

REVIEWER'S REPORT

Manuscript No.: IJAR-59214

Title: Geometry Anxiety among Senior High School Students: Examining the Roles of Perceived Spatial Visualization Ability, Geometry Self-Efficacy, and Perceived Geometry Classroom Learning.

Recommendation:

Accept as it is
 Accept after minor revision.....
Accept after major revision
 Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		X		
Techn. Quality			X	
Clarity		X		
Significance		X		

Reviewer's ID: JPR-212

Detailed Reviewer's Report

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

DETAILED REVIEWER'S REPORT

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Title: Geometry Anxiety among Senior High School Students: Examining the Roles of Perceived Spatial Visualization Ability, Geometry Self-Efficacy, and Perceived Geometry Classroom Learning Environment.

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RECOMMENDATION

- ☐ Accept as it is
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☒ Accept after major revision

☐ Do not accept

GENERAL ASSESSMENT

The manuscript addresses an educationally relevant issue by examining the relationships among perceived spatial visualization ability, geometry self-efficacy, perceived geometry classroom learning environment and geometry anxiety. The study uses a sample of 500 Form Two students and applies confirmatory factor analysis and structural equation modelling. The manuscript is generally well organised and presents a coherent conceptual framework based on Control-Value Theory and self-efficacy theory.

The measurement model reports strong fit indices, satisfactory factor loadings, reliability and convergent validity. The structural model also reports statistically significant direct and indirect associations. Importantly, the authors appropriately acknowledge that the cross-sectional design does not establish causal relationships.

However, several methodological, conceptual and reporting issues require substantial clarification and revision. The most important concerns relate to instrument development and validation, sampling procedures, the justification for the measurement model, treatment of ordinal data, common-method bias, interpretation of mediation, generalisability, and the distinction between perceived spatial ability and objectively measured spatial ability.

The manuscript should therefore be considered for publication only after major revision.

MAJOR COMMENTS

1. Instrument development and validation require greater detail.

The manuscript states that the questionnaire contained 40 substantive items, with 10 indicators for each construct. It also states that the items were informed by previous literature and reviewed by the research supervisor. However, the process of item development, adaptation, expert validation, pilot testing and refinement is not described sufficiently.

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The authors should clearly indicate whether the items were newly developed, adapted from established scales, or modified from previous instruments. If items were adapted, the original scales and permission/adaptation procedures should be reported. Information about pilot testing and content-validity assessment would also strengthen the methodological credibility.

The manuscript currently relies heavily on the CFA results for evidence of construct validity. CFA provides evidence regarding internal structure, but it does not by itself establish the complete validity of a newly developed or substantially adapted instrument.

2. The sampling procedure needs further clarification.

The manuscript reports simple random sampling from a population of 1,223 Form Two students and a final sample of 500. However, the practical procedure used to generate the sampling frame and randomly select the 500 participants should be explained.

The paper should specify whether all eligible students were assigned sampling numbers and selected using a random-number generator or another documented procedure. It should also report the response rate, if applicable, and explain whether any students declined participation or were excluded.

Because the sample came from one public Senior High/Technical School, the limitations regarding representativeness should be emphasised more strongly.

3. The issue of generalisability needs careful treatment.

The study was conducted in one school in the Sekyere South District of the Ashanti Region. Although the sample size is substantial, the findings cannot automatically be generalised to Ghanaian Senior High School students as a whole.

The manuscript acknowledges this limitation, which is appropriate. However, the Abstract, Discussion and Conclusion should consistently maintain this restricted interpretation. Statements referring broadly to "Senior High School students" should be qualified where necessary.

4. The treatment of five-category Likert-type indicators requires stronger justification.

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The authors used maximum likelihood estimation in AMOS and treated five-category indicators as approximately continuous. The manuscript acknowledges this choice and cites relevant methodological literature. This is a positive feature.

Nevertheless, the authors should provide more information concerning the distributional characteristics of the indicators, including skewness and kurtosis, rather than simply stating that there was no pronounced skewness.

A sensitivity or robustness analysis using an estimator appropriate for ordinal data would substantially strengthen the findings. The authors themselves recommend WLSMV as a future direction. Given that the entire analysis is based on five-category indicators, a robustness analysis would be preferable if technically feasible.

5. The mediation/indirect-effect interpretation should remain strictly non-causal.

The manuscript generally handles this issue responsibly. It explicitly states that the cross-sectional design does not establish temporal or causal mediation.

Nevertheless, expressions such as “GSE statistically accounted for part of the relationships” and “through GSE” should be used carefully throughout the manuscript. The indirect paths demonstrate statistical indirect associations within the specified model. They do not demonstrate that PSVA or PGCLE causes changes in GSE which subsequently cause changes in geometry anxiety.

The terminology should therefore consistently distinguish statistical mediation/indirect association from causal mediation.

6. Common-method bias should be considered.

All four constructs were measured using self-report questionnaire data collected at one time. This creates the possibility of common-method variance.

The manuscript should acknowledge this issue more explicitly and, where possible, report whether any statistical assessment of common-method bias was undertaken. The authors should explain how the use of self-report measures may affect the observed relationships.

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7. The distinction between perceived and objective spatial ability is important and should be highlighted.

