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Preparación para la enseñanza de matemáticas básicas en la escuela: análisis de la competencia y la autoeficacia de los docentes en formación tras la enseñanza con apoyo en las escuelas

Preparedness to Teach Basic School Mathematics: Exploring Pre-Service Teachers' Proficiency and Self-Efficacy After Supported Teaching in Schools

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Información

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Palabras clave:

Enseñanza con apoyo en las escuelas, Competencia matemática, Autoeficacia.

Resumen

Este estudio se centró en indagar sobre la preparación de futuros docentes de las facultades su autoeficacia percibida tras impartir clases con apoyo en las escuelas. La población de este estudio fue de 21 500 futuros docentes de nivel 400 de las 46 facultades públicas de educación de Ghana. Se empleó la técnica de muestreo intencional por cuotas para seleccionar a 390 futuros docentes para el estudio. El diseño del estudio integró el análisis cuantitativo basado en un marco causal-comparativo. La prueba de competencia matemática y el cuestionario de autoeficacia para la enseñanza de las matemáticas fueron los instrumentos utilizados para recopilar los datos. Los datos recopilados a partir de la prueba y el cuestionario se analizaron cuantitativamente. Se empleó la estadística descriptiva para analizar los niveles de preparación, competencia y autoeficacia de los profesores en formación. Se utilizaron la prueba t para muestras independientes y el ANOVA unidireccional para encontrar diferencias en la competencia, la autoeficacia y la preparación. Los resultados revelaron que los profesores en formación están moderadamente preparados, y que los participantes más jóvenes muestran niveles más altos de competencia. Se observaron diferencias relacionadas con el género en la autoeficacia, ya que las mujeres mostraron una mayor confianza, mientras que los hombres mostraron una mayor competencia y preparación. Los resultados subrayan la importancia de los programas de formación adaptados a los distintos grupos de edad, garantizando estrategias inclusivas en materia de género para fomentar la confianza en sí mismos de todos los profesores en formación.

Information

Keywords:

Supported Teaching in Schools (STS), Mathematics proficiency, Self-efficacy.

Abstract

This study investigated the preparedness of pre-service teachers in colleges of education to teach mathematics by examining their mathematics proficiency and perceived self-efficacy after supported teaching in schools. The population for this study was 21,500 level 400 pre-service teachers from the 46 public colleges of education in Ghana. The quota purposive sampling technique was employed to select 390 pre-service teachers for the study. The design of the study integrated quantitative analysis based on a causal-comparative framework. Mathematics proficiency test and self-efficacy for teaching mathematics questionnaire were the instruments used to collect data. Data collected from the test and questionnaire was analysed quantitatively. Descriptive statistics was employed to analyse pre-service teachers' levels of preparedness, proficiency and self-efficacy. Independent sample t-test and one-way ANOVA were used to find differences in proficiency, self-efficacy and preparedness. The findings revealed that pre-service teachers are moderately prepared with younger participants exhibiting higher levels of proficiency. Gender-related differences were noted in self-efficacy, with females demonstrating enhanced confidence while males demonstrated higher proficiency and preparedness. The findings underscore the importance of tailored training programmes for diverse age groups, ensuring gender-inclusive strategies to nurture self-confidence among all pre-service teachers.

INTRODUCCIÓN

The Ghana Accountability for Learning Outcome Project (GALOP, 2019) reports that despite huge expenditure and initiatives through curriculum reforms by the Government to achieve Sustainable Development Goals (SDG 4.1.1), the teaching and learning of mathematics at the basic school level has attracted questionable outcomes. Low proportion of children at the end of basic school education are able to achieve at least a minimum proficiency level in reading and mathematics. The effective teaching of mathematics at the basic school level is fundamental to nurturing learners' critical thinking, problem-solving abilities, and overall academic success. However, concerns have been raised globally and within Ghana regarding the preparedness of pre-service teachers to deliver quality mathematics instruction. Mathematics is often perceived as a difficult subject by both learners and teachers, with many pre-service teachers lacking the confidence and content mastery required to teach it effectively (Mereku, 2013).

In response to these challenges and as part of ongoing education reforms, Ghana introduced the Bachelor of Education (B.Ed) programme in all public colleges of education. The current cohort under study according to the Ministry of Education (MOE, 2017) represents the first batch of this new B.Ed curriculum, which places significant emphasis on practical experience through the Supported Teaching in Schools (STS) component. STS is embedded from the entry to the exit stages of the initial teacher education programme, accounting for approximately 40% of the total training duration. This model is designed to provide pre-service teachers with sustained, scaffolded opportunities to engage in real classroom settings, thereby enhancing the integration of theoretical knowledge with practical skills (MOE, 2017; Buabeng et al, 2020).

