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# Enhancing middle school Mathematics through a professional learning Mathematics community

Nadia Rashid Inam, Pakistan

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### School context

Located in Karachi, Pakistan, Beaconhouse Jauhar Campus is a part of the world-renowned Beaconhouse School System. It serves students belonging to upper-middle and high socioeconomic family backgrounds. The school has 1220 students aged 11–16 years in Middle and O level sections. It is proud of its exceptional teaching standards and conducive learning environment that propels students towards unparalleled success in their academic pursuits. The esteemed faculty, predominantly comprising Master's degree holders, serves as the backbone of the school. The school offers thorough training and development programmes for teachers to maintain high standards in education. The curriculum is carefully designed to meet Cambridge standards and helps students achieve great results in O Level exams. Jauhar Campus is dedicated to providing top-quality education and aims to benefit its students, the local community, and beyond through effective management and teaching.

### About the author

Dr Nadia Rashid Inam is an experienced educational leader who has over 20 years of experience. She has a background in Medicine and Educational Leadership and is able to bring scientific perspectives into education. She recently earned a distinction in Certificate in Educational Leadership from Cambridge Assessment International Education, enhancing her skills further. Dr Nadia specialises in strategic leadership, team building, staff development, effective communication and student engagement. She is dedicated to helping teachers grow professionally aiming to empower them to prepare students for the challenges of the world.



### Key learnings

**This study explored the impact of a Professional Learning Mathematics Community (PLMC) in Middle School.**

- Veteran teachers were paired with novices to mentor on instructional strategies, classroom management and curriculum implementation.
- Each teacher made an individual action plan to improve areas of weakness. The school provided personalised support which led to a cohesive teaching environment with a unified set of best practices.
- Challenges, such as time constraints and differences, were outweighed by the benefits perceived by both mentors and mentees. All were optimistic about enhanced teaching practices. Support from school management, clear communications and manuals helped the programme's success.
- The programme significantly boosted confidence, trust, and collaboration among the Maths faculty. It increased student interest and enthusiasm in Maths, and improved test results.

## Expected outcomes

- Enhanced professional development of Mathematics teachers.
- Improved pedagogical skills and content knowledge.
- Better instructional practices and targeted interventions.
- Increased student achievement in Middle School Mathematics.



Figure 1: Workshop on PLMC

## Action research rationale

This study explores the impact of a Professional Learning Mathematics Community (PLMC) in Middle School. The goal is to identify and disseminate effective teaching strategies, innovative approaches and successful interventions for teaching Maths. Learning gaps in Maths, attributed to disparities in knowledge, pedagogy, and training, are particularly pronounced for new teachers. Concerns regarding the variability in Maths teaching quality and students' below-average performance in the subject have been raised by parents and students alike. Additionally, the lack of regular Maths practice due to the pandemic has created significant challenges for students. Teachers reported distracted and disengaged students during classes. The standardised assessment results showed slightly lower scores compared to the average national score, highlighting these issues.

The formation of the PLMC is a strategic response to these concerns, focusing on uniform competency levels in Mathematics teaching across the middle school.

In *Turning Points*, Jackson and Davis (2000) emphasised the importance of school principals in initiating and sustaining improvement in middle school students' performance. Collaborative discussions about teaching and learning are crucial for student learning, enhancing the professional development of teachers, and fostering a synergistic environment geared towards academic success. Dufour and Eaker (1998) argue that the most promising strategy for sustained, substantive school improvement is developing the ability of school personnel to function as professional learning communities.

## Exploratory research questions

1. How does my perception of the potential benefits of a Professional Learning Mathematics Community align with existing literature?
2. What are the beliefs and attitudes of Mathematics teachers towards participating in a PLMC?
3. What are the teachers' expectations from this community?
4. What insights are provided by the results of students in Mathematics regarding their comprehension of the subject?

## Methodology

Employing a triangulation approach, the methodology combined qualitative and quantitative data sources to effectively address the research questions. Consent was obtained from all participants, including teachers and mathematics experts before commencing with research activities. For students, parental/guardian consent was obtained. Participants were briefed on the research's purpose, their rights, and data handling procedures. Furthermore, participants were reassured that data would be treated with strict confidentiality, and personal information kept anonymous to protect privacy.

The research began with a literature review of a minimum of six scholarly articles on PLMCs. A reflective journal documented the alignment between the researcher's perceptions and existing scholarly discourse. Focus group discussions with all eight middle school Maths teachers disclosed their beliefs, attitudes and expectations regarding the PLMC. A survey questionnaire further captured these aspects, while in-depth interviews with an O Level Maths teacher and the Mathematics Subject Lead provided additional insights.



