
A CRITIQUE OF THREE (3) JOURNAL PUBLICATIONS IN MATHEMATICS EDUCATION

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ABSTRACT

This paper presented a comprehensive critique analysis of three journal publications in mathematics education: Abbas (2000), Olanrewaju (2023), and George and Kakraba (2023). The concept of critique, derived from the Greek word kritike meaning “faculty of judgement,” was explored as a systematic and evidence-based evaluation of scholarly work. The purpose of critique was to assess the credibility, validity, and contribution of research, thereby strengthening academic quality and promoting knowledge advancement. A good critique was characterized by objectivity, analytical reasoning, balance, constructiveness, and logical organization. The elements of an effective critique included an introduction, summary, analysis, interpretation, and conclusion, each designed to facilitate a holistic understanding of a study’s strength and weaknesses. The types of critique are theoretical, methodological, empirical, and practical-offered multiple lenses through which to examine educational research. Applying these frameworks, the study evaluated the methodological rigor, theoretical depth, and pedagogical contributions of the selected journals. Abbas (2000) emphasized cultural pedagogy through ethnomathematics; Olanrewaju (2023) highlighted the role of direct instruction in improving numeracy; and George and Kraraba (2023) examined the impacts video-aided instruction on students’ geometry achievement. Collectively, the analyses revealed that while each study contributed uniquely to mathematics education, they shared limitations in sample size, theoretical grounding, and generalizability. The importance of critique in mathematics education research was underscored by its role as a reflective and developmental tool that enhances methodological soundness, pedagogical innovation, and scholarly discourse. Through constructive critique, educators and researchers could refine teaching practices, strengthen curriculum design, and promote evidence-based decision-making. Ultimately, this paper underscored critique as an indispensable mechanism for improving the quality and impact of mathematics education research in Africa and beyond.

Keywords: Critique, Cultural pedagogy, Direct instruction, and Video-aided instruction, Mathematics Education.

Introduction

Research in mathematics education is the systematic and scholarly inquiry into the teaching, learning, and assessment of mathematics. It encompasses the study of instructional practices, curriculum development, cognitive processes, and the socio-cultural factors that influence mathematical understanding, with the ultimate goal of improving educational outcomes for all learners. Mathematics education research has increasingly focused on strategies to improve students' performance in basic numeracy and advanced topics such as geometry. Approaches range from culturally responsive pedagogy, teacher-centered direct instruction, to the integration of technology. This critique examines three journal articles: Abbas (2000) on ethnomathematics in Nigerian primary schools, Olanrewaju (2023) on direct instruction in numeracy, and George and Kakraba (2023) on video-aided instruction in geometry. The analysis considers each study's strengths, weaknesses, and overall contribution to mathematics education.

What is Critique

The term critique derives from the Greek word *kritikē*, meaning "the faculty of judgment." In scholarly contexts, a critique refers to the systematic evaluation and interpretation of an academic work, with the purpose of determining its validity, significance, and contribution to knowledge. A critique goes beyond mere summary or opinion; it involves objective, evidence-based appraisal of how well the study was designed, implemented, and interpreted. Booth et al., (2008), asserted that critique is "a reasoned analysis of another writer's argument that identifies both strengths and limitations, not merely agreement or disagreement." It is a core element of academic inquiry because it allows scholars to build upon, challenge, or refine existing knowledge. Tod et al. (2022) defined critique as a systematic evaluation of a study's trustworthiness and methodology rigor. Best and Kahn (2006) also defined critique as "an appraisal of the strengths and limitations of a study and the logical and empirical bases on which it is built". Burns and Grove (2005) posited that critique involves a careful and objective appraisal of the strengths and weaknesses of a research report. Creswell (2014) explained that critique is more than criticism; it is a balanced and constructive evaluation that aids in understanding and advancing the research process. Polit and Beck (2012) emphasized that a critique is an objective assessment of a study's strengths and limitations with a view to informing further research or policy decisions.

