International Journal of Evaluation and Research in Education (IJERE)
Vol. 15, No. 1, February 2026, pp. 725~739
ISSN: 2252-8822, DOI: 10.11591/ijere.v15i1.36495

Extended theory of planned behavior: a contextual framework for school mathematics reform

Prince Hamid Armah, Robert Benjamin Armah, Dennis Osei Yeboah, Matilda Sarpong Adusei
Department of Mathematics Education, University of Education, Winneba, Ghana

Article Info

Article history:

Received Aug 7, 2025
Revised Jan 3, 2026
Accepted Jan 13, 2026

Keywords:

Contextual support
Curriculum reform
School mathematics
Teacher intentions
Theory of planned behavior

ABSTRACT

This study extends the theory of planned behavior (TPB) by testing a structural equation model that incorporates teachers perceived contextual support in explaining implementation of a problem-solving mathematics curriculum reform in Ghana. Using cross-sectional survey data from 368 primary teachers, we measured attitude, subjective norm, perceived behavioral control, intention, self-reported implementation behavior, and contextual support. Confirmatory factor analysis (CFA) supported the measurement model. Structural equation modelling (SEM) showed that attitude (β=.38, p<.001) and perceived behavioral control (β=.29, p<.001) predicted intention, while subjective norm was marginal (β=.12, p=.051). Intention predicted implementation behavior (β=.52, p<.001). Contextual support had a direct effect on behavior (β=.28, p<.001) and strengthened the intention to behavior relationship, which was larger in high support contexts (β=.63) than in low support contexts (β=.30; $\Delta\chi^2(1)=7.84$, p<.01). The model explained 57% of intention and 55% of behavior. Strengthening school resources, leadership support, and professional collaboration is likely to improve mathematics curriculum reform enactment. Policy makers and school leaders should prioritize these contextual supports to help teachers translate mathematics curriculum reform intentions into consistent practice.

Corresponding Author:

Prince Hamid Armah
Department of Mathematics Education, University of Education
Winneba, Ghana
Email: pharmah@uew.edu.gh

1. INTRODUCTION

Reform of school mathematics has become a central focus of many education systems as governments seek to promote problem-solving, reasoning, and learner-centered pedagogies. Although these ambitions are widely reflected in curriculum frameworks, translating them into consistent classroom practice has proved difficult in numerous jurisdictions. Empirical research consistently shows that teachers struggle to implement reform-oriented pedagogies when working in environments marked by resource constraints, demanding workloads, and inconsistent school-level support [1], [2]. Even where teachers express favorable attitudes toward pedagogical innovation, their ability to enact new approaches remains limited by the conditions in which they teach [3], [4], including limited resources, overcrowding, and uneven professional and school-based support. These findings illustrate the persistent challenge of converting policy expectations into routine instructional practice.

Ghana's recent curriculum reforms reflect these global ambitions. The Standards-Based Curriculum and the Common Core Program emphasize the teaching of mathematics through problem-solving and conceptual understanding. Yet, national assessments and empirical studies continue to show that many pupils struggle to apply mathematical ideas flexibly and independently, indicating that intended pedagogical shifts

have not yet been fully realized [5], [6]. Research further indicates that several teachers continue to rely on traditional demonstration-based methods, particularly in schools with limited material and institutional support [5]. This mismatch between curricular aspirations and classroom practice highlights an implementation gap that requires systematic investigation.

A coherent analytical framework is needed to explain why teachers adopt or resist reform-oriented pedagogies. The theory of planned behavior (TPB) provides a well-established basis for examining teacher decision-making because it explains how attitudes, subjective norms, and perceived behavioral control (PBC) shape intention, which in turn predicts behavior [7]. Attitude reflects a teacher's evaluative judgement of the instructional reform, subjective norm captures perceived expectations or pressures from significant others such as colleagues or school leaders, and PBC concerns teachers' beliefs about their capacity and confidence to implement the reform under existing conditions. Numerous studies in educational settings consistently show that attitudes and PBC are strong predictors of intention, while subjective norms tend to play a weaker or more variable role [8]–[10]. Research conducted in Ghana similarly demonstrates that teachers' intentions to teach through problem-solving are shaped primarily by beliefs about the value of the approach and confidence in their ability to implement it effectively [5]. Despite its explanatory power, most applications of the TPB focus on psychological determinants and give limited attention to the contextual conditions that shape whether intentions can be enacted, even though several studies highlight the substantial influence of environmental and organizational factors on teacher behavior [11], [12].

The purpose of the study is to address this limitation by extending the TPB to include perceived contextual support as a structural condition influencing teacher behavior. Contextual support is conceptualized as teachers' perceptions of the material, organizational, and interpersonal conditions that facilitate or hinder the implementation of problem-solving pedagogy. By modelling contextual support as both a direct predictor of behavior and a moderator of the intention-to-behavior relationship, the study offers a more contextually grounded account of teacher action during curriculum reform. This approach aligns with emerging evidence that teachers' intentions translate into practice more effectively in environments that provide adequate support, resources, and professional collaboration [1], [2]. Guided by four research questions, the study examines: i) the extent to which attitude, subjective norm, and PBC predict intention; ii) the extent to which intention predicts self-reported behavior; iii) the direct influence of contextual support on behavior; and iv) whether contextual support moderates the intention-to-behavior pathway. In doing so, it provides insights into how mathematics curriculum reforms can be supported within resource-constrained environments.

2. THEORETICAL BASIS – EXTENDED TPB FRAMEWORK

2.1. TPB in education

According to the TPB, if teachers have a favorable attitude toward an instructional reform, perceive supportive subjective norms from important others, and have high PBC over implementation, they will form a stronger intention or willingness to implement the reform [7]. Intention is expected to be the immediate antecedent of actual implementation behavior. This theory has been widely used to study teacher decision-making. For example, MacFarlane and Woolfson [13] applied TPB to teachers' inclusion of students with special needs and found that attitudes and perceived control were significant predictors of intentions to practice inclusive teaching. Similarly, a review by Opoku *et al*. [8] concluded that across studies of inclusive education, teachers' attitudes about an innovation and their self-efficacy or control beliefs consistently predict intention strength, whereas social normative pressures are less consistent drivers. These findings echo results from broader domains such as technology adoption and competency-based instruction, teachers' personal beliefs in the value and feasibility of a reform often outweigh external mandates in shaping behavior [10], [14], [15]. In short, changing teachers' practices requires first changing their beliefs and confidence.

2.2. Extending TPB with contextual factors

While TPB emphasizes individual agency, education researchers have long noted that context matters for whether teachers follow through on their intentions [16], [17]. Thurlings *et al*. [16] in a review of teachers' innovative behavior, observed that organizational supports and school context greatly affect whether teachers try new methods in their classrooms. More recently, a systematic review by Johnson and Fitzmaurice [1] identified inconsistent institutional support and resource constraints as key impediments to mathematics teachers' readiness to implement pedagogical reforms. These perspectives align with Ajzen [18] concept of actual control conditions. Even a well-intentioned, well-trained teacher may fail to enact a new curriculum if, for example, class sizes are very large or required materials are unavailable. Empirical evidence from developing country contexts underscores this point. For instance, Yakavets *et al.* [12] examined a nationwide pedagogical reform in Kazakhstan and found that, despite surface-level changes in

teachers' practices, deeper implementation of new methods was limited without strong school-based support and genuine teacher agency. Dierendonck *et al*. [11] likewise showed that contextual variation explained differences in teacher implementation beyond their intentions. These findings support calls to extend TPB by integrating contextual factors [19], [20].

