British Journal of Contemporary Education
ISSN: 2997-3198
Volume 5, Issue 3, 2025 (pp. 1-17)
www.abjournals.org

TEACHERS' PERCEPTION OF THE EFFECTIVENESS OF PROFESSIONAL LEARNING COMMUNITIES IN TEACHING MATHEMATICS

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Cite this article:

Alagbela, A. A., Bornaa, C. S., Okorie, G. U., Alembilla, A. R. (2025), Teachers' Perception of the Effectiveness of Professional Learning Communities in Teaching Mathematics. British Journal of Contemporary Education 5(3), 1-17. DOI: 10.52589/BJCE-BJ9I3JGB

Manuscript History

Received: 2 Sep 2025

Accepted: 6 Oct 2025

Published: 30 Oct 2025

ABSTRACT: *This study investigates teachers' perceptions of Professional Learning Communities (PLCs) in enhancing mathematics instruction at Senior High Schools in Bawku Municipality, Upper East Region, Ghana. The study was guided by two research questions and a hypothesis. The study employs an embedded mixed method research design involving both quantitative and qualitative methods. The population includes all mathematics teachers in the Senior High Schools within the Bawku Municipality, with a sample size of 106 teachers, using census sampling and seven Heads of Departments for qualitative interviews. Data were collected utilising questionnaire and an interview guide. Analyses of the data were done using means and standard deviations, thematic analysis and independent samples t-test. Findings indicated that teachers perceived PLCs positively for professional development but face challenges such as time constraints, inadequate resources, and limited administrative support. Furthermore, the hypothesis that there is no significant difference in the perception of PLCs between male and female mathematics teachers was affirmed. The study concluded that teachers had a positive perception about PLC, faced several challenges and have similar perceptions about PLC regardless of their gender. We therefore recommend that school leadership should continue in strengthening institutional support for PLCs with allocated resources and professional development opportunities tailored for mathematics instruction, addressing logistical barriers through improved scheduling and technological integration, and promoting inclusivity to maximize PLC effectiveness across gender lines.*

KEYWORDS: PLCs, Teachers, Perception, Mathematics Education.

Article DOI: 10.52589/BJCE-BJ9I3JGB
DOI URL: https://doi.org/10.52589/BJCE-BJ9I3JGB

INTRODUCTION

Education is the process by which society transmits its norms and values from one generation to the next. Importantly, it serves as the building block of any society (Schofer et al., 2021). Mathematics occupies a prominent position among academic subjects, as it supports many aspects of modern life – technology, science, finance, engineering, etc. As a result, the emergence of mathematics education has become an essential platform that ensures students become critical thinkers, problem solvers, and meaningful users of information (Zhu, 2023).

Presently, mathematics teachers are under mounting pressure to continuously improve their teaching skills and professional skills. Serin (2017) states that this pressure is created to provide students with a high proficiency level. Besides, there is a dissatisfaction within the society on the differences in the mathematics results. As a result, studies like that of Dampson (2021) asserts that there is demand for continuous professional development, which includes employing effective teaching approaches that suit students' needs.

Within this context, Professional Learning Communities (PLCs) have emerged as a credible structure for teachers to enhance their instruction. PLCs are collaborative forums that allow educators to work together to enhance their practice to improve student learning outcomes (Daly, 2018). They differ from traditional professional development models, like a one-off workshop or a seminar, because they enable teachers to collaborate and help one another to implement lasting improvements in the instruction (Rajesh, 2023).

Professional Learning Communities (PLCs) are defined as collaborative communities of educators who gather regularly to share expertise and work cooperatively to improve teaching skills and the academic performance of students (Dampson, 2021). Brown et al. (2018) argue that this collaboration creates a climate of collective responsibility. Mundschenk et al. (2016) consider peer observation and feedback valuable in strengthening reflective practice. PLCs creates the platform for mathematics teachers to foster innovations and improve their practices for increasing student engagement and achievement through a culture of continuous improvement (Brown et al., 2016).

Even with promising contributions, the evidence on the effectiveness of PLCs in mathematics education varies. These variations come from different contexts, as research demonstrates that the different views of PLC held by teachers are due to several factors. Teacher characteristics, cultural norms, and the availability of institutional support and resources influence how PLCs are implemented and perceived (Hairon & Dimmock, 2012; Hairon & Tan, 2016). Likewise, Braga et al. (2021) assert that, while some teachers see gains from PLCs, other teachers have challenges which prevent them from participating.

In Ghana, challenges exist in the area of mathematics education, especially in the Bawku Municipality. Among them are below average student performance, excessive traditional teaching methods and the negative attitudes of students toward mathematics (Robinson-Cimpian et al., 2014; Núñez-Peña et al., 2013). As a result, professional development initiatives, such as PLCs, may offer an avenue for addressing these issues; yet not much is known on how mathematics teachers themselves view its effectiveness.

To fill this lacuna above, the present study is directed by the following research questions and hypothesis:

Article DOI: 10.52589/BJCE-BJ9I3JGB
DOI URL: https://doi.org/10.52589/BJCE-BJ9I3JGB

1. What are teachers' perceptions of Professional Learning Communities in enhancing mathematics instruction?

2. What challenges do mathematics teachers face in their practice of PLC?

H_0: There is no significant difference in the perception of PLCs between male and female mathematics teachers.