In the context of research and education, a critique examines a published work (e.g., a journal article) by:

- Identifying its research problem, questions, and objectives
- Evaluating the appropriateness of its methodology
- Analyzing the quality and logic of the arguments or data
- Assessing its contributions to the field
- Pointing out gaps, inconsistencies, or biases
- Offering suggestions for future work.

A critique helps deepen understanding and promotes scholarly dialogue

Purpose of a Critique in Research Article

The purpose of critique is to assess how confident people can be in the findings of set of studies, by identifying methodological strengths and limitation (Tod et al., 2022).

The aim of critique is not to discredit research but to:

1. Evaluate the credibility and rigor of the study
2. Determine how the research problem was framed

3. Assess the research design, methods, and instruments
4. Review the validity and reliability of findings
5. Examine the implications and recommendations
6. Suggest improvements or alternative approaches

In this regard, critique serves as both a quality control mechanism and a knowledge enhancement tool in research.

Key Characteristics of a Good Critique

A good critique is:

1. **Objective** – Based on evidence, not personal opinion.
2. **Analytical** – Goes beyond summarizing to examine deeper meanings and implications.
3. **Balanced** – Recognizes both strengths and weaknesses.
4. **Constructive** – Aims to improve scholarly understanding and practice.
5. **Well-structured** – Follows a logical organization (e.g., introduction, analysis, evaluation, conclusion).

Furthermore, a critique should be explicit, systematic, evidence-based, and transparent about criteria used (Eldredge, 2024). For example; when critiquing a mathematics education journal article, a researcher might assess:

- Whether the teaching method used is appropriate for the topic.
- If the statistical analysis supports the conclusion.
- How well the findings relate to classroom practices.
- Whether the study aligns with curriculum theories or learning theories like constructivism.

Elements of an Effective Critique

A comprehensive critique includes the components presented in Table 1.

Table 1: Components of a critique

Element	Description
Introduction	Identifies the article title, author, publication source, and purpose of the critique.
Summary	Provides a brief overview of the research, including its aims, questions, and findings.
Analysis	Evaluates methodology, theoretical framework, data analysis, and validity of conclusions.
Interpretation	Discusses implications, significance, and contribution to the field.
Conclusion	Highlights the overall judgment, offering balanced praise and criticism, and suggests improvements.

Types of Critiques

(Gough et al., 2017), identifies the following types of critique;

- **Theoretical Critique:** Evaluates the use of theories and frameworks.
- **Methodological Critique:** Focuses on research design, sampling, and data analysis.

- **Empirical Critique:** Reviews findings, reliability, and generalizability.
- **Practical Critique:** Assesses the usefulness and applicability of the study.

Importance of Critique in Mathematics Education Research

In mathematics education, critique is essential for:

1. Advancing pedagogical theories.
2. Improving instructional practices.
3. Ensuring methodological soundness.
4. Promoting reflective teaching and learning.
5. Guiding policy and curriculum development.

In addition, Schoenfeld (2016) opined that critique supports methodological robustness and helps translate findings into meaningful educational practice. Jaworski (2006) noted, that critique enables researchers to move beyond surface features of teaching to underlying complexities of learning and instruction in mathematics.”

CRITIQUE ANALYSIS OF THE THREE SELECTED JOURNAL ARTICLES

Article 1: Abbas (2000): Ethnomathematics and Teaching of Mathematics in Primary Schools

Abbas(2000) argued that the integration of ethnomathematics—mathematical practices rooted in cultural contexts—enhances pupils’ learning of geometric concepts in Nigerian primary schools. Using Hausa cultural artefacts such as tabarma (mat) and gida mai kusurwa (rectangular house), the study demonstrated that pupils taught with ethnomathematical examples performed significantly better than those taught conventionally.

Strengths: The study provided a clear conceptual framework, empirical evidence of improved performance, and the notable finding that girls outperformed boys when taught with ethnomathematics. This suggests its potential for reducing gender disparities in mathematics learning.