2.3. Conceptual framework and hypotheses

Unlike previous extensions of the TPB that primarily refined its psychological components, the present framework foregrounds contextual support as a structural condition shaping whether intentions translate into behavior. Although Ajzen [7] and Do *et al*. [19] acknowledged that PBC incorporates both internal and external elements, empirical studies have predominantly operationalized it as an individual cognitive variable akin to self-efficacy, leaving the external, environmental dimension underdeveloped in educational applications. Building on the conceptual distinction established in earlier work [21], the model restores theoretical balance by formally modelling this external control dimension as a distinct construct that captures the systemic conditions which enable or constrain teachers' behavior. Thus, whilst PBC reflects teachers' personal sense of capability and confidence in managing the reform, contextual support represents structural enablers such as resource availability, leadership encouragement, manageable class sizes, and opportunities for professional collaboration. The model is novel in two ways. First, unlike earlier TPB extensions that introduced additional psychological determinants such as moral or descriptive norms, the present study focuses on structural-environmental conditions that determine whether intentions can be enacted. Second, contextual support operationalizes Ajzen's notion of actual control, thereby addressing long-standing critiques of the TPB's sufficiency assumption, which presumes that intention predicts behavior only when individuals have full volitional control. In low-resource education systems such as Ghana's, this assumption is frequently violated, as teachers may hold strong intentions yet lack the institutional resources or leadership backing needed to act; by formalizing this contextual dimension, the model demonstrates empirically that behavior depends not only on beliefs but also on the enabling environment.

Ecological and implementation science perspectives reinforce the relevance of contextual support within the extended TPB model by emphasizing the significance of the broader environment in shaping teachers' behavior during reform implementation. Ecological theories such as Bronfenbrenner's ecological systems theory [22], [23] and the social ecological model [24] view behavior as embedded within wider environmental conditions that influence the opportunities available for purposeful action. Parallel insights from implementation science frameworks, including the implementation drivers framework [25] and the consolidated framework for implementation research [26], highlight the importance of organizational support, leadership, and the general institutional climate as determinants of successful reform enactment. These perspectives align with the TPB principle of actual control and strengthen the theoretical grounding for incorporating contextual support as an important factor shaping teachers' implementation behavior.

The framework therefore proposes that contextual support will have both a direct facilitating effect on teachers' implementation of the problem-solving pedagogy and a moderating effect on the intention–behavior relationship. In high-support environments, teachers should be better able to act on their intentions, whereas in low-support environments even well-intentioned teachers may fall short. This perspective highlights the interplay between teacher-internal factors (beliefs, attitudes, confidence) and teacher-external factors (school resources and climate) in shaping reform implementation. Although contextual support could theoretically be disaggregated into subdimensions such as material resources, instructional leadership, and professional collaboration, TPB scholars [27], [28] caution that additional predictors should only be introduced following strong theoretical and empirical justification to preserve the parsimony and coherence of the model. Guided by this principle, contextual support was conceptualized as a general enabling construct reflecting teachers' overall perceptions of their implementation environment, thereby maintaining theoretical economy while ensuring adequate statistical power for the structural estimation.

Figure 1 illustrates the proposed model. The traditional TPB paths are retained: attitude, subjective norm, and PBC are expected to influence teachers' intention to implement the reform, and intention is expected to predict behavior. The model is extended by including contextual support, which is hypothesized to influence behavior directly and to moderate the strength of the intention–behavior link. Figure 1 presents the conceptual framework extending the TPB for teacher implementation of school mathematics reform. Attitude (ATT), subjective norm (SN), and PBC are hypothesized to influence teachers' intention to implement problem-solving pedagogy, which in turn predicts their actual behavior (classroom implementation). The model is extended to include contextual support (CTX), representing enabling school-level conditions. Contextual support is hypothesized to influence behavior directly and to moderate the intention–behavior relationship.

To investigate this framework, we formulated the following research hypotheses (H1–H7): i) H1: attitude positively influences teachers' intentions to implement the problem-solving curriculum reform in mathematics; ii) H2: subjective norm positively influences teachers' intentions to implement the problem-

solving curriculum reform in school mathematics; iii) H3: PBC positively influences teachers' intentions to implement the problem-solving curriculum reform in school mathematics; iv) H4: PBC positively influences teachers' behavior in implementing the problem-solving curriculum reform in school mathematics; v) H5: teachers' intention positively influences their behavior in implementing the problem-solving curriculum reform in school mathematics; vi) H6: contextual support positively influences teachers' behavior in implementing the problem-solving curriculum reform in school mathematics; and vii) H7: contextual support moderates the relationship between teachers' intention and behavior, such that the intention–behavior link is stronger under higher contextual support. A positive finding for H6 and H7 would provide evidence that the TPB can be extended into a contextual framework for teacher intentions, suggesting that successful curriculum reform requires alignment of both teacher-internal factors (beliefs, attitudes, confidence) and teacher-external factors (supportive conditions).

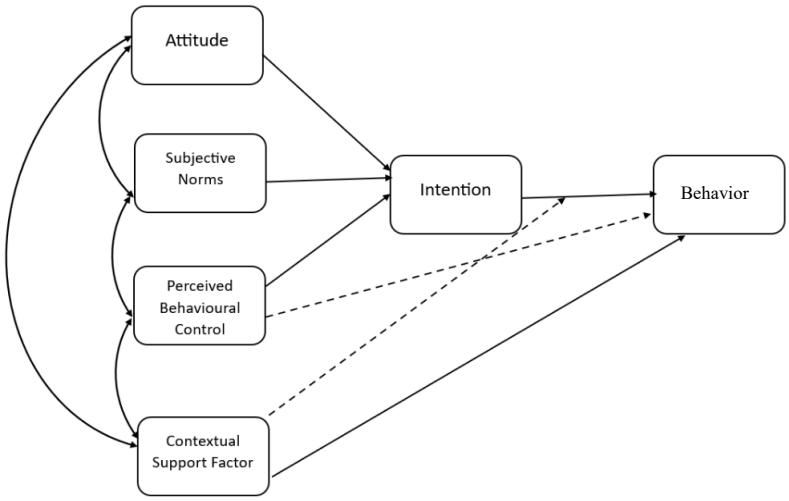

Figure 1. Conceptual model of the extended TPB framework

3. METHOD

We employed a cross-sectional survey design with quantitative data analysis. The target population comprised primary school mathematics teachers engaged in an ongoing curriculum reform in Ghana, which emphasizes teaching mathematics through problem solving. Using a cluster sampling approach, schools were selected from two regions to incorporate both urban and rural settings and thus capture contextual variation. In total, 368 teachers (52% female; mean age=37 years, range=22–59) from 60 public primary schools participated. The selection of schools was guided by the need to reflect both urban and rural contexts as well as variation in resource availability, ensuring representation of the diverse teaching conditions across Ghana.

Participation was voluntary and anonymous, with all respondents providing informed consent. Teaching experience among participants ranged widely (mean=8.4 years, SD=5.7). All participants had been introduced to the new problem-solving curriculum through workshops or official circulars from the Ghana Education Service, ensuring that they were familiar with the reform's goals and expectations. The achieved sample size of 368 was adequate for the planned structural equation modelling (SEM). Methodological guidelines recommend at least 200 cases to ensure stable and interpretable results [29], while simulation studies suggest a minimum of 10 cases per estimated parameter for robust estimation [30]. Our final model contained fewer than 35 free parameters, requiring approximately 350 cases; with 368 participants, our sample exceeded this threshold. Comparable TPB studies in education [10], [14] have reported reliable SEM results with smaller samples (220–300 cases), further supporting the adequacy of the present study's sample size.

3.1. Measures

The survey instrument consisted of several sections measuring the TPB constructs, the added context construct, and background variables. Wherever possible, we adapted existing validated measures from prior studies [5], [31] to ensure content validity and comparability. Table 1 provides an overview of the key constructs and example items. All items were scored on 7-point Likert-type scales, with higher scores indicating more of the construct.