LITERATURE / EMPIRICAL REVIEW

Theoretical Framework

The study is underpinned by the Social Learning Theory (Bandura, 1977). According to Bandura (1977), the theory suggests that individuals are able to learn not just by doing, but also through seeing and interacting with others. Modelling, vicarious learning, and reinforcement are the key forms of knowledge acquisition in the theory. In the educational field, this would imply that teachers' professional development is not only tied to their practice but also to their interactions with others (Bandura, 1999).

Within Professional Learning Communities (PLCs), Social Learning Theory explains how teachers learn from each other through specific examples like lesson planning, discussion of instructional strategies, and reflection on what is being taught. Observing colleagues as they apply successful strategies and classroom practices creates or provides models that encourage adoption of new methods in teaching (Voelkel & Chrispeels, 2017; Postholm, 2016). Such collaborative experiences have been shown to promote teachers' collective sense of efficacy, or the belief that they can help all their students get better results (Tschannen-Moran & Hoy, 1998). This collective confidence grows when teachers witness positive results from joint efforts and is reinforced through peer validation and shared goals (Donohoo, 2018).

In addition to this, the Social Learning Theory emphasizes the importance of group norms and the same helps cooperation to persist. According to DuFour (2004), effective collaboration among teachers can create a strong sense of efficacy. By taking well informed risks, innovating and communicating openly, the teacher develops a culture of continuous improvement. As a result, the social learning theory presents a useful lens for this study as it connects professional learning of an individual to a group. This demonstrates how collaborative learning communities (PLCs) may enhance teachers' collaboration, influence their teaching practice as well as enhance mathematics teaching and learning.

Review of Related Studies

The efficacy of Professional Learning Communities (PLCs) has been the subject of considerable examination in educational research, particularly through the use of structured measurement instruments, like the Professional Learning Community Assessment-Revised (PLCA-R) (Olivier et al., 2003). The PLCA-R serves as a more standardized tool for researchers to assess teachers' perceptions, and therefore is a useful tool for examining the various impacts of PLCs, whether on teacher collaboration, professional learning, or instruction. Assessments such as these provide opportunities for comparison across contexts which can help build the evidence base that shows PLCs as an impetus for both professional

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learning and for school improvement (Peppers, 2015). Based on ideas about institutional change by Fullan (1991), PLCs are seen as a vehicle for pedagogical reform and organizational change in schools.

Researchers are in agreement that leadership, trust and shared vision are fundamental building blocks that provide a foundation for the success of PLCs. Scholars view leadership as a key agent of change in establishing collaborative conditions, trusting relationships, providing direction, and developing a mutual accountability in student learning for the future (Peppers, 2015; Marzano et al., 2016). Trust is maintained as an essential building block in authentic collaboration so that collaborative conversations are open, psychologically safe, and allow for sharing innovative practices (Stollar, 2014; Hipp & Huffman, 2010). This concept of shared mission and values cannot be separated from the idea of ultimately aligning instructional practices in relation to students' educational experiences outside of school (DuFour et al., 2008), centralizing a common mission together creates continuity in systemic action in respect to educated students' development, and having mutual accountability among themselves. This synthesis of findings reinforces our understanding that the structural and relational elements of PLCs are essential for ensuring PLCs' positive impacts on teachers as they relate to work and school overall.

In addition to structural supports, researchers highlight the professional and instructional advantages teachers gain from continued engagement in PLCs. Working in collaborative learning communities allows educators to have reflective dialogues about teaching practices, co-design lessons, and collaboratively problem-solve, thus deepening their teaching repertoire and providing better instruction (Buffum, Mattos & Malone, 2018; Mertler, 2018). PLCs also alleviate professional isolation and establish collegial networks so that they can share ideas and provide support beyond the all-too-frequent isolation associated with teaching (Mathewson, 2016). Experienced educators will benefit by mentoring novices and refining their own practice; novices will benefit by receiving support, having access to better resources, and having increased confidence (Mizell, 2010; Battersby & Verdi, 2015). In addition, PLCs create a strong sense of teacher efficacy and a growth mindset, while putting the teachers at the centre of their ongoing professional learning (Donohoo, 2018).

PLCs have been shown to foster equity, inclusion, and student learning outcomes at the school and student levels. DuFour et al. (2016) and Provini (2012) cite that through planning key and collaborative lessons and using data to inform actions, teachers can differentiate responses to students' learner needs and build a consensus around individual/collective performance that facilitates success for every student. Also, by strengthening aspirations for school culture through adopting values of collective efficacy and by adopting a commitment to success and excellence, the PLC process has fostered school cultures. (Tomlinson, 2014; Carpenter, 2015). Additionally, evidence shows that collaboration via a PLC process strengthens engagement, differentiation, and achievement in studying and achieving curricular objectives across content areas (McGuire, 2015; Shoem et al., 2018). Lastly, when PLCs are combined with a portfolio of strategic initiatives to improve a school, the PLC model serves both as a professional learning opportunity for teachers and as an opportunity to engage whole-school development and change (DuFour & Fullan, 2014).

