of unhealthy food among children.

AI: The image of the dreaming girl indicates the world of imagination, dreams, nature, wildlife, and protection of wildlife. It symbolizes happiness, joy and social interaction, while the child eating healthy food indicates growth, development, health, activity, and importance of nutrition to the body.

Human Intelligence is focused on contradiction in the first image between gentleness and predation. In the second image, the focus was on messages to children about healthy food in light of the spread of unhealthy nutrition habits. As for Artificial Intelligence, it dealt with the first image without linking it to contradiction between gentleness and predation, while the second image is linked to body growth.

6. Analysis using HI: It adopted a comprehensive method linking the images together, and it linked the images with the social context of the Jordanian society.

7. Analysis using AI: It dealt with every image separately from the rest of the images. It also adopted a detailed method to every image including the analysis sub-elements such as sexual balance, sexual representation, positive representation, educational pattern, family ties and the imaginary world, etc.

8. The semiotic analysis employing Artificial Intelligence (AI) can serve as a valuable support and monitoring tool for Human Intelligence (HI) in

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

interpreting images. The analysis using AI might offer directions or insights that could influence the human analysis.

Recommendations

- The need for curriculum authors and images painters to depend on a matrix including certain criteria of the images that go with the strategic directions of education and public and private outputs of the curriculum.
- Setting a public framework to the images ensures sexual balance, cultural diversity and reinforcing positive values in the society, and getting rid of negative values.
- Utilizing Artificial Intelligence (AI) alongside Human Intelligence (HI) in analyzing textbook images ensures a balanced approach. This allows for the analysis of images within their social context and facilitates linking images together for a comprehensive understanding.
- Conducting more scientific studies to analyze images using AI to increase the accuracy of this analysis in the context of the various societies.

Conflict of Interest: The author reported no conflict of interest.

Data Availability: All of the data are included in the content of the paper.

Funding Statement: The author did not obtain any funding for this research.

Human Studies: This research included content analysis of the book "Our Arabic Language" for the Third Grade in Jordan, which is prescribed by the Ministry of Education for teaching in its schools and published on its website. This research did not include application to humans.

References:

1. Azaroff, S. & Mayer, G. (1977). *Applying Behavior Analysis Procedures with Children and Youth*. New York: Holt, Rinehart, and Winston, Inc.,
2. Bani Omar, K. (2018). Gender in “Our Arabic Language” Books for the First Three Grades in Jordan, *European Scientific Journal*, Vol.14, No.11 ISSN: 1857 – 7881 ,(DOI: https://doi.org/10.19044/esj.2018.v14n11p59
3. Bin El Din, B. (2018). Image Semiotics and Understanding the Written in the Educational Process, *educational*, Volume 5, Issue 14, 10-15. https://www.asjp.cerist.dz/en/downArticle/184/8/2/50902

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

4. Bowman, E. (2022). A new AI chatbot might do your homework for you. But it's still not an A+ student, https://www.npr.org/2022/12/19/1143912956/chatgpt-ai-chatbot-homework-academia
5. Kababsa, H. (2018). *The Semiology of the Image in the Textbook; Semantics and communication, the Arabic language book for the fourth year of primary school as a model*, an unpublished master's thesis, University of May 8, 1945, Guelma, Algeria.https://dspace.univguelma.dz/xmlui/bitstream/handle/123456789/6570/M813.420.pdf?sequence=1&isAllowed=y
6. Kılıç, V. & Sarıkartal, Z. (2016). What Do Images Mean in Visual Semiotics? *Aydın Sanat*, Yıl , 2 Sayı 3 (1 -13). https://dergipark.org.tr/tr/download/article-file/357993.
7. Jam, S., Khiabani, S. & Hejazi, M. (2021). Discourse Representation in the Images of English Textbooks "Prospects" and "Visions": A semiotic, *Language Related Research*, Vol. 11, No. 6, Tome 60, pp. 419-448, https://lrr.modares.ac.ir/article-14-29439-en.pdf. Analysis: The Case Study of Ethnicity and Place
8. Mijwil, M. (2023). Chat GPT: The Future of Artificial Intelligence in the Scientific Research, DOI:10.13140/RG.2.2.32002.76484
9. Ministry of Education (2022). *Our Arabic language, student's brochure,* for the third grade, Part One.
10. Ministry of Education (2022). *Our Arabic language, student's brochure,* for the third grade, Part Two.
11. Nielsen, L. (2016). Artificial Intelligence vs. Human Intelligence/ Man vs. Machine, discussion paper on Artificial Intelligence, Human Intelligence and the rapid transformation of digitalization and datafication that our current society is goingthrough,file:///C:/Users/Admin/Downloads/ArtificialIntelligencevs.HumanIntelligenceManvs.Machine2016%20(2).pdf
12. Saed, S. & Sabti, O. (2011). *The press photo, a semiological study*, Cairo: Al-Maktab, Al-Jama'i Al-Hadith.
13. Saldana, J. (2021). *The Coding Manual for Qualitative Researchers*. Thousand Oaks, CA: SAGE Publications Limited.
14. Sovič, A. & Hus, V. (2016). Semiotic Analysis of the Textbooks for Young Learners, *Creative Education*, Vol.7 No.4, 639- 645, DOI: 10.4236/ce.2016.74066
15. Suleiman, I. (2014). Introduction to the concept of image semiotics, University Journal, 16 (2), https://www.academia.edu/38963071