Previous studies have indicated that teachers' confidence in their ability to teach (self-efficacy) and their mastery of subject content (proficiency) are crucial determinants of instructional effectiveness (Yarkwah, 2020). Yet, limited empirical evidence exists on how STS impacts these competencies among pre-service teachers in the Ghanaian context. Despite this effort, questions remain about whether these experiences sufficiently enhance their readiness to teach mathematics, particularly in terms of content proficiency and self-efficacy. Furthermore, demographic variables such as age, gender, and programme of study may influence how pre-service teachers develop proficiency and confidence in teaching mathematics (Yarkwah, 2020). A valid understanding of these factors is essential for informing policy and practice in teacher education.

In light of these considerations, this study seeks to explore the extent to which pre-service teachers in Ghana's colleges of education feel prepared to teach basic school mathematics after participating in STS. Specifically, it examines their mathematics proficiency and self-efficacy levels, while also analyzing the influence of age, gender, and programme of study on these factors. The relevance of this study lies in its potential to inform curriculum design, teaching practice, and professional development initiatives aimed at improving the quality of mathematics education in basic schools. By identifying key areas of strength and weakness among pre-service teachers, the findings can guide the development of targeted interventions to enhance teacher readiness and ultimately, student learning outcomes.

MATERIAL Y MÉTODOS

Research Objectives and Hypothesis

1. To find out how pre-service teachers perceive their preparedness to teach basic school mathematics after STS focusing on their Mathematics proficiency Level and Self-efficacy Level.
2. To determine whether age, gender and programme of study influence pre-service teachers' mathematics proficiency, self-efficacy and preparedness.

   Ho: There's no significant differences in pre-service teachers' preparedness based on age, gender and programme of study.

Theoretical and Methodological Elements Considered

This study is grounded in two major theoretical frameworks: Bandura's Social Cognitive Theory and Kilpatrick et al.'s (2001) Mathematical Proficiency Framework. Bandura's theory, particularly the construct of self-efficacy, provides a valuable lens for understanding how pre-service teachers' beliefs in their ability to teach mathematics influence their motivation, persistence, and classroom practices (Bandura, 1997). Self-efficacy is widely recognized as a key factor in determining how well teachers translate knowledge into effective instructional strategies.

In evaluating mathematical competence, the study adopts the Mathematical Proficiency Framework articulated by Kilpatrick, Swafford, and Findell (2001). This framework defines mathematical proficiency as comprising five interconnected strands: (a) conceptual understanding—comprehension of mathematical concepts and relationships; (b) procedural fluency—skill in carrying out procedures flexibly and accurately; (c) strategic competence—the ability to formulate and solve mathematical problems; (d) adaptive reasoning—capacity for logical thought, explanation, and justification; and (e) productive disposition—a habitual inclination to see mathematics as sensible, useful, and worthwhile. These dimensions serve as benchmarks for assessing the depth and scope of pre-service teachers' mathematical understanding and teaching readiness.

Methodologically, the research employed a quantitative design within a causal-comparative framework, which is appropriate for identifying and analysing differences among predefined groups without manipulation of variables (Creswell, 2014). The target population included 21,500 level 400 pre-service teachers from all 46 public colleges of education in Ghana. A quota purposive sampling technique was used to select a representative sample of 390 participants across different colleges, ensuring variation in gender, age, and programme of study. The researcher utilized a combination of multi-stage, cluster, and quota sampling to ensure an adequate distribution of participants based on gender and programme of study. Since not all institutions and students were readily accessible within the study period, multi-stage sampling was employed.

First, the researcher identified 30 out of 46 public colleges of education in Ghana that offer mathematics in early grade, primary and junior high school education. In the second stage, cluster sampling was used to group these colleges by region, and specific clusters were randomly selected. This included colleges from the Ashanti, Eastern, and Bono regions to ensure regional representation. Quota sampling was then applied to guarantee balanced representation based on gender and programme of study. After identifying the colleges, the population was divided into subgroups (quotas) according to gender and the specific programme of study.

This study was situated within the positivist research paradigm, which assumes that reality is objective, measurable, and can be understood through empirical investigation. Positivism emphasizes the use of structured methodologies, observable data, and statistical analysis to derive conclusions (Kridel, 2015). This paradigm was appropriate for the study, as it sought to objectively assess and compare pre-service teachers' levels of mathematics proficiency and self-efficacy, as well as identify statistically significant differences based on demographic variables such as age, gender, and programme of study.