To sum this up, an overwhelming body of literature shows that professional learning communities are effective in developing teacher professionalism, establishing a collaborative culture, and improving student success, but only with a few significant enablers (i.e.,

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leadership, trust and common vision), establishing the relational and structural foundations for successful collaboration. Professional learning communities develop teacher reflective practice, agency, and equity, while promoting not only individual teacher growth but lasting change in schools.

METHODOLOGY

Research Approach

This study is situated within the pragmatist paradigm, which emphasizes the practical use of research findings and favours the methods that best fit the research problem. The pragmatist paradigm accepts some form of freedom concerning how research is conducted as it draws from both quantitative and qualitative methods, "what works" is a key pillar to pragmatism and, ultimately, relies upon generating knowledge that is useful (Creswell & Creswell, 2018; Kivunja, 2016). In contrast to paradigms like positivism and constructivism that necessarily limit us to a single worldview, pragmatism welcomes methodological pluralism and is committed to research questions, irrespective of any strict ontological or epistemological position. Educational research is ideally suited to pragmatism because understanding entails both measurable outcomes and insights into participants' experiences.

As a corollary, this study uses a mixed-methods approach to explore teachers' perception of the effectiveness of Professional Learning Communities (PLCs) in teaching mathematics. The quantitative form of data collection offers broad applicability (generalizability), while the qualitative form provides depth and context for a richer understanding that could not be provided by either form alone (Creswell & Plano Clark, 2017; Tashakkori & Teddlie, 2010). The combination of quantitative and qualitative data will not only help offset the shortcomings of each method of data collection but the mix-methods research aligns with the multifaceted structure of understanding teacher perceptions. Therefore, the pragmatist paradigm and mixed-methods approach create a strong foundation for investigating the effectiveness of PLCs in mathematics education.

Research Design

The study utilized an embedded mixed methods research design. In this study, the quantitative component of the data, collected from a pre-validated, structured questionnaire, was the primary focus and it was utilized to quantify teachers' perceptions, while the qualitative part of the data, collected from Interview guide, was included as a subcomponent of the quantitative data for the enhancement of quantitative results (Creswell & Plano Clark, 2017). This design adequately served the study's objective. Creswell and Creswell (2018) state that in educational research, particularly, the embedded design is beneficial as added qualitative data supports, explains, or elaborates on quantitative findings. Thus, although the quantitative strand was about the "what" of teachers' perceptions, the qualitative strand provided insights to "why" and "how" to provide additional perspectives/persuasiveness for teachers' perceptions to impact conceptualization of effectiveness of PLCs to teaching mathematics.

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Population

Creswell (2014) defines the population for the study as a group of individuals that have characteristics in common and conform to a particular inclusion criteria in alignment with the interests and the purpose of the researcher. The population in this study was made up of 106 Senior High School teachers, drawn from seven Senior High Schools in Bawku Municipality of Upper East Region.

Sample and Sampling Technique

The study focused on seven Senior High Schools from the Bawku Municipality and utilized a census sampling strategy, which involved all the 106 mathematics teachers from the schools. This was deemed to be practically appropriate since the target population was relatively small, accessible and therefore included all the teachers without further sampling. Israel (1992) observes that the advantages of census sampling in this instance are to reduce sampling bias and to represent the population in its entirety.

Research Instruments

The study used a questionnaire instrument to acquire both demographic data and teachers' perceptions of Professional Learning Communities (PLCs). PLC perceptions of effective PLCs were measured with six scales from the Professional Learning Communities Assessment (PLCA-R) that was revised by Olivier and Hipp (2010): Shared and Supportive Leadership, Shared Values and Vision, Collective Learning and Application, Shared Personal Practice, Supportive Conditions-Relationships, and Supportive Conditions-Structures. The original 52-item scale was adapted by removing four items that were not relevant in context and slightly changing some items to match the setting for the study. The study further used a self-developed semi-structured interview guide to supplement the quantitative reports of the study and drew qualitative data for reports on their challenges with PLCs. The combination of using both standard and self-developed tools for a mixed-methods study format provides both breadth and depth to the findings for understanding teachers' perceptions and experiences.

Ethical Considerations

To ensure a socially responsible research, the study followed a strict ethical guideline that safeguards participants' rights. The study received approval from the Ethics Committee of the Department of Mathematics and ICT Education at C. K. Tedam University of Technology and Applied Sciences, and permission was obtained from the school authorities after discussing the aims, timeline, and potential outcomes of the study. Mathematic teachers were provided with detailed information about the goals, procedures, and implications of the study. Participation was purely voluntary, and participants could withdraw from the study at any time. Informed consent, confidentiality, and anonymity were assured, data was secured in a locked location, and data was used only for academic purposes as it pertains to how mathematics teachers view and use technology in their teaching.

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Data Collection Procedure

Data was collected over three teaching weeks with the consent of both the head teachers and the participant mathematics teachers, after an introduction letter from the Department of Mathematics and ICT Education from C. K. Tedam University of Technology and Applied Sciences. Each school was assigned a code (e.g., BA-01, BB-01, BC-01) and the participants were provided with questionnaires which took approximately 20 minutes to complete. Additionally, follow-up interviews were conducted with the Heads of Mathematics Departments from each of the seven schools, to supplement the survey data.