ESJ Humanities Peer-reviewed

Black Women Educators' Activism: The Evolution of a Black Feminist Pedagogy

Dr. Yvette Pierre
Associate Professor, Education Graduate Programs
Delaware State University, DE, USA

Doi:10.19044/esj.2023.v19n32p181

Submitted: 21 September 2022
Accepted: 26 November 2023
Published: 30 November 2023

Cite As:
Pierre Y. (2023). *Black Women Educators' Activism: The Evolution of a Black Feminist Pedagogy*. European Scientific Journal, ESJ, 19 (32), 81.
https://doi.org/10.19044/esj.2023.v19n32p181

Abstract

Exploring the historical narrative of activism among black American women offers valuable insights into their significant role in advocating for equal and high-quality educational opportunities within their community. It unveils their cultural and political acumen, attitudes, and dedication, which they extend into the realm of teaching. Their moral philosophies and sense of purpose have been instrumental in the creation of a black feminist pedagogy that has evolved within the frame of black women's resistance to oppression and the ensuing battle for collective survival and institutional change (Collins, 1990).

Keywords: Activism, Black women, African American women, Black Feminist, Pedagogy

Introduction

This paper provides a glimpse into literature that sheds light on the activism of black women in the field of education. The review encapsulates three key aspects: (1) A historical journey into the activism of African American women, (2) An exploration of contemporary issues and studies pertaining to black women activists in the teaching profession, and (3) The development of black feminist pedagogy. Collectively, these elements illustrate the dual dimensions of black women's activism, encompassing the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

fight for group survival and the quest for institutional transformation (Collins, 2000).

Defining Black Women's Activism

Activism is generally interpreted as the doctrine or practice of taking vigorous action or becoming involved to achieve political or other objectives, often through demonstrations or protests (Costello, 1991). Nevertheless, when viewed through the prism of black women educators' experiences and historical legacies, activism assumes a much more profound meaning rooted in their history. Thus, it represents a complex interplay of various forms of oppression faced by black women and their intersecting oppressions. Collins (2000) suggests a model to analyze black women's activism encompassing two aspects: (1) struggles for group survival, and (2) struggles for institutional transformation. This model captures the multifaceted nature of black women's activism in the face of multiple oppressions and dominance structures. Numerous studies on the history of black women teacher activism reflect the significant role these educators played in uplifting their race through promoting education and accomplishment within their schools and communities (Beauboeuf-LaFontant, 1999; Hooks, 1994; Giddings, 1984; Ladson-Billings, 1994).

Historical Overview of African American Women's Activism

Gordon (1995) points out that history abounds with both known and unknown tales of African American women who have devoted their lives to uplift African American people. In various scholarly works by African American women (e.g., Giddings, 1984; Washington, 1987; Lerner, 1973; Carby, 1987), it is evident that these women have waged battles to define themselves and their communities against the cultural hegemonic image and status established by the horrors of slavery, proving to be important contributors to American society.