Weaknesses: The study’s sample size (70 pupils in one school) limited generalizability, while statistical reporting is minimal, lacking effect sizes or detailed variance analysis. Reliance on older literature without recent theoretical perspectives weakens its currency. There was also a tendency to overemphasize cultural practices without acknowledging possible mathematical limitations.

Critique on each sub-heading are as follows;

1. Introduction and Relevance

Abbas (2000) situated the teaching of mathematics within the cultural realities of Nigerian children. He emphasizes that overreliance on Eurocentric mathematical models alienates learners, resulting in poor achievement. By framing mathematics as an aspect of culture, the study advocated for **ethnomathematics** as a bridge between learners lived experiences and formal mathematics. This is a timely and relevant argument, especially in multicultural societies like Nigeria.

Strength: The paper highlights the disconnect between school mathematics and cultural practices, offering a practical pedagogical solution.

Weakness: The introduction relies heavily on older literature (Gerdes, 1988; Bishop, 1994; D’Ambrosio, 1995), with limited engagement with contemporary or local empirical studies.

2. Conceptual Framework

The paper defines ethnomathematics as mathematical practices embedded in cultural groups, arguing that such practices should form a foundation for formal teaching. Examples include Hausa mats (tabarma) for teaching rectangles/cylinders and round huts (daki mai da'ira) for teaching circles.

Strength: Provided concrete, culturally relevant teaching tools that can make abstract concepts tangible.

Weakness: The conceptual discussion was descriptive but lacks deeper theoretical grounding (e.g., socio-cultural theory, constructivism, or Vygotsky's mediated learning framework).

3. Methodology

- **Design:** Quasi-experimental (control vs experimental groups).
- **Sample:** 70 pupils (35 per group) from Riruwai Primary School, Kano.
- **Procedure:** The control group was taught with conventional methods; the experimental group was exposed to ethnomathematical models before the curriculum content.
- **Analysis:** Independent t-test, significance at $p < 0.05$.

Strengths:

- Clear experimental design with treatment and control groups.
- Random assignment improved internal validity.
- Use of everyday objects ensured ecological validity.

Weaknesses:

- Limited to one school in Kano State; results lack generalizability.
- Small sample size ($N = 70$) reduces statistical power.
- Reliability and validity of the achievement test not reported.
- Overemphasis on quantitative outcomes, with little qualitative insight into learners' perceptions.

4. Findings and Discussion

- Pupils in the experimental group significantly outperformed those in the control group.
- Girls in the experimental group outperformed boys in the control group, suggesting ethnomathematics can reduce gender gaps in mathematics.

Strengths:

- Empirical evidence on the relevance of ethnomathematics in Nigerian classrooms.
- The novel finding on **gender equity** is particularly significant.

Weaknesses:

- The discussion generalizes findings without exploring alternative explanations.

- Gender-related findings are not explored in depth (e.g., whether cultural familiarity boosted girls' confidence).
- The study did not consider long-term retention or transfer of learning.

5. Implications

The author recommended:

- Incorporating ethnomathematics into teacher training;
- Official policy adoption by Nigerian government; and
- Reducing reliance on foreign textbooks.

Strengths: Practical recommendations that align with local realities.

Weaknesses: Recommendations were ambitious but lacked a structured implementation plan (e.g., curriculum integration strategies, teacher capacity-building models).

6. Conclusion

The article provided compelling evidence that **ethnomathematics improves understanding and inclusivity in primary mathematics**. However, limitations in scope, theoretical framing, and methodological rigor restricted the generalizability of findings. It remains a pioneering contribution to mathematics education in Nigeria, but future research should use larger samples, mixed methods, and stronger theoretical lenses.

Overall Evaluation:

- **Contribution:** High (introduces cultural pedagogy into Nigerian classrooms).
- **Methodological Strength:** Moderate.
- **Theoretical Depth:** Weak.
- **Practical Implication:** Strong but underdeveloped.

Hence, the study made a strong case to mathematics education by contextualizing mathematics through culture, but future research should expand its scope and strengthen statistical rigor.