Table 1. Descriptive statistics and correlations

No	Construct	Mean	SD	ATT	SN	PBC	Intention	Behavior	CTX
1	ATT	5.94	0.88	–					
2	SN	4.76	1.11	0.25**	–				
3	PBC	4.53	1.05	0.34**	0.22**	–			
4	Intention	5.47	1.01	0.52***	0.21**	0.45***	–		
5	Behavior	4.02	1.34	0.41***	0.18**	0.36***	0.56***	–	
6	CTX	4.18	1.49	0.29***	0.12	0.40***	0.35***	0.50***	–

Note: **p<.01, ***p<.001 (two-tailed). **Pearson correlation coefficients are shown. All scales are scored 1–7 (higher=more of the construct). Attitude, subjective norm, and intention are TPB measures; behavior is self-reported implementation; contextual support is perceived environmental facilitation. Correlations with magnitude |0.12| or greater are statistically significant at the .05 level.

ATT toward teaching through problem solving was measured with three semantic differential items. Teachers were asked to evaluate the implementation of the new problem-solving approach in their class using bipolar adjective scales (e.g., harmful, beneficial, unenjoyable, enjoyable, ineffective, effective). This scale was originally developed by Armah and Robson [5]. In the present study, the attitude items showed strong internal consistency (Cronbach's α=0.82).

SN was measured with three items reflecting perceived social pressure or support to use problem-solving methods. Teachers rated statements such as "*most people who are important to me (e.g., head teacher, parents) think that I should use problem-solving methods in my teaching*," on a 7-point agreement scale (1=strongly disagree, 7=strongly agree). This measure was adapted from Armah and Robson [5] and Ajzen's standard TPB questionnaires, capturing both injunctive norms (others' expectations) and a sense of whether colleagues and supervisors encourage the practice. Cronbach's α for the norm scale was 0.75.

PBC was measured with four items assessing teachers' confidence and perceived control over implementing the reform. Two items tapped control capacity beliefs (e.g., "If I wanted to, I could easily implement problem-solving tasks regularly"), and two items tapped control constraint beliefs (e.g., "I lack the resources and time to implement problem-solving in math class," reverse-scored). These items were based on an elicitation study by Armah and Robson [31], which had identified "lack of instructional resources" and "time constraints" as key barriers to teaching through problem solving. In our data, the PBC scale showed good reliability (α=0.80).

Intention (INT) to implement the problem-solving pedagogy was measured with three intention statements on a 7-point scale. Example items include "I intend to incorporate problem-solving activities in my mathematics lessons frequently in the next term" and "I plan to teach mathematics through problem solving whenever possible." These items followed standard TPB item construction, Ajzen [18] and were informed by Armah and Robson [5]. The intention scale was highly reliable (α=0.88).

Implementation behavior (BEH) was assessed via self-report, using three items that captured the teacher's actual use of problem-solving approaches in their recent teaching practice. Since direct classroom observation was not feasible at scale, we relied on teacher self-reports of their behavior over the past month. A sample item is "in the past four weeks, I often gave my students mathematical problems to solve that have multiple solutions or approaches." Responses were on a 7-point frequency scale (1=never, 7=very often). We acknowledge that self-report can overestimate actual behavior; to mitigate this, we assured respondents that the survey was not an evaluation and encouraged honesty. Previous studies suggest that when anonymity is ensured, teachers' self-reported implementation correlates reasonably with observed practice. In this study, the behavior scale had acceptable reliability (α=0.79).

CTX was measured by a composite index of four items reflecting the supportive conditions of the teacher's school environment. Teachers indicated their agreement (7-point scale) with statements such as "I have access to the materials and resources I need to teach using problem solving," "The class size and schedule allow me to engage students in problem-solving activities," "My school administration supports me in trying out new teaching methods like problem solving," and "I have opportunities to learn and collaborate on problem-solving teaching (e.g., training or sharing with colleagues)." These items were newly developed for this study based on common themes in the literature on enabling conditions for instructional reform [32], [33]. An exploratory factor analysis confirmed that the four items loaded on a single factor, so we averaged them to form a contextual support index. Higher scores represent a more favorable context for implementation. The scale reliability was α=0.84. We treated this variable as an observed composite in analyses for parsimony. Additionally, the survey collected demographic information and a few control variables (e.g., years of teaching experience, highest qualification). These were used to describe the sample and were examined in the analysis to check for any confounding effects, but they were not central to our hypotheses.

3.2. Procedure

Data were collected over one month using paper questionnaires during teacher workshops and staff meetings, with two trained research assistants distributing and collecting responses on-site. Participants received information about the study's purpose, were assured that participation was voluntary, and informed of their right to withdraw at any time. Informed consent was obtained. Confidentiality was ensured, with data anonymized and used solely for research. Teachers were encouraged to respond honestly, as there were no correct or incorrect answers. The survey took 20 to 25 minutes to complete. Ghana Education Service district offices and school heads granted permission. No financial compensation was provided; however, light refreshments were offered as a courtesy without constituting undue influence. Two trained research assistants distributed and collected the surveys on-site. To minimize social desirability bias, teachers were assured that their responses would be confidential and used only for research. We emphasized that honest answers, whether positive or negative about their implementation of the new approach, would help identify needed supports, and that there were no "right" answers. The teachers completed the survey in approximately 20–25 minutes. Permission was obtained from the Ghana Education Service district offices and school heads to approach teachers.

3.3. Data analysis

Our analysis proceeded in two main stages corresponding to the measurement model and the structural model. First, we performed a confirmatory factor analysis (CFA) on the multi-item scales (ATT, SN, PBC, INT, BEH, CTX) to verify the factor structure and to ensure the measures were reliable and valid for hypothesis testing. The CFA was conducted using IBM SPSS AMOS 27 with maximum likelihood estimation. Model fit was evaluated with standard indices: Chi-square (χ^2), comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA). Following the CFA, as in Table 2, we calculated composite scores (scale means) for each construct to use in the structural model.

Table 2. CFA for measurement model – standardized loadings

Construct (factor)	Example item (abridged)	Loading
ATT	ATT1: Implementing problem-solving is beneficial for pupils' learning.	0.79
	ATT2: Using problem-solving in my class is enjoyable (for me and the students).	0.82
	ATT3: Overall, teaching through problem-solving is good (versus bad).	0.75
SN	SN1: Important others (e.g., headteacher) expect me to teach via problem-solving.	0.73
	SN2: Most colleagues whose opinion I value use problem-solving methods.	0.68
	SN3: I feel under social pressure to incorporate problem-solving in teaching.	0.71
PBC	PBC1: If I want, I can easily implement problem-solving regularly.	0.76
	PBC2: I am confident in my ability to teach through problem-solving.	0.80
	PBC3: (reverse) Lack of time in the curriculum prevents me from teaching problem-solving.	0.66
	PBC4: (reverse) I don't have the necessary materials to teach through problem-solving.	0.72
INT	INT1: I intend to frequently use problem-solving tasks in my math teaching.	0.88
	INT2: I plan to implement problem-solving approaches in the coming term.	0.90
	INT3: I will try to teach math through problem-solving whenever possible.	0.85
BEH	BEH1: In the last month, I often gave open-ended math problems for students to solve.	0.81
	BEH2: I regularly engage students in solving novel problems in class.	0.78
	BEH3: (reverse) I stuck strictly to examples from the textbook without additional problem-solving.	0.65
CTX	CTX1: I have sufficient materials and resources to teach using problem-solving.	0.77
	CTX2: Class size and schedule allow for problem-solving activities.	0.69
	CTX3: My school leaders support me in trying new methods like problem-solving.	0.83
	CTX4: I have opportunities (training/colleagues) to develop problem-solving teaching skills.	0.80

Note: All factor loadings are significant at $p<.001$. Items marked (reverse) were reverse-coded in analysis so that higher scores indicate greater perceived control or more frequent behavior.