During slavery, African women organized resistance against legal sexual exploitation. They participated in rebellions, acts of sabotage, escapes, and used birth control methods and self-induced abortions to avoid bringing children into the abhorrent world of slavery (Gordon, 1995, p. 63; Davis, 1983, p. 205; Washington, 1987; Giddings, 1984). In addition, free black women tirelessly supported the anti-slavery movement through fundraising activities, lectures, and writing newspaper articles. They understood the correlation between their feminism and racial progress (Giddings, 1984; Yee, 1995).

Zinn (1980) documents their pivotal involvement in the Civil War, highlighting the significant contributions of black women. This includes renowned figures like Sojourner Truth and Harriet Tubman, alongside lesser-

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

known individuals such as Josephine St. Pierre Ruffin and Susie King Taylor, who made substantial impacts during the war.

Organized Black Women's Activism

Racial oppression catalyzed the emergence of black women's organizations. Notable activists and leaders like Ida B. Wells-Barnett, Josephine St. Pierre Ruffin, and Mary Church Terrell were instrumental in setting up the black women's club movement. Their leadership arose from their experiences with societal racism rather than from the masses of working women, thus differentiating them from white club leaders (Davis, 1983).

Prompted by racist attacks on Ida B. Wells-Barnett, the first significant meeting independently organized by African American women took place. When her newspaper offices in Memphis, Tennessee were destroyed, she relocated to New York, where she continued publishing her experiences. This incident inspired prominent women in New York's African American community to organize a rally in her support, which led to the formation of the first women's club exclusively created and led by black women. A few years later, the National Association of Colored Women (NACW) was established under Mary Church Terrell's leadership, uniting the various black women's clubs that had formed by then (Davis, 1983).

However, the achievements of many black women activists remained undocumented. Collins (2000) affirms, "Without the efforts of countless black women to ensure group survival, struggles to transform U.S. educational, economic, and political institutions could not have been sustained."

Early Struggles for Black Education

The Black Women's Club movement echoed the objectives of black women activists who believed that educating black people was crucial for racial upliftment. Women like Charlotte Forten Grimke (1873-1914), Craft Laney (1854-1933), Frances (Fannie) Jackson Coppin (1837-1913), Anna Julia Cooper (1858-1964), Charlotte Hawkins Brown (1882-1961), and Mary McCloud Bethune (1875-1955) were primarily dedicated to the education of the black community and actively participated in the club movement and the struggle for suffrage (Gordon, 1995).

However, these women often found themselves marginalized during crucial discussions and debates concerning black education. A significant debate between Booker T. Washington and W.E.B. DuBois during the late nineteenth and early twentieth centuries encapsulated this. Although they sought the advancement of the black race through education, Washington favored a gradual path that included industrial education, while DuBois advocated the pursuit of the highest academic levels. Despite this tension, many black women leaders showed their independence by expressing the need

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

for both industrial education and the highest possible academic levels (Guiddings, 1984).

Mary McLeod Bethune, an educator and civil rights activist, was a prominent voice in the NACW. She saw the clubwomen as pioneers of social reform (Cash, 2001). Bethune acknowledged the centrality of the civil rights struggle to American democracy and the world. Her efforts helped pave the way to the Civil Rights Era (1954-1964) by motivating African descent people to leverage the political system and participate in freedom-fighting organizations (Smith, 2001).

During the Civil Rights Movement, numerous black women educators strove to continue Bethune's vision of black empowerment and equality by mobilizing working-class blacks at the grassroots level. Septima Poinsette Clark, an activist, organizer, and educator, is a prime example. She taught in Charleston and segregated black schools on the Sea Islands in South Carolina. She also participated in legal campaigns to equalize salaries for black and white teachers. After attending workshops at the Highlander Folk School in Monteagle, Tennessee, she began to develop adult education programs to achieve "Literacy and Liberation." Clark established "Citizen Schools" to prepare black southerners for voter registration. When Tennessee officials closed the Highlander Folk School in the early 1960s, the Citizenship School program was adopted by the Southern Christian Leadership Conference (SCLC), and Clark became its director (Rouse, 2001).

