Teachers as Change Agents: The Role of Social Capital

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Teachers play a crucial role as change agents in schools; however, research rarely positions teachers as the implementers of reform. Teachers in classrooms understand the complexity of their context and are well positioned to adapt professional learning to implement change in their schools. Multiple case study, one in Australia and one in Norway was used to investigate the most significant change and the role of social capital in implementing this change. Findings showed when teacher leaders had social capital, they could support colleagues to implement changes in mathematics teaching. This highlights the importance of nurturing networks of teachers' relationships.

Teachers play a crucial role in implementing change within their schools; however, research describes this change as generally imposed upon them by school leaders, curriculum designers or policy makers rather than being instigated by teachers themselves (Brown et al., 2023). Teachers in classrooms understand the complexity of their context and are well positioned to adapt professional learning to implement change in their school. In this project the teachers, one in Norway and one in Australia sought the professional learning themselves to implement change to mathematics teaching in their own school.

Reports from Australia (Merlo (Centre for Independent Studies), 2024; Australian Education Research Organisation, 2023; Hunter et al. (Grattan Institute) 2025) are urging policy makers to adopt more traditional teaching methods. This aligns with a broader international trend mandating explicit instruction (e.g. State of New South Wales, 2024) and more traditional teaching practices. Also, Australia's severe shortage of mathematics teachers means that less than 25% of year seven to ten students have a qualified teacher each year and the situation is worse in rural and remote locations (Australian Mathematical Sciences Institute, 2018). These out-of-field teachers need support with "relevant, high-quality training and educational materials to assist their ability to inspire, empower and educate students" (Australian Academy of Technological Sciences and Engineering (ATSE), 2022, p.14) mathematically in contextually and culturally appropriate ways particularly in regional, rural, and remote locations. (ATSE).

Queensland's Department of Education's (DoE) *M in STEM* project includes mathematics educators working with clusters of schools across Queensland to improve mathematics teaching, particularly supporting out-of-field teachers to engage students. Explicit instruction conflicts with the aims of *M in STEM*. The first author was a critical friend in *M in STEM*.

The Norwegian Directorate for Education and Training introduced a Teacher Specialist program where mathematics teachers studied at the university to lead professional development in their schools. In Norway's egalitarian society there is a flat organisational structure allowing teachers autonomy to choose how to best teach the mandated curriculum, hence these Teacher Specialists were not well received. Hoem et al. (2017) argued that Teacher Specialists need to be supported during their studies to become change agents in their schools. Although teachers have autonomy in how to teach, the mandated Norwegian curriculum requires development in competences like inquiry, reasoning, and argumentation, which conflicts with explicit instruction. The second author was a teacher educator with this Teacher Specialist program.

The research investigated the teachers' role as change agents. Collecting significant change stories from participants in these projects has allowed the identification of not only what the change to mathematics teaching was but also what contributed to this change, including the

(2025). In S. M. Patahuddin, L. Gaunt, D. Harris & K. Tripet (Eds.), *Unlocking minds in mathematics education. Proceedings of the 47th annual conference of the Mathematics Education Research Group of Australasia* (pp. 293–300). Canberra: MERGA.

participants' social capital. The research questions addressed are: *What was the most significant change arising from the teacher's choice to engage in the Professional Learning? How did social capital support the changes in these schools?*

Theoretical Background

Teachers play a crucial role as change agents in schools, influencing educational reform beyond their classrooms. However, current literature predominantly positions teachers as implementers of top-down change, neglecting bottom-up reform possibilities (Brown et al., 2023). Effective teacher leaders can create new cultures of support, lead collaborative inquiries to improve teaching effectiveness, and maintain ambitious instructional practices (Brondyk & Stanulis, 2014). These leaders may be looking to either influence, "indirectly altering another's practice by informing their thinking in ways that shape what they do" or change by intentionally steering others to implement a particular practice (Cooper et al., 2016, p.88). When teacher leaders are teaching in classrooms, they understand the complexity of teaching and so are well placed to model and adapt content specific pedagogies to their context (Wenner & Campbell, 2017) but need a 'means to influence' as well as 'engage in actions' that will support colleagues to change their practice (Cooper et al., 2016).