One of the strengths of the manuscript is that it clearly defines PSVA as perceived spatial visualization ability rather than objective spatial performance. The Discussion also acknowledges that no objective spatial test was administered.

This distinction should be maintained consistently in the Abstract, Discussion and Conclusion. The results should not be interpreted as demonstrating that students with objectively greater spatial ability necessarily experience less geometry anxiety.

8. Very high reliability coefficients require further discussion.

Cronbach's alpha and composite reliability values are approximately .96 across the constructs. Although high reliability is generally desirable, coefficients of this magnitude can sometimes indicate item redundancy.

The manuscript briefly acknowledges this issue, but the authors should examine item similarity and consider whether 10 items per construct are all necessary. If the instruments were adapted from established scales, this should be discussed in relation to the original scale structure.

9. The structural model reporting should be made clearer.

The authors state that the structural model reproduced the CFA global fit because the structural relations among the four latent variables were just-identified at the latent level. This is an important methodological explanation.

However, the paper would benefit from a clearer explanation of why the global fit indices do not provide an independent test of the structural hypotheses. Readers should be directed towards the path coefficients, confidence intervals and explained variance when interpreting the structural model.

10. The theoretical contribution should be developed further.

The manuscript uses Control-Value Theory and Bandura's self-efficacy framework appropriately. However, the theoretical contribution remains somewhat confirmatory.

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The authors should explain more clearly what the integrated model adds beyond the already established relationships between anxiety, self-efficacy, spatial ability and classroom environment. The Ghanaian geometry-specific context is potentially an important contribution and should be articulated more explicitly.

MINOR COMMENTS

1. The Abstract is generally well written, but the wording should consistently reflect the correlational and cross-sectional nature of the study.
2. The Introduction could provide a sharper statement of the research gap before introducing the hypotheses.
3. The manuscript should provide more information about the development or adaptation of the four scales.
4. The ethical approval statement should retain the exact institutional wording and, if available, provide the relevant approval/reference number. If no approval number exists, the authors should clearly state this as they currently do.
5. The sampling section should report the response rate and exclusions, if these data are available.
6. Table 1 is clear, but the relationship between the sampling procedure and programme representation could be explained more explicitly.
7. The authors should ensure consistency in terminology between “perceived spatial capability”, “perceived spatial visualization ability”, and “PSVA”.
8. The manuscript should carefully distinguish statistical significance from practical or educational significance.

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9. The Discussion could provide more explicit comparison with previous Ghanaian research while avoiding overgeneralisation.
10. The recommendations are reasonable, but because no intervention was tested, the language should continue to make clear that these are evidence-informed implications rather than demonstrated intervention effects.
11. The reference list is generally relevant and includes contemporary literature. The authors should nevertheless check all references for consistency with the journal's required referencing style and verify DOI and bibliographic details.
12. The manuscript should be proofread carefully for spacing, punctuation and formatting inconsistencies.

STRENGTHS OF THE MANUSCRIPT

- The topic is relevant to mathematics and geometry education.
- The manuscript identifies a specific research gap concerning geometry anxiety.
- The conceptual framework is clearly presented.
- The study uses a relatively large sample of 500 students.
- CFA and SEM are appropriate analytical approaches for the proposed latent-variable model.
- Reliability, convergent validity and discriminant validity are reported.
- Bootstrap confidence intervals are used for indirect effects.
- The manuscript appropriately distinguishes association from causation in several sections.

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- The limitations concerning cross-sectional design, self-report measures, single-school sampling and perceived rather than objective spatial ability are explicitly acknowledged.

STATISTICAL AND METHODOLOGICAL ASSESSMENT

The reported CFA results are strong, with $\chi^2(734) = 844.508$, CFI = .994, TLI = .994 and RMSEA = .017. Standardised factor loadings are also high across the four constructs. Reliability and AVE values reported in Table 2 provide evidence of internal consistency and convergent validity.

The structural results indicate significant relationships between PSVA and GSE, PGCLE and GSE, PSVA and GA, PGCLE and GA, and GSE and GA. The reported R^2 values indicate that PSVA and PGCLE account for 52.2% of the variance in GSE, while PSVA, PGCLE and GSE account for 64.7% of the variance in GA.

The indirect effects are statistically supported according to the reported bootstrap confidence intervals. However, these results should continue to be described as indirect statistical associations rather than causal mediation because all variables were measured at one time point.

OVERALL RECOMMENDATION

ACCEPT AFTER MAJOR REVISION

The manuscript has sufficient conceptual and empirical potential to warrant further consideration. However, major revisions are required before it can be recommended for acceptance. In particular, the authors should strengthen the description and validation of the measurement instruments, clarify the sampling procedure, address common-method variance, provide stronger justification for treating five-category indicators as continuous, improve the explanation of the structural model, and maintain precise non-causal language when interpreting indirect effects.

FINAL REVIEWER COMMENT

The manuscript addresses a worthwhile and relatively specific educational problem and provides a coherent SEM-based examination of geometry anxiety. Its strongest features are the integrated conceptual model, relatively large

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sample, detailed measurement-model assessment and transparent acknowledgement of important design limitations. The principal revisions concern methodological transparency and strengthening the validity of the conclusions. After these issues are adequately addressed, the manuscript would be substantially improved and suitable for further editorial consideration.