Article 2: Olanrewaju (2023): Effectiveness of Direct Instruction on Pupils' Academic Performance in Numeracy

Olanrewaju (2023) investigated the role of direct instruction in improving numeracy among primary school pupils in Ilorin West, Kwara State. Employing a quasi-experimental $2 \times 2 \times 2$ factorial design, the study analyzed the effects of treatment, gender, and school type on academic performance using ANCOVA. Results revealed that direct instruction significantly improved performance, but gender and school type had no significant effects.

Strengths: The study's robust design, structured hypotheses, and high instrument reliability (0.81) enhanced credibility. It also addressed a pressing national issue, as poor numeracy performance continued to be reported in WAEC chief examiners' reports.

Weaknesses: The introduction inadequately explained why direct instruction should work better than other strategies. The sample is relatively small (four schools), restricting broader applicability. While statistical findings are presented, the discussion is underdeveloped and

failed to engage with broader pedagogical debates such as constructivist alternatives.

Critique on each sub-heading are as follows;

1. Title and Abstract

Strengths:

The title is concise and clearly communicated the focus of the study — the use of direct instruction in numeracy and its effect on pupils' performance. The abstract provided a quick overview of the research problem, methodology, findings, and recommendations.

Weaknesses:

The abstract lacked sufficient detail on the *statistical results* beyond stating significance levels. There was no mention of the sample demographics (e.g., gender distribution, school characteristics) or effect sizes, which are important for understanding the magnitude of the findings.

2. Introduction

Strengths:

The introduction highlighted the persistent issue of poor academic performance in numeracy and linked it to ineffective teaching methods, citing relevant literature (Adunola, 2011; WAEC, 2017). It also identified the research gap by noting that direct instruction has been less explored compared to other strategies.

Weaknesses:

The section is somewhat repetitive, especially in discussing poor performance statistics. Some references (e.g., Wikipedia, 2010) were not credible scholarly sources for academic research and should be replaced with peer-reviewed journal articles or reputable reports.

3. Statement of the Problem

Strengths:

The statement of the problem is clearly linked to the national concern over numeracy achievement and the need for effective teaching strategies.

Weaknesses:

The problem statement could be strengthened by including more *quantitative evidence*, such as specific performance statistics over multiple years, to justify the urgency of the study.

4. Research Questions and Hypotheses

Strengths:

The study presented seven clearly stated null hypotheses covering both main and interaction effects of treatment, gender, and school type.

Weaknesses:

The hypotheses could be rephrased for clarity and conciseness. Additionally, while the factorial design justifies multiple hypotheses, the paper does not provide a theoretical framework explicitly linking these variables.

5. Methodology

Strengths:

The use of a quasi-experimental factorial ($2 \times 2 \times 2$) design is appropriate for testing the stated hypotheses. The description of the sampling process and instrument validation is clear.

Weaknesses:

The paper does not provide sufficient detail on the lesson content, duration, or structure of the direct instruction used, which limits replicability. The sample size is relatively small (only 4 schools and six primary 3 classes), which may affected generalizability. The reliability measure (0.81) was good, but the validity process was described vaguely.

6. Results and Analysis**Strengths:**

The results are presented with relevant statistical tables (ANCOVA results and post hoc tests). The finding that direct instruction significantly improved performance is clearly highlighted.

Weaknesses:

There were inconsistencies in reporting significance (e.g., Table 1 reports p values that did not always match the interpretation). The paper should report effect sizes to indicate the practical significance of the results.

7. Discussion**Strengths:**

The discussion connected findings to prior research (Oladayo, 2012; Rubina, 2010) and emphasized the superiority of direct instruction over traditional methods.

Weaknesses:

The discussion section was relatively short and did not explore *why* direct instruction was more effective or how contextual factors (like teacher quality or classroom resources) may have influenced outcomes.

8. Conclusion and Recommendations**Strengths:**

The conclusion is straightforward — direct instruction enhances performance in numeracy. Recommendations for teacher awareness are relevant.

Weaknesses:

Recommendations are too general and lacked concrete implementation strategies, such as professional development models or curriculum adjustments.