Integrity and Trustworthiness

Several processes were used in ensuring validity throughout the development of the instruments. Content validity was determined by designing items to match the research objectives and adequately covering all areas of the topic. Face validity was ensured by critically examining all items for clarity, relevance, and appropriate wording. The instrument was refined further through expert reviews. Construct validity was examined by looking at the relationships among the items pertaining to identified theoretical frameworks. Criterion-related validity was addressed by examining response condition against outside measures, to determine if the instrument could correspond or adequately predict the measures. Reliability was also ensured using a pilot test with a small group of respondents outside the research area. The use of simple language, unambiguous wording and consistent format improved clarity, and the internal consistency analysis had a Cronbach's alpha of 0.872, ensuring reliability as the 0.7 benchmark was exceeded.

In the qualitative component, trustworthiness was preserved by frequently liaising with qualified educators in instrument design and analysis – a process that serves as both a form of member checking and a key part of the audit trail – and by using unambiguous language familiar to participants to limit misinterpretation, the study enhances its credibility, confirmability, and trustworthiness. Dependability, which is similar to reliability in quantitative studies, was enhanced with a pre-testing of the instrument. This independent pre-test was completed in a school outside of the study area, in order to reduce risk of error, enhance credibility and guarantee that the researchers could assert that the results obtained truly represented the views of the participants.

Statistical Treatment of Data

In answering Research Question One that pertained to teachers' perceptions of Professional Learning Communities (PLCs) in improving mathematics instruction, quantitative descriptive statistics (i.e., means and standard deviations) were computed. For Research Question Two, pertaining to the challenges that mathematics teachers face in practicing PLCs, guided interviews with heads of mathematics departments were analysed using thematic analysis to distinguish themes and patterns. With regard to hypothesizing, appropriate inferential statistics were used. In particular, Hypothesis One, which examined differences in teachers' perceptions of PLCs based on their gender, was analysed with the use of an independent samples t-test comparing male and female teachers' mean PLC engagement scores.

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RESULTS / FINDINGS / DISCUSSION

Research Question 1: What are teachers' perceptions of Professional Learning Communities in enhancing mathematics instruction?

Teachers' responses to their perceptions of the role of professional learning communities (PLCs) to enhance mathematics instruction at the Senior High School level was examined. The examination was based on six dimensions of the teachers' perceptions, which included: Shared and Supportive Leadership, Shared Values and Vision, Collective Learning and Application, Shared Personal Practice, Supportive Conditions – Relationships, and Supportive Conditions – Structures. Data was collected on a 4-point Likert scale, and hence, mean values that exceeded the average threshold [(1+2+3+4)/4=2.5] of 2.5 were considered a positive perception, and below 2.5 a negative perception. Table 1 shows how the teachers responded to six dimensions of perception.

Table 1: Teachers' Perceptions of Professional Learning Communities in Enhancing Mathematics Instruction

Perceptions	Means	SD
Shared and Supportive Leadership	3.20	.708
Shared Values and Vision	3.30	.630
Collective Learning and Application	3.24	.723
Shared Personal Practice	3.15	.679
Supportive Conditions – Relationships	3.15	.681
Supportive Conditions – Structures	2.92	.817
Mean of Means	**3.16**	**.706**

Table 1 presents the overall perceptions of teachers' on the various dimensions of their perception on PLC. As regards the overall perceptions, the average of averages is 3.16 (SD = 0.706), which suggests a generally but varied positive perception of the six scales (dimensions) examined. The highest rated dimension was "Shared Values and Vision" (M = 3.30 SD = 0.630). This suggests that mathematics teachers felt very positive about the alignment of the values and vision of the school and reflects a strong sense of shared direction and commonality between mathematics teachers. Furthermore, the standard deviation was relatively low, suggesting a consistent and wide agreement between teachers and their positive perception. "Collective Learning and Application" had a mean of 3.24 (SD = 0.723), meaning staff's views of collaborative learning endeavours and applying new learning were still rated quite favourably. However, this dimension's standard deviation suggests that while the perception was still positive, there was substantial variation in the responses provided.

The mean of 3.20 (SD = 0.708) was obtained for "Shared and Supportive Leadership." This highlights a positive view of leadership actions which could stimulate support and shared decision-making. The moderate standard deviation suggests some variation in views, though an overall trend toward agreement was present. Both "Shared Personal Practice" and "Supportive Conditions – Relationships" had means of 3.15 (SD = 0.679 and 0.681, respectively), all indicating moderate agreement on the effectiveness of personal practices and relational dynamics in supporting teaching. Relatively low standard deviations for both

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dimensions suggest that teachers had fairly similar perceptions about these aspects of the school environment.

The results showed that while teachers generally have positive perceptions of their professional learning community (PLC), the display of positive perceptions was least favourable for "Supportive Conditions – Structures" with a mean of 2.92 (SD = 0.817). The data suggests some dissatisfaction with the associated structural supports, such as resources, schedule, and physical conditions. While it is evident that some factors of teachers' workplace assimilation were positively perceived by the teachers, the normative indicators of concern for teachers on the structural factors evidenced some concern for the actual structural features of their workplace settings. In summary, the data indicated a mixed yet generally positive attitude of the various dimensions that influence teachers' perspectives in their workplace settings.