The legacy of black women activists such as Septima Poinsette Clark, who utilized their organizational affiliations to fight for educational equality and social justice, lives on. Today's African American women teachers continue to reflect this sense of mission, thereby showing a collective ethical responsibility and personal commitment to the education and uplift of their communities and race (Beauboeuf-LaFontant, 1999). Their efforts have been chronicled in recent studies that focus on black women teacher activists.

Modern Examination of Activism by Black Women Educators

The volume of research focusing on present-day black women teacher activism is comparatively sparse. However, the existing studies reveal shared activist objectives and common sources of motivation among those who engage in activism. Kathleen Casey's 1993 study titled, "I answer with my life: Life histories of women teachers working for social change," offers invaluable insight. Casey delved into the oral histories of three groups of activist teachers of diverse racial and ethnic backgrounds, which included the narratives of four black women activist educators. She discovered that these women's strength emanated from the black community during their childhoods, and they continue to empower others within the same tradition. Despite working in

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

environments dominated by white racist priorities, these teachers deploy a nuanced, re-interpretative pedagogy.

Foster (1996) illuminates the tendency of black women activists to reject Eurocentric frameworks, interpretations, and viewpoints when conducting research on African American educators. With her research titled, "Like us but not one of us: Reflections on a life history study of African American teachers," she aimed to glean definitions of a "good teacher" from the standpoint of African Americans. The lack of comprehensive research on black teachers' methods and viewpoints provided the impetus for her study. Utilizing a technique she named "community nomination," Foster permitted the black community to suggest names of educators considered as good teachers. Her findings raised some questions when the researcher and respondents belong to the same cultural and linguistic community.

Beauboeuf-LaFontant (1997) study, titled "Politicized mothering among African American women teachers: A qualitative inquiry," draws from the literature on culturally relevant pedagogy and the history of African American education. She explores the life experiences, beliefs, and methods of six black women teachers. Furthermore, she promotes the concept of renaming "culturally relevant teaching" to "politically relevant teaching" to highlight the political, historical, social, and cultural awareness that black women educators contribute to their vocation. She argues that politically relevant educators exhibit "political clarity" and are aware not only of their students' cultural norms, values, and practices but, significantly, of the political realities and aspirations of people of color.

Dillard (2006) champions the concept of adopting a paradigm that places culture and spirit at its core. She introduces the term "'endarkened' feminist epistemology" to express how understanding reality is shaped by the historical roots of black feminist thought, while recognizing the difference in culturally constructed socializations of race, gender, and other identities. She further emphasizes the historical and current contexts of oppression and resistance for African American women. Dillard also underscores the spiritual aspect of African American teachers and researchers' work and posits that recognizing culture and spirit at academia's heart is crucial for those striving for social justice.

In "Let's do this! Black women teachers' politics and pedagogy," Dixson (2003) scrutinizes the political essence of contemporary African American women's pedagogy and its position within the black feminist activist tradition. Her examination of two African American primary school teachers reveals their teaching functions within the black feminist activist tradition. This is indicated by their belief in teaching as a way of life and a public service. It also reflects in their daily political confrontations against racism and their advocacy for quality education for their students. Dixson's

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

study underlines not just the teachers' dedication to their students' success but also how far that commitment extends beyond the classroom and the school.

The Role of Black Feminist Pedagogy

Black feminist pedagogy is the product of black women educators. It evolved from their tradition of activism and proposes learning methods influenced by black women's historical experiences with race, gender, class bias, and the outcomes of marginalization and isolation. It encapsulates four key elements of black feminist thought: dialogue in assessing knowledge claims, personal expressiveness centrality, personal accountability ethic, and concrete experience as a criterion of meaning. The focus and objective of black feminist pedagogy aims to increase students' political awareness by introducing an Afrocentric worldview and centering black women's experiences. Its primary assumption is the active involvement in the fight to conquer the multifaceted oppression they face.