9. References**Strengths:**

Included a mix of international and local sources.

Weaknesses:

Citation formatting is inconsistent, and some references are outdated. Reliance on Wikipedia (2010) undermines academic rigor. APA 7th edition formatting should be strictly followed.

Overall Evaluation

This paper addressed a relevant issue in mathematics education and used an appropriate quasi-experimental design. However, the methodological details were limited, the statistical reporting needed improvement, and the discussion lacked depth in interpreting the findings within broader educational contexts. Strengthening the theoretical framework, expanding the literature review, and providing richer methodological detail would improve its scholarly

contribution. Hence, despite these limitations, the study contributed to mathematics education by empirically validating direct instruction as an effective method for improving numeracy in Nigerian schools.

Article 3: George and Kakraba (2023): Effects of Video-Aided Instruction on Students' Learning Achievement in Geometry

George and Kakraba (2023) explored how video-aided instruction influences geometry achievement among college students in Ghana. Using a quasi-experimental pre-test–post-test design, the study found that video-based teaching significantly improved learning outcomes compared to diagram-based instruction. Gender differences were not statistically significant, suggesting that video-aided instruction benefits all students equally.

Strengths: The study employed a sound methodology with ANCOVA analysis, a high instrument reliability coefficient (0.87), and aligns with global trends in ICT integration. It demonstrated that video instruction can reduce the abstractness of geometry and make it more accessible.

Weaknesses: The sample was imbalanced (37 experimental vs. 21 control), which could bias results. The narrow focus on video versus diagram-based instruction overlooks blended learning or interactive digital tools. While results confirmed gender neutrality, the study did not deeply interrogate why gender differences disappeared.

Critique on each sub-heading are as follows;

1. Abstract and Introduction

The abstract clearly presents the aim: to investigate whether video-aided instruction (VAI) enhances students' geometry achievement compared to diagram-aided instruction (DAI). The introduction contextualizes the study within persistent difficulties students face in geometry.

Strengths:

- The problem statement was well-justified.
- It aligns with global trends in ICT integration in education.

Weaknesses:

- There was limited theoretical discussion on why videos may improve cognitive processing (e.g., dual coding, multimedia learning theory).
- There was also an overreliance on descriptive background rather than critical engagement with literature.

2. Methodology

- Design: Quasi-experimental, pre-test/post-test, non-equivalent control group.
- Sample: 58 students (37 experimental, 21 control) in Ghanaian Colleges of Education.
- Instrument: Geometry Achievement Test (GAT), reliability coefficient = 0.87.
- Analysis: ANCOVA to compare mean achievement scores.

Strengths:

- A robust quasi-experimental design enhanced internal validity.
- A reliable test instrument strengthened measurement credibility.
- The appropriate use of ANCOVA accounted for pre-test differences.

Weaknesses:

- Sample imbalance (37 vs. 21) may have introduced bias.
- The small overall sample limits external validity.
- There was no qualitative data to explain why students benefited from video instruction.

3. Findings and Results

Findings:

- Students taught with VAI performed significantly better than those taught with DAI.
- No significant gender differences in performance were found.

Strengths:

- Findings support ICT integration as an effective tool for mathematics instruction.
- Gender neutrality suggested broad applicability across diverse learners.

Weaknesses:

- Results were presented mainly quantitatively, with limited interpretation of why gender differences disappeared.
- There was a lack of long-term follow-up to assess retention of knowledge.

4. Discussion and Implications

The authors recommended greater adoption of video resources in teaching geometry.

Strengths:

- The practical recommendation aligned with current educational technology policies.
- The study contributed to addressing geometry underachievement in Ghana and Africa.

Weaknesses:

- Recommendations lacked discussion of infrastructural challenges (e.g., electricity, internet access in rural schools).
- There was limited analysis of teacher training needs for effective ICT integration.

5. Conclusion

The study concluded that video-aided instruction significantly improves geometry learning, with no gender disparities.

Strengths:

- The conclusion was clear and consistent with findings.

Weaknesses:

- There was an overgeneralization given the small, localized sample.