Data collection involved two instruments: a mathematics proficiency test, aligned with Kilpatrick's five strands of proficiency, and a self-efficacy for teaching mathematics questionnaire adapted from validated teaching efficacy scales. The data were analysed using descriptive statistics to describe levels of preparedness, proficiency, and self-efficacy. Furthermore, independent sample t-tests and one-way ANOVA were conducted to examine statistically significant differences in these outcomes based on age, gender, and programme of study. By combining these theoretical perspectives with a rigorous methodological approach, the study provided a robust foundation for evaluating the impact of the Supported Teaching in Schools (STS) model on pre-service teachers' readiness to teach mathematics at the basic education level.

RESULTADOS

Development and Results

The study followed a systematic research process beginning with the design of a mathematics proficiency test and a self-efficacy questionnaire tailored to assess the preparedness of pre-service

teachers after undergoing Supported Teaching in Schools (STS). The instruments were validated by experts in mathematics education and piloted with a group of 50 pre-service teachers who were not part of the main study to ensure reliability. Data were collected from 390 level 400 pre-service teachers using quota purposive sampling to ensure regional and programme diversity.

Table 1

Descriptive Statistics for Pre-service Teachers' Mathematics Proficiency, Self-Efficacy, and Preparedness (N = 390)

Variable	M	SD	Minimum	Maximum
Mathematics Proficiency	58.43	10.25	32	80
Teaching Self-Efficacy	3.89	0.47	2.10	5.00
Overall Preparedness Score	61.74	9.12	40	82

Note. *Self-efficacy measured on a 5-point Likert scale. Preparedness is a composite index.*

Descriptive statistics revealed that pre-service teachers demonstrated moderate levels of preparedness to teach mathematics at the basic school level. The mean scores for mathematics proficiency were slightly above average, indicating foundational understanding but with room for improvement in areas like strategic competence and adaptive reasoning.

In terms of self-efficacy, the majority of participants expressed confidence in their ability to teach mathematics, particularly in lesson planning and classroom delivery, though less so in responding to students' mathematical misconceptions.

Table 2

Independent Samples t-Test Results for Gender Differences

Variable	Gender	N	M	SD	t	df	p
Mathematics Proficiency	Male	180	60.25	9.84	3.21	388	.001**
	Female	210	56.87	10.41			
Teaching Self-Efficacy	Male	180	3.75	0.49	-2.74	388	.006**
	Female	210	4.01	0.44			

Note. **p < .01.

Table 3

One-Way ANOVA Results for Preparedness by Age Group

Source	SS	df	MS	F	p
Between Groups	782.56	2	391.28	4.78	.009**
Within Groups	31,450.89	387	81.25		
Total	32,233.45	389			

Post hoc (Tukey HSD) indicates that participants <25 years scored significantly higher than those ≥25 years.

Table 4

Mean Scores for Mathematics Proficiency by Programme of Study

Programme of Study	N	M	SD
B.Ed JHS Education	120	63.45	8.32
B.Ed Primary Education	100	60.84	9.50
B.Ed Early Grade Education	170	54.90	10.74

ANOVA Result: $F(2, 387) = 9.42$, $p < .001$

Inferential statistical analyses using independent sample t-tests and one-way ANOVA revealed the following:

- Age differences: Younger pre-service teachers (<25 years) scored higher on mathematics proficiency and overall preparedness.
- Gender differences: Male pre-service teachers had significantly higher mathematics proficiency scores, while female teachers showed higher self-efficacy.
- Programme of study: Pre-service teachers enrolled in Junior High School (JHS) education performed better in proficiency tests compared to those in upper primary and early grade education programmes.

These results indicated that age, gender, and academic programme are significant factors influencing pre-service teachers' preparedness and confidence in teaching mathematics. This aligns with studies by Murray (2018) and Mwingirwa (2015).

DISCUSIÓN

Analysis or Discussion of Results

The findings of this study align with Bandura's (1997) Social Cognitive Theory, which posits that self-efficacy influences the extent to which individuals engage with and succeed in specific tasks. The moderate levels of self-efficacy among pre-service teachers suggest that the STS model contributed positively to their confidence in teaching, especially through hands-on, practical experience. However, the variation in self-efficacy across gender lines indicates potential differences in how male and female pre-service teachers interpret and internalize teaching experiences.