Figure 2: Focus group discussion with students

Mid-year and End-of-Year examination results of Middle school in Maths were analysed and compared with other subjects to gain insight into students' comprehension. Focus group discussions with students from different ability groups offered perspectives on their understanding of Mathematics and influencing factors.

### Key findings from exploration

The researcher's perspective on Professional Learning Mathematics Communities (PLMC) aligned with the existing literature. Through learning communities, teachers gained deeper subject understanding, experienced professional renewal, and adapted more swiftly. The impact extended to staff satisfaction, higher morale, reduced absenteeism, and improved teaching in the classrooms.

Feedback from teachers highlighted the efficacy of PLMC in promoting collaboration and enhancing teaching methodologies. Results from the questionnaire and expert interviews demonstrated strong enthusiasm, with teachers anticipating improved instructions, inclusion and enhanced pedagogical techniques. The Mathematics Subject Lead foresaw PLMC as a structured collaboration to enhance subject knowledge, particularly in geometry teaching. Teachers were hopeful to address challenges like student disinterest and finding the subject very difficult through PLMC.

Exam analysis suggested a decline in students' Maths performance. During focus discussion, students emphasised an engaging Maths education including clear explanation of concepts with real-life examples, varied problem-solving methods, and practice worksheets. Students reported the subject becomes challenging when concepts are unclear and demanded more explanation time with effective use of digital technology. Students further highlighted the importance of a positive learning classroom environment, family support, and approachable teachers for effective learning experiences.

### Action plan

#### Phase 1: Build connections

- Ice breaker and goal setting: Build connections through fostering trust and align aspirations with mentors and senior Maths teachers of O level section.
- Mentoring and coaching: Connect middle school Maths teachers for diverse support. This will include:
  1. Introducing Mentoring programme
  2. Conducting Mentoring in action workshop
  3. Code of ethics for mentor and mentee
  4. Pairing of mentors and mentees
  5. Evaluation of mentoring programme.

#### Phase 2: Collaborative action (ongoing)

- Weekly meetings: Senior teachers and mentors join focused discussions on sharing best practices, pedagogy, resources, student engagement and performance.
- Peer observation and co-teaching: Share best practices and receive valuable feedback.
- Resource exchange and workshops: Bridge knowledge gaps across roles and levels.

**'I anticipate PLMC to enhance my understanding of geometrical concepts by exchanging ideas, discussing pedagogical approaches, and challenging concepts, ultimately enhancing my expertise in geometry instruction.'**  
Mathematics Subject Lead



Figure 3: Mentor/Mentee weekly meeting

Phase 3: Continuous growth and sharing (ongoing)

- Data analysis: Track progress
- Adaptive Improvement: Fine-tune based on data, evidence-based decisions, implement, reevaluate, feedback, and needs.
- School-wide celebrations: Celebrate success of students and acknowledge teachers.

### Action plan implementation

The middle school faced three interconnected challenges: an influx of new Maths teachers, disparities in the quality of Maths teaching, and low student performance. To address these issues, a structured mentoring programme was implemented for the four novice Maths teachers.

The first step was to pair veterans with the novices in the mentoring programme. Through this mentorship, inexperienced teachers received guidance on effective instructional strategies, classroom management, and curriculum implementation that fostered in developing them professionally.

In the subsequent phase, each Maths teacher was tasked with self-assessment to identify individual areas of improvement and make action plans outlining strategies for improving their areas of weakness. The school facilitated this process by offering personalised support, resources and professional development opportunities as per their need. This concerted effort nurtured a cohesive teaching environment with a unified set of best practices.

The issue of students' low Maths performance and bridging the gap between the transition from middle school to O level was resolved by incorporating proven strategies for improving student outcomes. Mentors, including both seasoned teachers in middle school and O level school worked collaboratively towards refining teaching techniques, introducing innovative methodologies, and developing strategies to address specific learning challenges faced by students.

### Data collection procedures:

To assess the efficacy of the mentoring programme, a mixed-methods approach was employed. Mentees were required to develop action plans identifying their areas of development and desired support from mentors. These action plans served as a quantitative measure of the programme's effectiveness in enhancing the professional development of mentees.

Mentors and mentees maintained reflective journals throughout the programme, documenting their learning experiences. Qualitative analysis of these journals provided insights into the programme's impact on their growth.