6. Overall Evaluation

Contribution: “Strong” – provided empirical evidence for ICT in mathematics education.

Methodological Rigor: “Moderate” – sound design but limited sample and imbalance.

Theoretical Depth: “Weak” – minimal engagement with cognitive/learning theories.

Practical Implications: Relevant but underexplored regarding implementation challenges.

Nevertheless, the research added valuable evidence that video-based instruction can enhance students’ comprehension of abstract mathematical concepts thereby contributing effectively to mathematics education.

Final Verdict: The article makes a valuable contribution to the literature on technology in education, particularly for geometry, but future studies should expand sample size, incorporate qualitative insights, and ground findings in stronger theoretical frameworks.

TABULAR CRITIQUE ANALYSIS OF THE THREE JOURNALS PUBLICATIONS

Table 2: Comparative Analysis of Reviewed Studies

Study	Pedagogical Focus	Strengths	Weaknesses	Contribution
Abbas, (2000)	Cultural pedagogy (ethnomathematics)	Contextual, inclusive, pioneering	Small sample, outdated literature, weak theory	Validates ethnomathematics
Olanrewaju, (2023)	Teacher-centered pedagogy (Direct Instruction)	Rigorous design, reliable test, empirical support	Theoretically shallow, oversimplified implications	Confirms Direct Instruction effectiveness
George & Kakraba, (2023)	Technology-mediated pedagogy (Video Instruction)	Reliable test, ICT integration, inclusive	Small sample, weak theory, ignores challenges	Supports ICT in geometry

Comparative Insights

Together, the three studies reflected different but complementary strategies for improving mathematics education:

- Abbas, (2000) emphasized cultural relevance through ethnomathematics.
- Olanrewaju (2023) underscored teacher-centered clarity via direct instruction.
- George and Kakraba, (2023) highlighted technological mediation through video-aided instruction.

While each demonstrated effectiveness in its context, all shared limitations of small sample sizes, restricted generalizability, and in some cases, limited theoretical engagement. Collectively, they suggested that a hybrid model combining cultural responsiveness, structured teaching, and technology integration could be most effective for mathematics education in Africa.

Conclusion

Critique plays a pivotal role in research as a tool for reflection, evaluation, and improvement. Whether applied to theoretical works or empirical studies, critique ensures that the academic community maintains standards of rigor and relevance. A well-executed critique not only identifies flaws but also illuminates new paths for inquiry and innovation. The reviewed studies contributed significantly to the discourse on mathematics pedagogy in Nigeria and Ghana. Abbas (2000) demonstrates the value of cultural context, Olanrewaju (2023) reaffirmed the effectiveness of structured teacher-centered methods, and George and Kakraba (2023) showed how technology can enhance abstract learning. Despite methodological limitations, these works highlighted the urgent need for context-driven, evidence-based, and innovative instructional strategies in mathematics education across Sub-Saharan Africa.

Suggestions

Based on the critique of the three journal articles, the following suggestions are offered for future research in mathematics education:

1. Future studies should employ larger sample sizes drawn from multiple schools and regions to enhance the generalizability of findings.
2. Researchers should incorporate qualitative methods, such as interviews and classroom observations, to gain deeper insights into why a particular intervention is effective and how it influences students' learning experiences and perceptions.
3. Studies should be explicitly grounded in relevant learning theories (e.g., constructivism, socio-cultural theory, cognitive load theory) to provide a stronger basis for explaining the mechanisms behind the observed effects.
4. There is need for longitudinal research to assess the long-term retention of learning gains and the sustained impact of pedagogical interventions.
5. Future research should critically examine the practical challenges of implementing these interventions, such as teacher training needs, resource availability, and curriculum constraints.
6. Given the complementary strengths of the different pedagogies reviewed, future research could explore the effectiveness of hybrid instructional models that combine elements of cultural relevance, structured teaching, and technology integration.
7. Researchers should ensure comprehensive statistical reporting, including effect sizes and confidence intervals, to allow for a better understanding of the practical significance of their findings.

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