The results indicated positive perceptions of PLCs held by teachers, especially in terms of shared mission and collaborative learning. Teachers valued how the PLC experiences helped create a focal point to which they set their goals and wanted to work as a team. This is echoed by Pepper (2015), who hailed PLCs as having the potential to transform the professional learning and development of teachers in their school for school improvement. Again, this was echoed by the study of DuFour et al. (2008), whose fundamental argument was that PLCs must have a shared mission and shared values to build effective collaboration and successful learning and instruction in teams. The current study echoes this consensus, establishing that teachers can see the value of PLCs as a means to align education goals and include collaborative practice. In this light, PLCs appear conducive to the possibility of collegiality and pedagogical change.

Research Question 2: What challenges do mathematics teachers face in their practice of PLC?

The guided interviews of the Heads of Department (HoDs) from the seven participating schools were thematically analysed to address this question. The analyses generated five main themes: support and culture challenges, resource and technical issues, time and scheduling issues, collaboration and commitment, and preparation and training. Each of the themes is discussed below along with reflective quotes from participants.

Theme 1: Lack of Support and Culture Challenges

One of the challenges that mathematics educators faced in enacting Professional Learning Communities (PLCs) was the absence of a supportive culture and a lack of support from school leaders. The very concept of PLCs embodies a school-wide culture of collaboration, continuous learning and professional development, and shared responsibility for student learning. However, of the schools of those interviewed, there were descriptions of fragmented environments where collaboration was not encouraged and leadership took little to no involvement, consequently minimizing the capabilities of PLCs to improve instructional knowledge and practices.

A major difficulty raised by participants was the absence of a collaborative culture that could sustain teachers' commitment to PLC practices. Teachers felt that without such a culture, their participation was often superficial and lacked a sense of shared purpose. As one participant explained:

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"Without a clear culture of collaboration, teachers often felt isolated, which prevented PLC sessions from being effective." (HoD 2)

With reference to this concern, another participant remarked that because of the weak emphasis on professional growth, it meant teachers were viewing PLCs as an optional rather than an essential part of their work, and therefore were less willing to engage and derive value from the process. One HoD captured this sentiment quite clearly:

"There is no strong emphasis on professional development, leading teachers to see PLC as optional rather than necessary." (HoD 7)

The limited supportive culture was exacerbated by the ineffectiveness of administrators. Teachers indicated that the presence and support from administrators were key to legitimizing the work in the PLC and keeping teachers involved. In many schools, administrators rarely became actively involved with PLC practice. For example, one participant explained her concerns:

"The school leadership rarely attended PLC meetings, making it difficult to gain the necessary support and momentum for these initiatives." (HoD 1)

Additionally, the lack of leadership input and needed resources continued to lessen the overall impact of PLCs. Teachers noted that without leadership feedback and significant resources, the benefits of what was discussed in PLCs appeared to be largely theoretical and had little bearing on their day-to-day practices. In the words of another HoD:

"We received no feedback or resources from administration, which limited the impact of PLC activities on student outcomes." (HoD 6)

Overall, these perspectives, as shared by the teachers, demonstrated clearly how the non-existence of a supportive school culture and the needed backing of leaders served to undermine successful implementation of PLCs. In the absence of a productive culture of collaboration and leadership engagement, the mathematics teachers remained isolated in their struggles, and PLC practices lost their transformative potential.

Theme 2: Resource and Technical Issues

The second prominent challenge reported by the participants related to insufficient resources and technical infrastructure, which impeded success when it came Professional Learning Communities (PLCs). According to the participants, adequate resources such as teaching tools, current textbooks, online resources, and working technology were considered essential components of collaborative planning and carrying out the action ideas described in the PLC meetings. Although participants described a lack in resources as being an issue that limited their success, and they often had to make do, in many cases they had to pay for materials out of their own pockets in order to sustain the PLCs activities in class.

A common problem was the lack of basic teaching aids, so teachers were unable to use strategies from PLCs when they were necessary. One participant stated:

"...we often ran out of basic teaching aids during PLC sessions, making it challenging to implement strategies effectively." (HoD 3)

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Furthermore, the lack of current learning materials like textbooks and digital resources prohibited teachers from engaging in meaningful discussions within PLCs. One of the other HoD's stated:

"...the lack of access to updated textbooks and online resources has limited our ability to enrich PLC discussions." (HoD 1)

On another point, money was an issue because schools rarely allocated money for PLC work and teachers struggled to bring in an outside facilitator or to access extra access development resources. One participant shared this issue:

"There's no budget allocated for PLC activities, so we could not afford to bring in external facilitators or acquire learning resources." (HoD 4)

Similarly, the financial burden was left on teachers to bear. Most teachers were compelled to cover costs out of their own pockets so as to sustain PLC sessions. This frustration was reported in the words of another HoD:

"Hmm. Some of us even bought our own materials to prepare for PLC sessions because the school could not provide them." (HoD 6)

Aside resources, technical issues like poor internet connectivity also emerged as significant barriers to effective PLC practice. Participants acknowledged that these challenges made it difficult to integrate online tools into their collaborative work. As one participant observed:

"Our internet connection are not always stable; in fact, they are unreliable, making it difficult for us to access online resources during our PLC meetings." (HoD 7)

More like earlier, the lack of modern and functional computers in the schools also made teacher incapacitated in practising the technology-driven strategies they have been discussing. This challenge was also captured by one HoD who lamented:

"The school has outdated computers, yes... It has made it difficult to integrate the same technology we advocate at PLCs into our teaching strategies. Some classes don't even have sockets with functional light, making computer usage a bit challenging." (HoD 5)

All in all, the findings reveal how scarcity of resource and technical limitations undesirably constrained the practice of PLCs in the schools. These barriers as seen not only reduced the effectiveness of collaboration among the teachers but it also curtailed the implementation of innovative strategies geared towards improving mathematics instruction.