In the second stage, we specified a SEM to test the hypothesized relationships among the constructs. The structural model mirrored the framework in Figure 1. Attitude, subjective norm, and PBC were exogenous predictors of intention; intention and contextual support were predictors of behavior. additionally, to address H7, we tested the moderating effect of contextual support on the intention → behavior path. This moderation was examined in two ways: i) by adding an interaction term (intention × contextual support) into a regression equation predicting behavior and ii) by conducting a multi-group SEM analysis, splitting the sample into high (n=186) vs low (n=182) context support groups (using a median split on the contextual support index) and comparing the intention → behavior path coefficient between groups. The multi-group approach allowed a straightforward test of whether the path differed significantly across high-support and low-support contexts. Both methods of testing moderation yielded convergent results; for clarity, we primarily report the multi-group findings (the regression interaction approach similarly showed a significant interaction term).

We also checked for potential common method bias, given that all data were self-reported. A Harman's single-factor test (unrotated factor analysis) indicated no dominant single factor, and the largest factor accounted for less than 30% of variance, suggesting that common method bias was not a serious concern. Additionally, we conducted post-hoc tests for any indirect effects (for example, whether attitudes influenced behavior via intention) using bootstrapping (5,000 resamples) to generate confidence intervals. All statistical tests were interpreted at a significance level of α=.05 (two-tailed). Where applicable, we report standardized regression weights (β) for ease of interpretation, along with their significance levels. Descriptive statistics and correlations among the main variables are provided in Table 1 to give a preliminary sense of the relationships before turning to the SEM results.

4. DESCRIPTIVE AND PRELIMINARY ANALYSIS

Table 1 presents the means, standard deviations, and Pearson correlations for all the principal variables. On average, teachers' attitudes toward the problem-solving pedagogy were quite positive (Mean≈5.9 on the 7-point scale), indicating that most viewed it as beneficial for students. Subjective norm received a moderate score (Mean≈4.8), reflecting that some teachers felt social encouragement to change, while others were neutral or unsure about external expectations. PBC had a slightly lower mean (Mean≈4.5) with somewhat higher variance, suggesting many teachers recognized significant constraints (e.g., lack of time or materials) even as some felt confident in their ability. Contextual support varied widely across respondents (Mean≈4.2, SD=1.5), confirming that some schools were perceived as highly supportive environments while others were not. On average, teachers reported fairly strong intentions to implement problem-solving (Mean≈5.5), but their self-reported behavior was notably lower (Mean≈4.0). This indicates an intention–behavior gap: while many teachers planned to use the new pedagogy, fewer did so frequently in recent practice. The bivariate correlations showed that intention was positively correlated with attitude (r=.52, p<.001) and PBC (r=.45, p<.001), and less so with subjective norm (r=.21, p<.01). Implementation behavior was significantly correlated with intention (r=.56, p<.001) and with contextual support (r=.50, p<.001). Contextual support was also moderately correlated with PBC (r=.40, p<.001), implying that teachers in more supportive schools also felt more personal control. These correlations provide initial support for our model, especially the crucial link between intention and behavior and the potential role of context in that link.

5. RESULTS AND DISCUSSION

5.1. Measurement model confirmation

As reported in Table 2, the CFA supported the adequacy of our measurement model. All items loaded strongly on their intended factors (standardized loadings range 0.65-0.90, all p<.001). Fit indices were within recommended thresholds (CFI>0.95, RMSEA=0.045), and reliability/validity metrics were satisfactory. We also examined discriminant validity between closely related constructs (e.g., between attitude and PBC, which correlated r=.30). The average variance extracted (AVE) for each construct exceeded the squared correlation between any pair of constructs, indicating they are distinct. Overall, the measurement model was deemed acceptable for proceeding to structural analysis.

Model fit indices for the CFA indicated a good fit: $\chi^2(142)=237.5$, p<.001; CFI=0.956; TLI=0.943; RMSEA=0.045 (90% CI [0.037, 0.053]). These statistics suggest that the measurement model adequately represents the data. Composite reliability for each construct was above 0.75, and AVE for each latent construct exceeded 0.50, supporting convergent validity. Discriminant validity was checked by confirming that the square root of AVE for each construct was greater than its correlations with other constructs; this criterion was met for all pairs of constructs. The lowest-loading indicator (BEH3, λ=0.65) was reviewed for potential removal. Model re-estimation without BEH3 resulted in only a marginal fit improvement (ΔCFI=0.002), and the scale's conceptual coverage was reduced. We therefore retained BEH3 to preserve content validity, as shown in Figure 2. Standardized factor loadings are displayed on each indicator; all loadings were significant at p<.001.

5.2. Structural model results

We first tested a baseline TPB model (without the context variable) to address H1–H5, and then introduced the context variable and interaction for H6–H7. The baseline TPB model showed good fit to the data (χ^2(df=144)=259.4, p<.001; CFI=0.953; RMSEA=0.048) and largely supported the classic TPB predictions. In the baseline model, attitude, subjective norm, and PBC explained 57% of the variance in intention, and intention in turn explained 32% of the variance in behavior (when no context variables were included).

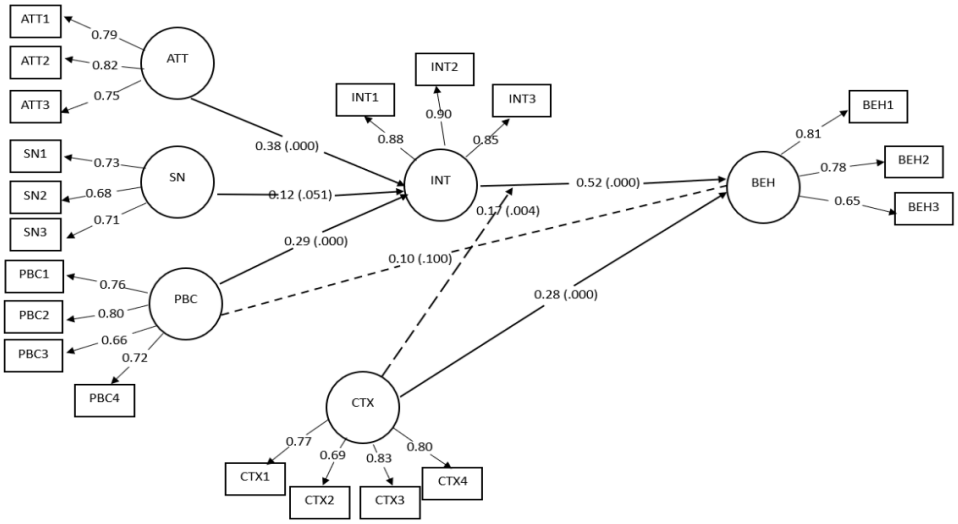

Figure 2. Measurement model of the extended TPB for teacher implementation of school mathematics reform

After adding contextual support and the intention × contextual support interaction term, the extended model captured substantially more variance in behavior. The tested structural model with standardized path coefficients is presented in Figure 3 (standardized path coefficients are displayed on arrows; non-significant paths are labelled as n.s. R^2 values are reported inside endogenous constructs; model fit: $\chi^2(144)=259.4$, CFI=.953, TLI=.940, RMSEA=.048), and the hypothesized paths were largely confirmed by the SEM results. Table 3 summarizes the key path coefficients. Attitude (H1) had a significant positive effect on intention (β=0.38, p<.001), indicating that positive evaluations of the reform fostered stronger commitment to implement it and PBC (H3) also positively affected intention (β=0.29, p<.001), meaning that teachers who felt capable of enacting the reform were more likely to intend to do so. These findings indicate that teachers who believed strongly in the benefits of the problem-solving approach and who felt confident in their ability to implement it were much more likely to form the intention to do so – a result consistent with TPB and prior research [5], [8].

In contrast, subjective norm (H2) showed only a small, marginally significant effect on intention (β=0.12, p=.051) in the baseline model, and it dropped to a non-significant level (β≈0.08, p=.12) once the contextual support interaction was included. Thus, there was little evidence that perceived external pressure from colleagues or authority figures strongly influenced teachers' motivational readiness to implement the reform, beyond what was accounted for by their attitudes and control beliefs. This weaker role of subjective norm aligns with some prior findings that external mandates alone do not strongly motivate teachers to change if not internalized [13], [19], [34].