Further, the mathematics proficiency results reflect the influence of Kilpatrick et al.'s (2001) Mathematical Proficiency Framework, with pre-service teachers performing relatively well in procedural fluency but showing less competence in adaptive reasoning and productive disposition. This implies that while STS may strengthen routine skills, it may need to better support deeper mathematical reasoning and a more sustained positive disposition toward mathematics teaching.

The statistically significant differences based on age and programme of study also highlight the value of tailored instructional strategies. Younger pre-service teachers may be more adaptable or familiar with current pedagogical methods, and those in JHS programmes (specialized to teach only mathematics) demonstrated stronger content knowledge and higher confidence to teach mathematics compared to upper primary and early grade education (class teachers).

Together, these findings suggest that while STS provides a useful platform for building teaching competence, its design and implementation should be continually refined to address disparities and foster balanced development across all dimensions of mathematical proficiency.

Conclusions

This study investigated the preparedness of pre-service teachers to teach basic school mathematics, focusing on their mathematics proficiency and self-efficacy after experiencing Supported Teaching in Schools (STS). The findings indicate a moderate level of overall preparedness, with notable variations influenced by age, gender, and programme of study.

Implications of the study suggest that:

STS significantly contributes to developing both confidence and competence in pre-service teachers.

- There is a need for gender-responsive training strategies, particularly to balance proficiency and self-efficacy.
- Teacher education programmes should emphasize deep mathematical reasoning and problem-solving, not just procedural fluency.
- Younger teachers may benefit differently from STS than older ones, and programmes must adapt to such demographic differences.

Limitations include the study's reliance on self-reported measures of self-efficacy and the exclusion of qualitative perspectives, which could provide richer insights into the experiences of pre-service teachers during STS.

Future research could explore:

- Longitudinal studies to assess how STS impacts teacher performance during the first few years of classroom teaching.
- Qualitative case studies to understand how individual experiences during STS shape teaching beliefs and practices.
- Intervention studies to enhance underdeveloped strands of mathematical proficiency, especially adaptive reasoning and productive disposition.

Overall, the study reinforces the importance of structured, practical teaching experiences and evidence-based teacher training models to ensure high-quality mathematics instruction in basic education.

REFERENCIAS

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.

Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches.* Sage publications.

GALOP (2019). *Ghana Accountability for Learning Outcomes Project. International Development Association Project Appraisal Document on A Proposed Credit in The Amount of SDR 107.9 Million ($150 Million Equivalent) and A Proposed Grant In The Amount Of Us$23.9 Million from the Global Partnership for Education to the Republic Of Ghana*. Education Global Practice Africa Region Report No: PAD3320.

Isaac Buabeng, Forster Danso Ntow & Charles Deodat Otami (2020).Teacher Education in Ghana: Policies and Practices Article *in Journal of Curriculum and Teaching; Online Published: February 20, 2020.* doi:10.5430/jct.v9n1p86; URL: https://doi.org/10.5430/jct.v9n1p86.

Kilpatrick, J., Swafford, J., & Findell, B. (2001). Adding *it up: Helping children learn mathematics.* Washington, DC: National Academy Press.

Kridel, C. (2015). Conceptual frameworks in educational research. In S. Lapan, M. Quartaroli, & F. Reimer (Eds.), *Qualitative Research: An Introduction to Methods and Designs (pp. 23-42)*. Wiley

Mereku D.K (2013). *Curriculum and Assessment Related Factors Inhibiting the Development of Literacy and Numeracy in Ghanaian Basic Schools.* A Presentation at Ghana National Association of Teachers (GNAT) Colloquium on Teachers' Awareness of Assessment Reforms.

Ministry of Education (2017). *National teacher education curriculum framework: The essential elements of initial teacher education*, Accra.

Ministry of Education [MOE]. (2017). Teacher education challenges and reforms in Ghana. Accra: Ministry of Education.

Murray, A. B. (2018). Gender differences in self-efficacy and preparedness among pre-service teachers. *Journal of Education for Teaching, 44*(1), 48-61.

Mwingirwa, I. M. (2015). Preparedness of Mathematics Teachers in Transforming the Teaching and Learning of Secondary School Mathematics: *International Journal of Humanities and Social Science 5* (4), 2220-8488 doi 2221/0989.

Yarkwah, C. (2020). Female students' participation in mathematics education at the university level in Ghana. *British Journal of Education, Vol.8, Issue 4, pp.30-45*