Theme 3: Time Constraints and Scheduling

Mathematics teachers also faced a challenge in terms of the scheduling conflicts and time management of PLC. Effective professional learning communities need adequate time for discussing lessons, instructional planning, and reflecting. A number of participants indicated that the PLC was not given ample time to talk and contribute, limiting the effectiveness of this meeting. The issue was worsened by overlapping school responsibilities, which limited teachers' capacity to actively engage in collaborative learning.

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Insufficient time was consistently cited by teachers as a limiting factor of collaboration. As one teacher noted,

"... frankly, the time that is allotted for PLC sessions is generally insufficient to really delve into detailed lesson planning or even student assessment strategies." (HoD 3)

This concern was reinforced by another teacher, who explained that

"We only had 1 hour for each session, which was not enough to cover all the necessary topics. Most of the time when you start getting to the interesting or problematic areas of the subject, then the time is up. It is just frustrating sometimes." (HoD 4).

In addition to the limited duration of sessions, issues regarding scheduling conflicts further magnified time-related challenges. One participant mentioned this stating that,

"PLC meetings, although not always, often overlapped with other scheduled school activities like inter school sporting or educational activities, compelling the teachers to either choose between attending meetings or other equally important school activities" (HoD 2).

Placing these concerns together, these findings indicate that limited time and ineffective scheduling diminished the effectiveness of PLCs, and consequently left teachers unable to utilize reflective and collaborative practices.

Theme 4: Lack of Collaboration and Commitment

Another significant issue that emanated in the practice of PLC among math teachers was the lack of collaboration and commitment, or the problem of collaborative commitment. Professional Learning Communities can only be effective when all members are engaged actively in discussing, planning, and implementing processes that each participant has agreed to engage in. Participants noted that when some teachers did not demonstrate the same commitment to engagement, this diminished the strength of the collaborative effort. Although some teachers were committed and so enthusiastic, some others also treated PLC sessions as another imposed task on them rather than seeing it as an opportunity for their professional development.

One participant commented on how this inconsistent engagement has collectively undermined the impact of the professional learning experiences:

"While some teachers are enthusiastic about these sessions and eager to learn some difficult concepts, some teachers see the whole idea of PLC as just another stressful obligation and so they don't fully engage in discussions." (HoD 7)

This lack of consistent participation, as echoed by another participant, again undermined the intended benefits of PLC collaboration:

"We have been recording inconsistent participation in PLC activities, which I can say has affected our overall effectiveness." (HoD 2)

In addition to inconsistency in participation, some teachers were resistant to new ideas that came out of the discussions within the PLCs. There were alternative ways to teach the same content that could help improve students' learning, but some teachers preferred to keep doing

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what they had always done. Resistance to these ideas created tension and slowed the implementation of new ideas. As one Head of Department noted:

"Some teachers were resistant to the methodologies that we were trying to implement through the PLCs." (HoD 1)

Another participant added support for this point and indicated staff reluctance to try new ideas impeded the PLCs from being effective:

"Staff were often reluctant to trying new practices from our discussions in PLC; in fact, they preferred to stick to their existing practice." (HoD 6)

These responses reveal that while PLCs provided a platform for professional collaboration, its success was hindered by unequal commitment and resistance to change exhibited by some teachers. This lack of collective ownership reduced the potential for PLCs to foster meaningful improvements in teaching practice.

Theme 5: Lack of Preparation and Training

Another issue that was brought to light in the implementation of PLC amongst mathematics teachers was inadequate preparation and a lack of necessary materials. Meritorious PLC occurs when topics are covered thoroughly, and discussions are fostered by well-prepared facilitators and the use of printed material (e.g., lesson plans, task posters), for example. Unfortunately, several teachers reported being called upon, unexpectedly, to facilitate a PLC session, without sufficient time to prepare or clear guidance. Oftentimes, the lack of preparation meant teachers' collaborative process was sparse.

One participant highlighted the preparation time issue,

"Sometimes, teachers were expected to facilitate PLC discussions but were not provided with sufficient time to prepare." (HoD 6)

In addition, facilitators routinely lacked structured guidance, which compounded the issue, as they were left with little insight about the content and direction of the discussed topics:

"Our facilitators in some cases were often unprepared because there has not been proper guidance about the topics to be discussed in the PLC sessions; they did not know what they were supposed to discuss." (HoD 1)

In addition to time and adequate guide, scarcity of materials also became a narrative. Teachers reiterated that there were not enough good training materials. Ultimately, this negatively impacted the quality of discussions and making attempts to implement new strategies. HoD 3 mentioned:

"We have not even received enough training materials to help us prepare for PLC meetings effectively." (HoD 3)

Article DOI: 10.52589/BJCE-BJ9I3JGB
DOI URL: https://doi.org/10.52589/BJCE-BJ9I3JGB

Another participant also highlighted how this challenge hindered the depth of collaborative learning:

"There are very few reference materials available for PLC; it has made it most times hard for teachers to have fruitful or meaningful PLC discussions." (HoD 7)

In conclusion, lack of preparation, insufficient facilitation support, and not enough training materials presented barriers to effective PLC practice, all of which contributed to substandard discussions and impeded the implementation of innovative teaching practices. Addressing and rectifying these issues will require a purposeful investment in teacher training, time to review and reflect on meaningful materials for the learning communities, and generally meeting the needs of teachers to achieve positive outcomes in PLCs.