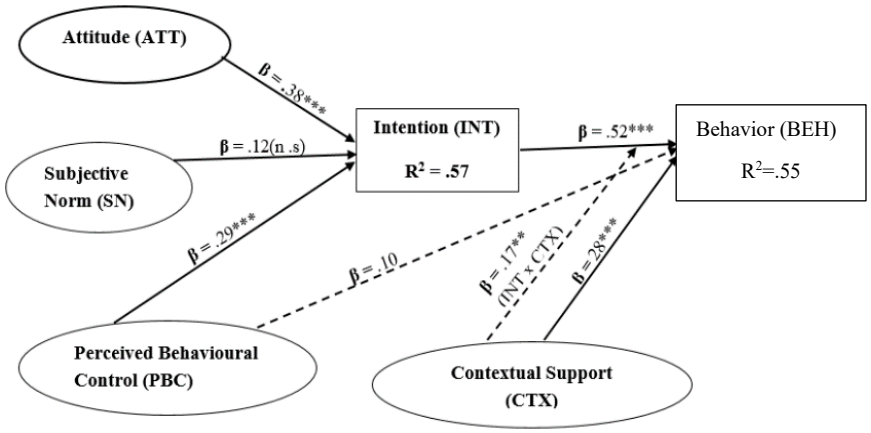

Figure 3. Structural model results of the extended TPB for teacher implementation of school mathematics reform

Table 3. Structural equation model results

Path (predictor → outcome)	Standardized β	SE	p-value
Attitude → intention	0.38***	0.05	<.001
Subjective norm → intention	0.12 (n.s.)	0.05	0.051
Perceived behavioral control → intention	0.29***	0.05	<.001
Intention → behavior	0.52***	0.06	<.001
Contextual support → behavior	0.28***	0.05	<.001
Intention × context support → behavior	0.17**	0.06	0.004

Note: β values are standardized. **p<.01, ***p<.001 (two tailed). n.s. means not statistically significant.

Turning to behavior, intention (H5) emerged as a significant predictor of self-reported implementation behavior (β=0.52, p<.001). This confirms that teachers stated intentions to use the problem-solving pedagogy did translate, at least in part, into actual classroom practice. However, the model also showed that contextual support (H6) had a significant direct effect on behavior (β=0.28, p<.001), even when controlling for intention. In other words, teachers working in schools with more supportive conditions (resources, encouragement, and manageable class conditions) reported a higher frequency of implementing the new teaching approach, beyond what their intentions would predict. Moreover, as hypothesized, there was a significant interaction between intention and contextual support (H7). The interaction term in the regression-based analysis was positive and statistically significant (β=0.17, SE=0.06, 95% CI [0.05, 0.29], p=.004), indicating that the relationship between intention and behavior grew stronger as contextual support increased.

To examine this moderation effect more directly, we conducted a multi-group SEM comparison, estimating the model separately for teachers in high-support schools (n=186) and those in low-support schools (n=182), based on a median split of the context index. The multi-group results in Table 4 showed a clear difference: for teachers in high-support contexts, the strength of the intention → behavior link was β=0.63 (***p<.001), whereas for teachers in low-support contexts, the same link was weaker at β=0.30 (**p=.003). This difference was statistically significant ($\Delta\chi^2(1)=7.84$, **p<.01). In simple terms, this indicates an interaction effect: the impact of teachers' intentions on their classroom behavior depended on the level of contextual support. Put differently, intentions translated into practice more than twice as effectively in supportive environments as in unsupportive ones. Figure 4 illustrates this effect graphically with slopes (the slope of behavior on intention is steeper for the high-support group than for the low-support group, indicating that intentions translated into behavior more effectively under supportive conditions), while Figure 5 presents the corresponding multi-group SEM path models for high- and low-support groups. Separate models are shown for teachers in low-support schools (top, β=.30**) and high-support schools (bottom, β=.63***). The difference was statistically significant ($\Delta\chi^2(1)=7.84$, **p<.01), indicating that contextual support strengthened the intention → behavior relationship.

Table 4. Multi-group moderation analysis of contextual support on intention → behavior

Group	Intention → behavior (β)	$\Delta\chi^2$ (df=1) vs. other group
Low context support	0.30**	
High context support	0.63***	7.84**

Note: β values are standardized. **p<.01, ***p<.001 (two-tailed). $\Delta\chi^2$ is the Chi-square difference test for equality of the intention → behavior path across groups.

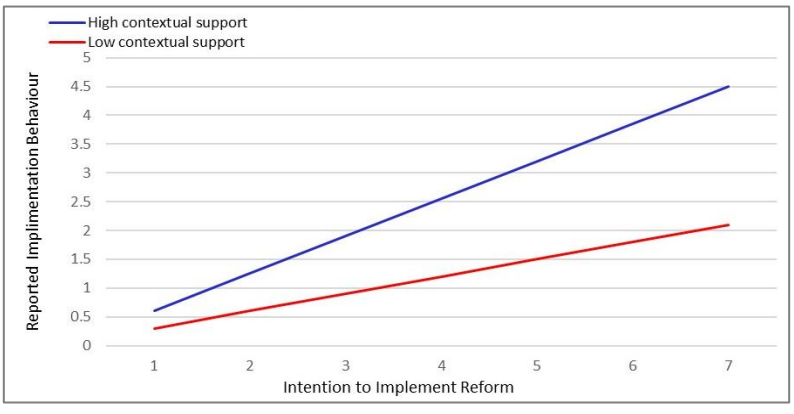

Figure 4. Moderating effect of contextual support on the intention–behavior relationship

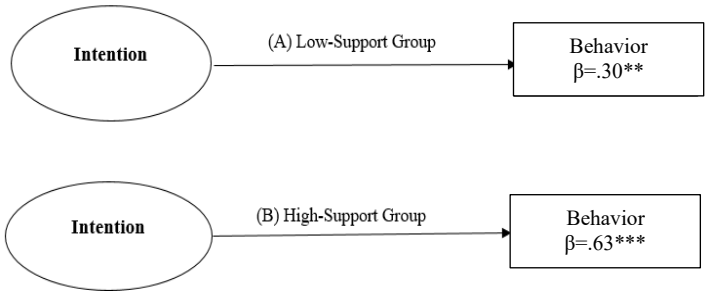

Figure 5. Multi-group SEM moderation results by contextual support

With the inclusion of context, the extended model explained 57% of the variance in intention and 55% of the variance in behavior, as shown in Table 5. This is a sizeable improvement over the 32% of behavior variance explained by the baseline TPB model. Thus, adding contextual support roughly doubled the explained variance in teachers' implementation behavior, underlining its importance. We note that the predictors accounted for virtually the same variance in intention with or without context (since we did not hypothesize context to affect intention directly in this model). In supplementary analyses, we checked whether contextual support might indirectly influence intention via PBC – the idea being that a supportive environment could enhance teachers' sense of control, thereby bolstering their intention. A bootstrapped mediation test revealed a small but significant indirect effect of contextual support on intention through PBC (indirect β=0.06, 95% CI [0.02, 0.11], p=.01). This suggests that supportive contexts may indeed improve teachers' perceived control (e.g., by providing resources that make implementation feel more feasible), which in turn fosters stronger intentions. Nonetheless, the primary role of context in this study was in facilitating behavior and moderating the intention–behavior link.

Table 5. Explained variance for endogenous variables

Endogenous variable	R^2 (Baseline TPB)	R^2 (Extended model)
Intention	0.57	0.57 (same)
Behavior	0.32	0.55

Note. R^2 values represent explained variance. Baseline model is TPB. The extended model adds contextual support and the interaction between intention and contextual support.