Survey forms were sent to the participants after obtaining their consent to gather insights about their expectations and concerns regarding participation in the mentoring programme. This quantitative data provided insights into the perceived benefits and challenges of the programme. Moreover, quantitative analysis of students' mathematics results was done to measure the impact of the mentoring programme on student outcomes.

Interviews were conducted with mentors and mentees to explore the most valuable aspects of the mentoring programme and identify potential areas for improvement in the programme.

The qualitative analysis of the school's documents helped to appreciate the support and resources provided by the management to address the various needs of the mentoring programme.

The summation of both quantitative and qualitative findings provided a holistic understanding of the mentoring programme's efficacy and impact on teacher professional development and student achievement in Mathematics.

**Being a mentee is inspiring me to achieve my full potential, fostering my personal development and helping me to develop key skills and overcome obstacles.**

**Grade 6 Maths teacher**



**‘It’s immensely rewarding to witness the transformation and success of those I mentor, knowing that I’ve played a part in their development.’**

**Mentor, Grade 8 Mathematics teacher**

### **Key findings**

After eight weeks, mentees through mentor support, achieved over 80% of their set goals. Quantitative analysis of the result of standardised tests conducted by Beaconhouse showed improved performance of students surging from 49% to 73.88%, surpassing the previous year’s national average of 51% to the current 53.28%.

Qualitative analysis of reflective journals highlighted enhanced pedagogy, improved learning outcomes, and sustained professional growth. In a survey, 80% of mentees were optimistic about the programme in enhancing their professional development and teaching practices in Maths. Mentees anticipated support networks, leadership skill development, and constructive feedback from mentors. Mutual respect, trust and effective communication were deemed essential for programme efficacy. Of the mentees, 80% emphasised obtaining feedback from mentors after classroom observations for improved engagement.

The mentor survey showed that all mentors were enthusiastic about improving mentees’ teaching practice and professional development. However, 25% showed concerns related to time constraints, while 75% agreed to guide mentees in Maths teaching, integrating technology, and providing resources. Mentors anticipated improved teaching skills, insight into Maths teaching challenges, and enhanced relationships with colleagues for them-selves. Half (50%) found satisfaction in helping others, boosting their leadership and coaching skills in mathematics.

In the interview, the mentor anticipated improving their own teaching skills and relationships with their colleagues. Mentees valued guidance in pedagogical skills, communication, and overcoming challenges during the interview. Both, mentor and mentee emphasised programme continuity for sustained benefits.

The school facilitated mentorship logistics and resource support. Manuals outlined clear roles of mentor and mentees. Trainings and reading materials offered diverse support and structured sessions.

### **Conclusion**

The research on ‘Enhancing Middle School Mathematics through a Professional Learning Mathematics Community’ reveals significant findings. The exploratory research validated the positive effects of PLMCs on teacher growth and student outcomes through literature review. Feedback from teachers emphasised the efficacy of PLMCs in promoting collaboration, enhancing teaching methodologies, and addressing student disinterest.

Following the exploratory phase, the implementation of action plans and mentoring interventions yielded promising results. After eight weeks of mentoring, mentees achieved over 80% of their set goals. Quantitative analysis showed a remarkable improvement in students’ Maths performance, in standardised test results surging from 49% to 73.88%.

Qualitative analysis of reflective journals further underscored the positive impact of PLMCs, highlighting enhanced pedagogy, improved learning outcomes, and sustained professional growth among teachers. Surveys revealed high optimism among mentees regarding the programme’s effectiveness in enhancing professional development and teaching practices in Mathematics. Mentors also expressed confidence in improving mentees’ teaching practice and professional development.

The research demonstrated the transformative potential of PLMCs in fostering collaborative learning environments, enhancing teaching practices, and improving student achievement. Moving forward promoting trust, sustaining collaboration among teachers, sharing best practices and resources and data driven decisions will be crucial for maximising the long-term benefits of PLMCs in schools.

Moreover, the programme significantly boosted confidence, trust, and collaboration among the Mathematics faculty. Teachers also reported increased enthusiasm and interest of students in the subject, indicating a positive shift in classroom dynamics and student engagement.

Challenges such as time constraints, differences in context were mentioned but were outweighed by the benefits perceived by both mentors and mentees. Furthermore, clear roles, effective communication, and comprehensive support provided by school management resulted in the success of the programme.

In conclusion, the research demonstrated the transformative potential of PLMCs in fostering collaborative learning environments, enhancing teaching practices, and improving student achievement. Moving forward promoting trust, sustaining collaboration among teachers, sharing best practices and resources and data driven decisions will be crucial for maximising the long-term benefits of PLMCs in schools.

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