The challenges mathematics teachers encountered in their professional learning community (PLC) practice resonate explicitly with previous studies, affirming the kinds of barriers (e.g., no administration support, limited resources, and lack of dedication for narrowing focus on improving instruction). One of the key irritants that aligned best within the findings of the current study was the low commitment to changing classroom practices. Despite PLCs being a primary focus of pedagogical change, Wasta (2017) argued that although PLCs critique student achievement data, they often provide little more than comfort and support in thinking of ways to change or refine practice. This was reflective of the experiences of teachers in the current study, as they reflected back on their frustration with the gap between PLC meetings and the practical implications for their classrooms, suggesting that without a clearly defined focus on pedagogy, PLCs and their intended intentions are left to be procedural.

Another major challenge identified is the availability of resource and time for the PLC's implementation. Teachers reported struggles with the availability of teaching materials and technological devices, which inhibited their ability to truly participate in collaborative practices. This was supported by Motswiri et al. (2017) who noted the importance of having a solid infrastructure and updated materials to promote continual collaboration and professional learning among teachers. Time issues and inconsistent participation mirrored the comments of Masterson and Koch (2021) in that the sustained interaction, reflection and commitment were important for conquering a rigid mindset towards instruction. Time and participation emerged in this study as significant barriers, making it imperative to pay attention to the collective need for strong support from administration, adequate resources, and commitment to a positive school culture built on shared learning.

Research Hypothesis 1: There is no significant difference in the perception of PLCs between male and female mathematics teachers

The objective was to determine whether male and female mathematics teachers differed in their perceptions of PLCs. An independent samples t-test was conducted to compare the average perception scores between the two groups. The hypothesis was tested with a 5% significance level.

Table 2: Independent Samples t-test of Perception between the Males and Females

Test	Group	N	M	SD	t	*df*	Sig
Perception	Male	94	3.17	.389	.266	104	.791
	Female	12	3.14	.285			

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Table 2 displays the outcome of an independent samples t-test conducted to find out whether or not male and female mathematics teachers view PLCs differently. The sample involved 94 male teachers and 12 female teachers. The average perception score of male teachers was 3.17 while the average perception score of female teachers was 3.14. The standard deviation for male teachers was .389 while the female teacher's was .285. The male group's perceptions appeared to show more variability than those of the female group. The analysis resulted in a t-test value of .266, 104 degrees of freedom, and a sig. value of .791. As the p-value of (.791) was more than .05, the perception scores of males and females were not statistically different. According to the data gathered, male and female teachers have similar perceptions of PLCs.

The results of the study, which indicate no significant difference between male and female perceptions of PLCs by mathematics teachers, is consistent with other studies in the literature. For instance, Ghbban (2021) discovered that male and female teachers showed no significant difference in their perceptions of PLCs practice. The absence of substantial gender distinctions indicates that both male and female educators tend to view PLCs similarly concerning their role and usefulness for professional development. Lin (2013) also revealed a gender difference in teachers' self-efficacy but a strong overlap in perception of PLCs. The studies provide evidence that PLCs' effectiveness and perceptions have more to do with school culture, resources, and other aspects of the environment than gender. The results of the present research confirm a trend in education where gender does not significantly affect teachers' opinions toward PLCs.

CONCLUSION

The findings of this study demonstrates that Professional Learning Communities (PLCs) are regarded as very valuable to mathematics teachers as a core part of their professional development. Teachers view PLCs as valuable structures for improving teaching practices, creating partnerships among colleagues, and sharing best practices. The structure and dynamic nature of PLCs provided teachers with a way to enhance their teaching strategies and improve their mathematics instruction, revealing the capacity of PLCs for improving teaching practice and the quality of teaching.

There are however barriers identified in this study that limit the power of PLCs. The barriers identified include not having sufficient time for meetings, and most schools did not have resources and materials available to enhance teaching practice that was shared in PLCs. The study also noted inadequate support from leadership, lack of preparation and training, and lack of collaboration and commitment. These barriers limit the capacity of teachers to implement PLC discussions to improve classroom teaching and learning practices. The study finally concludes that there is/are no gender differences in teachers' perceptions of PLCs. Male and female mathematics teachers held similar perceptions of the perceived effectiveness of PLCs in facilitating professional growth and improving instructional practice.

FUTURE RESEARCH

Further research should examine how participation in PLCs shapes the professional identity and pedagogical beliefs of mathematics teachers, which in turn can enhance effectiveness.

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REFERENCES

Battersby, S., & Verdi, B. (2015). The culture of professional learning communities and connections to improve teacher efficacy and support learning. *Art Education Policy Review*.