5.3. Interpretation and implications

The findings of this study extend the TPB and provide new insights into the conditions under which teachers implement curriculum reform. We interpret these results in relation to the hypotheses and existing literature, beginning with how attitudes and PBC influence teachers' intentions.

5.3.1. Attitude and control beliefs drive intentions

Consistent with H1 and H3, teachers' attitudes toward the reform and their PBC were the strongest predictors of intention to implement it. Teachers who believed that problem-solving approaches would benefit students and who felt confident in their ability to use them were more likely to plan on doing so. This underscores a key point for reform: intentions will falter if teachers doubt either the value or feasibility of new methods. Our findings align with prior studies showing that attitudes and self-efficacy are central predictors of teacher intentions. For example, Irish mathematics teachers hesitated to adopt reform until they saw tangible student benefits and felt capable of applying the changes, even when supportive in principle. Similarly, Opoku *et al*. [8] reported that attitudes and self-efficacy consistently predict intentions, while PBC has also been linked to teachers' enacted classroom practices [11]. These results suggest that strengthening teacher buy-in requires both evidence of pedagogical value and investments in capacity building.

5.3.2. External pressure vs. internal motivation

Subjective norm (H2) had only a marginal effect on intention, indicating that social pressure from principals, colleagues, or parents was not decisive once attitudes and control beliefs were considered. This echoes prior research showing that mandates or external pressure rarely produce lasting change unless teachers internalize reform goals [10], [15]. Some teachers in our setting reported that expectations existed

"on paper," but without support, compliance was difficult. Louie [35] similarly observed that invoking teacher "agency" or authority expectations alone cannot overcome entrenched habits. Do *et al*. [19] and Wijaya *et al*. [34] also caution that reform initiatives relying only on compliance messaging tend to fail. While norms may matter more once a critical mass of colleagues embrace reform, in this early-stage subjective norm was the weakest TPB component. Reform strategies should therefore focus on shifting teacher attitudes and strengthening support systems rather than relying on external pressure.

5.3.3. Intention is necessary but not sufficient: the implementation gap

Intention strongly predicted behavior (H5), confirming TPB's basic premise. Yet many teachers with high intention reported limited implementation, reflecting the well-documented intention–behavior gap. Our contribution lies in demonstrating that contextual support helps explain this gap. H6 and H7 were supported: contextual support both directly increased behavior and moderated the intention–behavior relationship. In low-support schools, even highly motivated teachers struggled to implement problem-solving pedagogy, while in high-support schools strong intenders translated intentions into action more consistently. This confirms that changing teacher mind-sets must be accompanied by enabling environments. Case studies of curriculum change similarly show that reforms stall when "adaptive challenges" such as large classes, misaligned assessments, or lack of materials remain unaddressed [36].

In our study, contextual support encompassed manageable class sizes, access to resources, leadership encouragement, and collegial collaboration. For example, supportive principals enhanced teacher morale and accountability, while lack of peer uptake often left teachers isolated. Our moderation analysis empirically affirms the systemic principle that teachers are embedded in contexts that either enable or constrain reform [1], [37]–[39]. Findings from other lower- and middle-income countries reinforce this pattern. Studies in Vietnam have shown that positive attitudes and strong control beliefs predict intentions, yet contextual constraints continue to suppress behavioral enactment [40]. Evidence from Myanmar indicates that teachers with strong self-efficacy translate reform intentions into practice only when institutional support is present [3]. Research in Kazakhstan shows that pedagogical change becomes sustained when school level leadership, collaboration and resource support align with teacher beliefs [12]. South African work similarly highlights that resources, collegial support and leadership are decisive in enabling teachers to enact new pedagogies [2]. Across these LMIC settings, as in Ghana, strong intentions are necessary but insufficient; supportive contextual conditions consistently determine whether teachers implement the pedagogies they intend to use.

5.3.4. Implications for theory – extending TPB

The extended TPB model explained 55% of the variance in behavior compared to 32% in the classic model. Unlike previous extensions that focused on psychological refinements, our model highlights contextual support as a structural determinant. This suggests TPB should be treated not as a closed system of attitude–norm–control but as a flexible template that can incorporate salient external factors without compromising its parsimonious feature. Contextual support in this model may be viewed as operationalizing Ajzen's [18] notion of actual control, complementing perceived control by representing structural realities. Interestingly, contextual support indirectly bolstered PBC, suggesting that confidence is shaped in part by environment. Future models could examine context as an antecedent of perceived control or as a moderator of the attitude–intention link. Our findings also suggest that subjective norm may gain influence if reconceptualized as descriptive norms (peer practice) rather than injunctive norms (expectations), since descriptive norms often better predict behavior [41]. This points to a possible future trajectory of TPB applications in later stages of reform when peer adoption increases.

5.3.5. Implications for practice – supporting teachers through change

The findings show that effective curriculum reform depends not only on teacher training but also on the alignment of the wider school conditions that enable teachers to adopt new pedagogies. Education authorities should therefore strengthen contextual supports by providing essential instructional materials, adjusting class sizes and timetables to accommodate inquiry-oriented lessons, and reinforcing instructional leadership. School leaders play a critical role in encouraging pedagogical innovation and managing pressures from high stakes examinations that can reinforce traditional teaching [42]. Peer-based professional learning communities can help normalize problem-solving approaches and enhance teachers' confidence and sense of collective responsibility. Reform advocates should also work to build positive attitudes by demonstrating the benefits of problem-solving instruction through model classrooms, mentoring, and visible success stories [43], while addressing concerns about time constraints or syllabus load to mitigate resistance [4]. Overall, reform efforts are most likely to succeed when technical supports such as resources and training are complemented by adaptive supports that strengthen leadership, collaboration, and teacher agency [38], enabling teachers to translate intentions into consistent classroom practice.

6. CONCLUSION

In conclusion, this study contributes to both theory and practice by demonstrating that an extended TPB model incorporating contextual factors provides a powerful framework for understanding and supporting teacher change in school mathematics reform. Our findings show that teachers' intentions to implement a problem-solving curriculum – driven mainly by their attitudes and control beliefs – do translate into classroom practice, but the extent of this translation depends heavily on the contexts in which teachers work. By integrating context into the picture, we move closer to a realistic theory of teacher behavior that acknowledges teachers are not free agents acting in isolation; rather, they are situated within school systems that can either enable or constrain their efforts. For educational stakeholders aiming to improve the quality of mathematics teaching and learning, the implication is clear: it is not enough to change minds; their circumstances must also be improved. Professional development and motivational initiatives will be most effective when paired with tangible enhancements in teachers' working conditions and institutional support systems. As our findings suggest, when enthusiastic, well-trained teachers are met with enabling conditions, educational reforms have a far greater chance of leaping off the policy document and into real classrooms, ultimately benefiting student learning outcomes. In short, successful curriculum reform requires the alignment of teacher preparedness with contextual support. Policymakers and school leaders should therefore pursue a dual strategy: build positive teacher beliefs and skills on one hand, and build supportive institutional environments on the other. Bridging the intention–behavior gap in this manner will increase the likelihood that ambitious curricular reforms achieve their intended impact on students.

Whilst our findings are robust, several limitations must be acknowledged. First, the study relied on validated self-report measures that are common in TPB based research, yet self-reported behavior remains susceptible to social desirability, selective recall and the tendency to overstate alignment between beliefs and actions. These limitations do not compromise the structural relations tested, but they indicate that future research would benefit from complementary behavioral indicators such as classroom observations, lesson artefacts or student achievement outcomes. Such triangulation would provide a richer assessment of the intention to behavior relationship and strengthen the empirical grounding of the extended TPB model in pedagogy reform. Second, SEM enabled us to estimate a comprehensive structural model consistent with TPB, yet the cross-sectional design limits causal inference, since some relationships may be reciprocal or evolve over time. Longitudinal SEM would better capture these dynamics. Third, contextual support was measured as a broad enabling construct. Future work could examine whether resource availability, leadership encouragement, manageable class sizes, and opportunities for professional collaboration function as distinguishable indicators of a higher order contextual construct, incorporate objective contextual measures and model context as a latent structure to improve precision. The study also examined only the moderating effect of contextual support on the intention to behavior pathway and did not explore whether contextual support might moderate other TPB pathways such as the influence of PBC on intention. Future studies could test these additional interactions to provide a more complete assessment of contextual conditions within the extended TPB model. Further research might also examine moral obligation as an additional predictor and apply the extended TPB framework across subjects and contexts to assess its generalizability.

