Developing Creative Math Leadership through the Power of Collaborative Culture

Anjali Khirwadkar [1]
(akhirwadkar@brocku.ca)
Ayse Pinar Sen [1]
Sheliza Ibrahim Khan [2]
Joyce Mgombelo [1]
Brock University, Ontario, Canada [1]
University of Toronto, Ontario, Canada [2]

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This proposal presents the process of building multifaceted math leadership roles among teacher candidates. Drawing on the conference theme, Circles of Resonance in Mathematics, the circle concept (Kennedy & Smolinsky, 2016) offers a framing for the nature of the collaborative and reciprocal interactions that the teacher candidates participated in during this study. For the purpose of our study, the circle concept is considered as an interconnected and unifying learning metaphor. Thus, this metaphor serves our study since the expectations in a math leadership role at the elementary level are growth mindset, teamwork (Mitchell and Rivera, 2023), competence in the subject area (Manno, 2006), compassion (Asamoah, 2023), inspiration, pedagogical expertise, (research), and collaboration (Martinovic and ElKord, 2023).

The researchers present findings from a study conducted at an Ontario university, aiming to develop math leadership skills among preservice teacher candidates (PSTs) in their second-year mathematics methods course. While the study is ongoing, data has been collected over 3 years of cohorts participating in this collaborative learning experience designed to cultivate math leadership. The research questions that were investigated are:

i) How are teacher candidates prepared to become effective creative math leaders in their community through a pedagogical implementation in their methods course?

ii) How collaborative learning experiences when developing a unit plan project and facilitating a professional development webinar can support building creative math leadership skills?

PSTs growth is not just about acquiring aforementioned math leadership qualities but about creatively navigating challenges, adapting to new teaching scenarios, innovating within their teams and developing collectively a creative vision for math education. The Mathematics Education course was designed for pre-service elementary teacher candidates who use collaborative leadership to create a dynamic community for learning. Collaborative leadership entails; continuous interaction among members (discussing, giving feedback, commenting), progression of learning, in a spiral way; allowing each circle of learning to build upon the previous one, and features group work where members are assigned roles working together towards a common goal over a 6-week period (Khirwadkar et al,. 2024).

To examine the development of multifaceted math leadership roles among PSTs, this study adopted the lens of complexity science (Davis & Simmt, 2003), which conceptualizes the mathematics learning environments as a dynamic social system (Reid, 2014). Complexity science considers knowledge construction as an emerging process shaped by interactions between PSTs, social norms and mathematical work and ideas. (Davis & Simmt, 2003). According to this framework, leadership is not a static role but it is a dynamic and evolving role that grows by collaboration, compassion, feedback and shared learning experiences.

A total of 150 PSTs enrolled in the 2nd year of their Bachelor of Education program for Junior Intermediate (G4-9) took an elementary Mathematics method course. The PSTs were organized into small groups to work collaboratively towards their unit plan development and facilitating a professional development webinar for their peers in the critical topic of interest like teaching financial literacy, report card writing, differentiating instructions and inquiry approach to learning mathematics. While working on the unit plan, each group selected their mathematics strand and topics to work on over six weeks, creating a collective unit plan for teaching a particular mathematical concept (e.g., Number Strand, Fractions, Grade 6). The unit plan included; overall and specific expectations (together with those for one grade up and one grade below), a landscape of learning, misconceptions, and a snapshot of lesson plans considering a variety of mathematical tasks, assessment tools, differentiating instructions and the integration of technology in unit planning. In addition, PSTs participated in group peer assessment of their unit plan activities and provided constructive feedback to each other.

Data was collected from the 24 PSTs who accepted the invitation to participate in the study.

Data included an online questionnaire of 11 questions (6 likert scale and 5 open ended). For this paper, data used was from the open ended questions. The data was analyzed using a thematic approach (Braun & Clarke, 2019). Four themes emerged which are leadership skills, math content and pedagogical knowledge, math mindset, and leadership groups.

The findings presented below addressed the research questions listed above. Considering the first research question, PSTs reported that math leadership skills such as gained confidence, planning lessons, differentiating activities for students, collaborating with team members, active listening, problem solving, critical thinking, and developing a collective math vision were evident. The findings addressing the second research questions revealed that collaboration, seeing different perspectives, working on each of the strengths as a team, managing group conversations, bouncing ideas, taking initiative, and taking on parts as per individual skill helped PSTs gain comprehensive understanding for developing unit plan. The findings showed that PSTs significantly increased their confidence in mathematics and self-identified themselves as experts and leaders in the math concepts they collaboratively learned and taught, in the workshops. Some participants shared their feelings such as; "Leading a webinar gave me more confidence in leading a math activity" and "My confidence levels have grown over my time in this course. I can use this to take on math leadership roles at my future schools." These research findings indicate the importance of collaborative culture as PSTs acquired creative collaboration and leadership qualities.

To conclude, this study highlights the relevance and importance of connection much like the healing circle concept to foster creative math leadership. In connection to the circles of resonance in mathematics, this study draws on the circle concept (Kennedy & Smolinsky, 2016) as a metaphor for understanding the interconnected and reciprocal nature of math leadership development which has been well demonstrated through the findings of the study indicating how working in small groups, collaborating, sharing practices, ideas, brainstorming, and giving feedback to one another to build their strengths develop their leadership in a spiral way.

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