Braga, A.M., Erdem, Ö., Noordzij, G., Merkelbach, I., Kocken, P., & Denktaş, S. (2021). Exploring the Intersectionality of Family SES and Gender with Psychosocial, Behavioural and Environmental Determinants of Physical Activity in Dutch Adolescents: *A Cross-Sectional Study*.

Caniglia, C., Picanco, K., Arnold, K., & Naccarato, S. (2023). Educators' Perceptions of Professional Growth Plans in the Context of Professional Learning Communities. *Journal of Interdisciplinary Teacher Leadership*.

Carpenter, D. (2018). Intellectual and Physical Shared Workspace: Professional Learning Communities and the Collaborative Culture. *International Journal of Educational Management, 32*, 121-140.

Daly, E.A. (2018). Teacher Perceptions of Professional Learning Communities' Impact on Math Critical Thinking Pedagogy.

Dampson, D.G. (2021). Effectiveness of Professional Learning Communities in Ghanaian Basic Schools through the Lenses of Socio-Cultural Theory. *Journal of Educational Issues*.

Doğan, S., Pringle, R., & Mesa, J. (2016). The impacts of professional learning communities on science teachers' knowledge, practice and student learning: a review. *Professional Development in Education, 42*, 569-588.

Doğan, S., Pringle, R., & Mesa, J. (2016). The impacts of professional learning communities on science teachers' knowledge, practice and student learning: a review. *Professional Development in Education, 42*, 569-588.

Donohoo, J. (2018). Collective teacher efficacy research: Productive patterns of behaviour and other positive consequences. *Journal of Educational Change, 19*, 323-345.

Fred, H., Meeuwen Pierre, V., Ellen, R., & Marjan, V. (2019). How to enhance teachers' professional learning by stimulating the development of professional learning communities: operationalising a comprehensive PLC concept for assessing its development in everyday educational practice. *Professional Development in Education, 46*, 751-769.

Fred, H., Meeuwen Pierre, V., Ellen, R., & Marjan, V. (2019). How to enhance teachers' professional learning by stimulating the development of professional learning communities: operationalising a comprehensive PLC concept for assessing its development in everyday educational practice. *Professional Development in Education, 46*, 751-769.

Ghbban, E. A. (2021). Teachers' Perceptions Concerning Practicing Professional Learning Communities at Elementary Schools in Saudi Arabia.

Hargreaves, E., & Elhawary, D. (2018). Exploring collaborative interaction and self-direction in Teacher Learning Teams: Case studies from a middle-income country analysed using Vygotskian theory. Compare: *A Journal of Comparative and International Education, 50*, 71-89.

Karali, Y. (2022). Difficulties Classroom Teachers Encounter in Teaching Mathematics: A Phenomenological Study. *International Journal of Progressive Education*.

Article DOI: 10.52589/BJCE-BJ9I3JGB
DOI URL: https://doi.org/10.52589/BJCE-BJ9I3JGB

Lin, S. (2013). The Relationships among Teacher Perceptions on Professional Learning Community, Collective Efficacy, Gender, and School Level. *Journal of Studies in Education, 3*, 98-111.

Lin, S. (2013). The Relationships among Teacher Perceptions on Professional Learning Community, Collective Efficacy, Gender, and School Level. *Journal of Studies in Education, 3*, 98-111.

Little, M. (2020). Collaboration and Connections among Middle School Teachers of Mathematics: Enhancing Efficacy through Professional Learning Communities. *SRATE Journal, 29*.

Masterson, L., & Koch, M. (2021). Obstacles to Promoting Growth Mind-set in a Streamed Mathematics Course: "It's like Confirming They Can't Make the Cut". *Investigations in Mathematics Learning, 13*, 167-181.

Motswiri, M. J., Zimudzi, E., Garegae, K. G., & Nkhwalume, A. A. (2017). Emerging Technologies as Tools for Enhancing Mathematics Professional Learning Communities in Botswana. Teacher Empowerment toward Professional Development and Practices: *Perspectives across Borders*, 281-293.

Mundschenk, N.A., & Fuchs, W.W. (2016). Professional Learning Communities: An Effective Mechanism for the Successful Implementation and Sustainability of Response to Intervention. *SRATE Journal, 25*, 55-64.

Niemi, H., Nevgi, A., & Aksit, F. (2016). Active learning promoting student teachers' professional competences in Finland and Turkey. *European Journal of Teacher Education, 39*, 471-490.

Paulus, M., Villegas, S., & Howze-Owens, J. (2020). Professional Learning Communities: Bridging the Technology Integration Gap through Effective Professional Development. *Peabody Journal of Education, 95*, 193-202.

Postholm, M. (2016). Collaboration between teacher educators and schools to enhance development. *European Journal of Teacher Education, 39*, 452-470.

Robinson-Cimpian, J. P., Lubienski, S. T., Ganley, C. M., & Copur-Gencturk, Y. (2014). Teachers' perceptions of students' mathematics proficiency may exacerbate early gender gaps in achievement. *Developmental Psychology, 50*(4), 1262.

Voelkel, R., & Chrispeels, J. (2017). Understanding the link between professional learning communities and teacher collective efficacy. *School Effectiveness and School Improvement, 28*, 505-526.

Article DOI: 10.52589/BJCE-BJ9I3JGB
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