ACKNOWLEDGMENTS

The authors would like to thank the participating teachers and school administrators for their time and insights. We also thank the research assistants, Stanley Asare-Bediako and Nicholas Quartey, for their assistance in administering surveys and supporting data entry.

FUNDING INFORMATION

The paper was solely funded by the authors.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Prince Hamid Armah	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Robert Benjamin Armah	✓	✓		✓		✓		✓		✓	✓	✓		✓
Dennis Osei Yeboah			✓	✓	✓		✓			✓	✓		✓	✓
Matilda Sarpong Adusei		✓			✓		✓	✓		✓	✓	✓		✓

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicting interests.

INFORMED CONSENT

Participants received an information statement and provided informed consent before completing the questionnaire. Participation was voluntary, responses were anonymized, and no identifying information was collected or reported.

ETHICAL APPROVAL

We complied with ethical principles and guidelines (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research [NCPHS], 1979). All participants were informed of the study's purpose and their rights, provided written consent, and participated voluntarily with the option to withdraw at any time without consequence.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [PHA], upon reasonable request.

REFERENCES

[1] P. Johnson and O. Fitzmaurice, "Navigating mathematics curriculum reform: teachers' efforts and implementation challenges," *Journal of Curriculum Studies*, pp. 1–25, Apr. 2025, doi: 10.1080/00220272.2025.2495973.

[2] S. Govender, "South African teachers' perspectives on support received in implementing curriculum changes," *SA Journal of Education*, vol. 38, no. 2, 2018, doi: 10.15700/saje.v38ns2a1484.

[3] K. M. Latt and G. Wei, "How Teacher Efficacy and Receptivity Affect the Perceived Outcomes of Curriculum Reform in Myanmar Basic Education," *European Journal of Education*, vol. 60, no. 1, p. e70022, 2025, doi: 10.1111/ejed.70022.

[4] C. Byrne and M. Prendergast, "Investigating the concerns of secondary school teachers towards curriculum reform," *Journal of Curriculum Studies*, vol. 52, no. 2, pp. 286–306, 2020, doi: 10.1080/00220272.2019.1643924.

[5] P. H. Armah and D. Robson, "Exploring intentions to teach mathematical problem solving: An application of the Theory of Planned Behaviour," *African Journal of Educational Studies in Mathematics and Sciences*, vol. 15, no. 1, pp. 117–133, 2019, doi: 10.4314/ajesms.v15i1.10.

[6] L. M. Ahl, O. Helenius, M. S. Aguilar, U. T. Jankvist, M. Misfeldt, and J. Prytz, "Implementation Research in Mathematics Education: A Systematic Mapping Review," *Implementation and Replication Studies in Mathematics Education*, vol. 3, no. 2, pp. 135–199, 2023, doi: 10.1163/26670127-bja10015.

[7] I. Ajzen, "The theory of planned behavior," *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2, pp. 179–211, 1991, doi: 10.1016/0749-5978(91)90020-T.

[8] M. P. Opoku, M. Cuskelly, S. J. Pedersen, and C. S. Rayner, "Applying the theory of planned behaviour in assessments of teachers' intentions towards practicing inclusive education: a scoping review," *European Journal of Special Needs Education*, vol. 36, no. 4, pp. 577–592, 2021, doi: 10.1080/08856257.2020.1779979.

[9] E. Kupers, A. de Boer, A. Bakker, F. de Jong, and A. Minnaert, "Explaining teachers' behavioural intentions towards differentiated instruction for inclusion: using the theory of planned behavior and the self-determination theory," *European Journal of Special Needs Education*, vol. 39, no. 4, pp. 638–647, 2024, doi: 10.1080/08856257.2023.2263717.

[10] F. Hellmich, M. F. Löper, and G. Görel, "The role of primary school teachers' attitudes and self-efficacy beliefs for everyday practices in inclusive classrooms – a study on the verification of the 'Theory of Planned Behaviour,'" *Journal of Research in Special Educational Needs*, vol. 19, no. S1, pp. 36–48, 2019, doi: 10.1111/1471-3802.12476.

[11] C. Dierendonck, D. Poncelet, and M. Tinnes-Vigne, "Why teachers do (or do not) implement recommended teaching practices? An application of the theory of planned behavior," *Frontiers in Psychology*, vol. 15, 2024, doi: 10.3389/fpsyg.2024.1269954.

[12] N. Yakavets, L. Winter, K. Malone, Z. Zhontayeva, and Z. Khamidulina, ""Educational reform and teachers' agency in reconstructing pedagogical practices in Kazakhstan," *Journal of Educational Change*, vol. 24, pp. 727–757, 2023, doi:

10.1007/s10833-022-09463-5.
[13] K. MacFarlane and L. M. Woolfson, "Teacher attitudes and behavior toward the inclusion of children with social, emotional and behavioral difficulties in mainstream schools: An application of the theory of planned behavior," *Teaching and Teacher Education*, vol. 29, no. 1, pp. 46–52, 2013, doi: 10.1016/j.tate.2012.08.006.
[14] A. E. Lenski, D. Richter, and O. Lüdtke, "Using the theory of planned behavior to predict teachers' likelihood of taking a competency-based approach to instruction," *European Journal of Psychology of Education*, vol. 34, no. 1, pp. 169–186, 2019, doi: 10.1007/s10212-017-0356-7.
[15] K. Urton, J. Wilbert, J. Krull, and T. Hennemann, "Factors explaining teachers' intention to implement inclusive practices in the classroom: Indications based on the theory of planned behaviour," *Teaching and Teacher Education*, vol. 132, 2023, doi: 10.1016/j.tate.2023.104225.
[16] M. Thurlings, A. T. Evers, and M. Vermeulen, "Toward a Model of Explaining Teachers' Innovative Behavior: A Literature Review," *Review of Educational Research*, vol. 85, no. 3, pp. 430–471, 2015, doi: 10.3102/0034654314557949.
[17] Y. Liu, "Implementing educational reform—cases and challenges edited by Colleen McLaughlin and Alan Ruby, Cambridge, UK, Cambridge University Press, 2021," *Comparative Education*, vol. 59, no. 1, 2023, doi: 10.1080/03050068.2022.2149166.
[18] I. Ajzen, "Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior," *Journal of Applied Social Psychology*, vol. 32, no. 4, pp. 665–683, 2002, doi: 10.1111/j.1559-1816.2002.tb00236.x.
[19] T. T. Do *et al.*, "Factors influencing teachers' intentions to use realistic mathematics education in Vietnam: An extension of the theory of planned behavior," *Journal on Mathematics Education*, vol. 12, no. 2, pp. 331–348, 2021, doi: 10.22342/JME.12.2.14094.331-348.
[20] H. Knauder and C. Koschmieder, "Individualized student support in primary school teaching: A review of influencing factors using the Theory of Planned Behavior (TPB)," *Teaching and Teacher Education*, vol. 77, pp. 66–76, 2019, doi: 10.1016/j.tate.2018.09.012.
[21] P. H. Armah, "Teaching mathematical problem solving in Ghana: Teacher beliefs, intentions and behaviour," University of Aberdeen, 2015.
[22] U. Bronfenbrenner, *The Ecology of Human Development: Experiments by Nature and Design*. Cambridge: Harvard University Press, 1979.
[23] U. Bronfenbrenner, "Ecological models of human development," in *International encyclopedia of education*, T. Husen and T. N. Postlethwaite, Eds. Oxford: Pergamon Press and Elsevier Science, 1994, pp. 1643–1647.
[24] K. R. Mcleroy, D. Bibeau, A. Steckler, and K. Glanz, "An Ecological Perspective on Health Promotion Programs," *Health Education & Behavior*, vol. 15, no. 4, pp. 351–377, 1988, doi: 10.1177/109019818801500401.
[25] F. Fixsen, D. L., Naoom, S. F., Blase, K. A., Friedman, R. M., & Wallace, *Implementation research: A synthesis of the literature*. Tampa: National Implementation Research Network, 2005.
[26] L. J. Damschroder, D. C. Aron, R. E. Keith, S. R. Kirsh, J. A. Alexander, and J. C. Lowery, "Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science," *Implementation Science*, vol. 4, no. 1, 2009, doi: 10.1186/1748-5908-4-50.
[27] M. Fishbein and I. Ajzen, *Predicting and Changing Behavior*. New York: Psychology Press, 2010, doi: 10.4324/9780203838020.
[28] I. Ajzen, "The theory of planned behaviour: Reactions and reflections," *Psychology and Health*, vol. 26, no. 9, pp. 1113–1127, 2011, doi: 10.1080/08870446.2011.613995.
[29] R. B. Kline, *Principles and Practice of Structural Equation Modeling*, 5th ed. New York: Guilford Publications, 2023.
[30] Y. In'nami and R. Koizumi, "Review of Sample Size for Structural Equation Models in Second Language Testing and Learning Research: A Monte Carlo Approach," *International Journal of Testing*, vol. 13, no. 4, pp. 329–353, 2013, doi: 10.1080/15305058.2013.806925.
[31] P. H. Armah and D. Robson, "Identifying beliefs underlying the teacher's decision to teach mathematical problem solving: An elicitation study using the Theory of Planned Behaviour," *African Journal of Educational Studies in Mathematics and Sciences*, vol. 14, p. 167, 2018, doi: 10.4314/ajesms.v14i1.14
[32] M. Fullan, *Leadership & Sustainability: System Thinkers in Action*. Thousand Oaks: Corwin Press, 2004.
[33] B. Andoh Charles, "Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature," *International Journal of Education and Development using Information and Communication Technology*, vol. 8, no. 1, pp. 136–155, 2012.
[34] T. T. Wijaya, P. Jiang, M. Mailizar, and A. Habibi, "Predicting Factors Influencing Preservice Teachers' Behavior Intention in the Implementation of STEM Education Using Partial Least Squares Approach," *Sustainability (Switzerland)*, vol. 14, no. 16, 2022, doi: 10.3390/su14169925.
[35] N. Louie, "Agency Discourse and the Reproduction of Hierarchy in Mathematics Instruction," *Cognition and Instruction*, vol. 38, no. 1, pp. 1–26, 2020, doi: 10.1080/07370008.2019.1677664.
[36] K. Pak, M. S. Polikoff, L. M. Desimone, and E. Saldívar García, "The Adaptive Challenges of Curriculum Implementation: Insights for Educational Leaders Driving Standards-Based Reform," *AERA Open*, vol. 6, no. 2, 2020, doi: 10.1177/2332858420932828.
[37] I. Buabeng, F. D. Ntow, and C. D. Otami, "Teacher Education in Ghana: Policies and Practices," *Journal of Curriculum and Teaching*, vol. 9, no. 1, p. 86, 2020, doi: 10.5430/jct.v9n1p86.
[38] P. Johnson, J. V. Freemyer, and O. Fitzmaurice, "The Perceptions of Irish Mathematics Teachers Toward a Curriculum Reform 5 Years After Its Implementation," *Frontiers in Education*, vol. 4, 2019, doi: 10.3389/feduc.2019.00013.
[39] M. Shirrell, M. Hopkins, and J. P. Spillane, "Educational infrastructure, professional learning, and changes in teachers' instructional practices and beliefs," *Professional Development in Education*, vol. 45, no. 4, pp. 599–613, 2019, doi: 10.1080/19415257.2018.1452784.
[40] K. T. Pham, X. V. Ha, N. H. Tran, and Y. T. X. Nguyen, "Curriculum reform in Vietnam: primary teachers' views, experiences, and challenges," *Education 3-13*, vol. 51, no. 3, pp. 440–451, 2023, doi: 10.1080/03004279.2022.2162829.
[41] A. Rivis and P. Sheeran, "Descriptive norms as an additional predictor in the theory of planned behaviour: A meta-analysis," *Current Psychology*, vol. 22, no. 3, pp. 218–233, 2003, doi: 10.1007/s12144-003-1018-2.
[42] L. Cheng, D. Baidoo-Anu, and C. DeLuca, "Examining school principals' conceptions of assessment and grading practices," *Alberta Journal of Educational Research*, vol. 69, no. 1, pp. 41–65, 2023, doi: 10.55016/ojs/ajer.v69i1.73115.
[43] C. Ableitinger and J. Gruber, "Standardized school-leaving exam in mathematics: manifold effects on teaching, teacher cooperation and satisfaction," *Frontiers in Education*, vol. 9, 2024, doi: 10.3389/feduc.2024.1407441.

BIOGRAPHIES OF AUTHORS

Prince Hamid Armah is a lecturer in the Department of Mathematics Education at the University of Education, Winneba, Ghana. He holds a Ph.D. in Mathematics Education (Curriculum, Pedagogy, and Education Policy) from the University of Aberdeen, UK, an M.Ed. in Mathematics, and a B.Ed. (Hons) in Mathematics, as well as an MSc in Development Finance and an LLB from Ghana. He also holds Qualified Teacher Status (QTS) from England and Scotland. His academic training includes advanced quantitative methods at the Universities of Nottingham, Edinburgh, and Manchester, UK. He served as director-general of the National Council for Curriculum and Assessment (NaCCA), where he led Ghana's most comprehensive curriculum reform, introducing the Standards-Based Curriculum and the Common Core Programme, and developed the national framework for implementing the National Standardised Test (NST). His research focuses on mathematics education policy and reform, curriculum development and implementation, with extensive consultancy experience on funded projects for the World Bank, USAID, the UN Education Commission, and the UK's FCDO, among others. He can be contacted at email: pharmah@uew.edu.gh.

Robert Benjamin Armah is the program coordinator for the BSc Mathematics Education Program at the College for Distance and e-Learning (CODeL) and a senior lecturer in the Department of Mathematics Education, University of Education, Winneba, Ghana. His research interests encompass mathematics teacher education and STEM education, with sustained attention to technology mediated mathematics pedagogy, including distance and e-learning models and flipped classroom approaches. He can be contacted at email: rbarmah@uew.edu.gh.

Dennis Osei Yeboah is a lecturer in the Department of Mathematics Education at the University of Education, Winneba, Ghana. He holds a BSc in Mathematics, an MSc in Mathematical Sciences, an MPhil in Applied Mathematics, and a postgraduate diploma in Teaching and Learning in Higher Education. He is a PhD candidate in the Department of Mathematics at Kwame Nkrumah University of Science and Technology. His research interests include advanced optimization techniques, data-driven decision-making, mathematics pedagogy, and technology-enhanced learning. His scholarly work bridges theoretical and applied mathematics and contributes to curriculum design, teacher professional development, and interdisciplinary research, with a strong emphasis on promoting critical thinking and problem-solving in mathematics education through innovative, evidence-based approaches. He can be contacted at email: doyeboah@uew.edu.gh.

Matilda Sarpong Adusei is a lecturer in the Department of Mathematics Education at the University of Education, Winneba, Ghana. Her research focuses on mathematics education, particularly teacher professional development, instructional techniques, valuing in mathematics, socio-cultural issues in the teaching and learning of mathematics, and curriculum issues. She can be contacted at email: msadusei@uew.edu.gh.