The tenets of black feminist pedagogy have been exercised for centuries, empowering black women as they undertook various activist roles in the pursuit of quality education for black people. The connection between black feminist pedagogy and the pedagogies and models discussed is clear. It provides students, teachers, and institutions with a method for promoting equity, multiple visions, and perspectives. This echoes black women's efforts to be recognized as humans and citizens rather than objects and victims. In conclusion, black feminist pedagogy serves as a pedagogical approach aimed at enhancing students' political awareness. It can be seen as a valuable contribution to multicultural education, culturally relevant teaching, and teaching for social justice. This is attributed to its introduction of a non-western (Afrocentric) worldview and its incorporation of gender and patriarchy as central elements in understanding all historical phenomena.

Conclusion

This article provides a succinct historical summary of the activism of African American women, emphasizing the pivotal roles they have played in propelling a remarkable movement towards educational equity for the entire black race. The brief recounting of African American women's activism is significant as it underscores the active roles that black women played in achieving education for black people and attempts to secure a place for black feminist pedagogy in historical literature.

Conflict of Interest: The author reported no conflict of interest.

Data Availability: All of the data are included in the content of the paper.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Funding Statement: The author did not obtain any funding for this research.

References:

1. Beauboeuf, T. M. (1997). *Politicized mothering among African-American women teachers: A qualitative inquiry* [Doctoral dissertation, Harvard University]. ProQuest Dissertations Publishing. (9734782)
2. Beauboeuf-Lafontant, T. (1999). A movement against and beyond boundaries: "Politically relevant teaching" among African American teachers. *Teachers College Record, 100*(4), 702-723.
3. Casey, K. (1993). *I answer with my life: Life histories of women teachers working for social change*. Routledge.
4. Cash, F. B. (2001). *African American women and social action: The clubwomen and volunteerism from Jim Crow to the new deal, 1896-1936*. Greenwood Press.
5. Collins, P. H. (1990). Black feminist thought in the matrix of domination. In C. Lemert (Ed.), *Social theory: The multicultural and classical readings* (pp. [pages of chapter]). Westview Press.
6. Collins, P. H. (2000). *Black feminist thought: Knowledge, consciousness, and the politics of empowerment*. Routledge.
7. Costello, R. B., et al. (Eds.). (1991). *Webster's college dictionary*. Random House.
8. Davis, A. (1983). *Women, race, and class*. Vintage Books.
9. Dillard, C. (2006). *On spiritual strivings: Transforming an African American woman's academic life*. State University of New York Press.
10. Dixson, A. (2003). "Let's do this!" Black women teachers' politics and pedagogy. *Urban Education, 38*(2), 217-235.
11. Foster, M. (1991). Constancy, connectedness, and constraints in the lives of African American teachers. *National Women's Studies Association Journal, 3*, 233-261.
12. Foster, M. (1996). *Unrelated kin: Race and gender in women's personal narratives*. Routledge.
13. Giddings, P. (1984). *When and where I enter: The impact of black women on race and sex in America*. Bantam Books.
14. Gordon, B. M. (1995). The fringe dwellers: African American women scholars in the postmodern era. In B. Kanpol & P. McLaren (Eds.), *Critical multiculturalism: Uncommon voices in a common struggle*. Bergin & Garvey.
15. Hooks, B. (1994). *Teaching to transgress: Education as the practice of freedom*. Routledge.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

16. Joseph, G. (1995). Black feminist pedagogy and schooling in capitalist white America. In B. Guy-Sheftall (Ed.), *Words of fire* (pp. 462-471). The New Press.
17. Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African American children*. Jossey-Bass Publishers.
18. Omalade, B. (1997). A black feminist pedagogy. *Women's Studies Quarterly, 15*(3/4), 32-39.
19. Palmer, P. J. (1993). *To know as we are known: Education as a spiritual journey*. Harper Collins.
20. Rouse, J. A. (2001). "We seek to know… in order to speak the truth": Nurturing seeds of discontent—Septima Clark and participatory leadership. In B. Collier-Thomas & V. P. Franklin (Eds.), *Sisters in the struggle: African American women in the Civil Rights-Black Power Movement* (pp. 95-120). New York University Press.
21. Walker, V. S. (2005). Organized resistance and black educators' quest for school equality, 1878-1938. *Teachers College Record, 107*(3), 355-388.
22. Zinn, H. (1980). *A people's history of the United States, 1492-present*. Harper Perennial Modern Classics.