Research suggests that social capital plays a crucial role in supporting teachers to implement change and improve their pedagogical practices. Social capital can be defined as "the mutual sense of reciprocity and trust which enables groups of people to live and work together successfully" (Australian Institute of Family Studies, 1998). Within schools, social capital comes from the networks of relationships between the teachers. In Li & Choi's (2014) study social capital, including collegial trust, access to expertise, and willingness to take risks, had a strong direct effect on teachers' self-perceived changes in their pedagogical use of technology. The trust built between teachers means that they can rely on one another for support and social influence may emerge from the interactions between teachers (Uekawa et al., 2006). Comprehensive school reform can increase social capital among teachers, which in turn mediates the influence of reform on teachers' pedagogy (Uekawa et al., 2006). Cooper et al. (2016) suggested that teacher leaders guide change by focusing on teaching and learning, productive and trusting relations with both formal and informal support.

Teachers who are most capable of acting as change agents have social capital (Brown et al., 2023). There are two types of social capital 'instrumental' social capital which includes the ability to give advice, problem-solve, and can support colleagues to achieve specific goals, and 'expressive' social capital - trust, encouragement, and support (Tomanovic, 2012). These teachers can depict their desired change as attractive to and achievable by others (Brown et al., 2023). Participation in professional learning networks allows teachers to cultivate new pedagogies which they share with colleagues. (Wenner & Campbell, 2017).

Research has shown that professional learning is more effective when it takes place within school settings, allowing teachers to test and refine ideas in their own mathematics classrooms while collaborating with supportive colleagues to discuss challenges and solutions (e.g., Loucks-Horsley et al., 2003). This was particularly so when the professional learning focussed on content knowledge and ways to support students learn this content, provided opportunities for participants to plan how to implement ideas in the classroom using the curriculum, and discussed outcomes with colleagues (Garet et al., 2001).

Research Design

Multiple cases can shed light on a phenomenon (Stake, 2006). In this study, we present two cases of teachers who have enacted bottom-up change to mathematics teaching in their schools: one conducted in Australia (Case 1) and the other in Norway (Case 2). The study compares the

findings from these two projects to explore similarities and differences in the ways teachers drive change within their respective educational contexts.

Context

Case 1 is investigating *M in STEM* run by DoE in Queensland. Teachers in schools identify a problem of practice in mathematics teaching within their school, or cluster of schools and register to participate and enact change in their school. Professional learning is run by DoE and each cluster of schools is assigned a university-based researcher as a critical friend. *M in STEM* aims to support the improvement of mathematics teaching, particularly for out of field teachers.

Case 2 is a professional development course in the Teacher Specialists Programme in Mathematics in Norway. The participants work in schools whilst taking this master level course, *Selected professional-relevant methods and perspectives on learning*. Participants must have at least five years teaching experience and a minimum of one year study in mathematics. The course aims to provide insight into various ways of leading professional development among colleagues, in addition to relevant learning theories and research methods in schools.

Participants

Sarah who led the project in her school was from a rural school in Queensland participated in a 20-minute interview. She is a primary trained teacher who had moved to teaching in secondary schools and was new to acting head of mathematics. Two out of field teachers, Anne and Chloe, and an experienced mathematics trained teacher, Ben, participated in a 25-minute focus group. Pseudonyms have been used.

Mary (pseudonym) is one of the students in the Teacher Specialist programme in Norway. She is an experienced teacher working at a Year 5-10 school in Norway. After the Teacher Specialist programme, she continued with a master's thesis in mathematics education.

Data Collection and Analysis

A semi-structured interview with Sarah and a focus group with three teachers who had worked with Sarah were conducted face-to-face using the Most Significant Change (MSC) methodology (Davies & Dart, 2005). This methodology asks interviewees to tell a story that illustrated the most significant change they observed whilst participating in the project; why the story was significant to them; and how participation in the project contributed to a change in their or the school's practice. Focus group participants were then asked to build a single story that best described what aspect(s) of their involvement with *M in STEM* led to the most significant changes in their own mathematics teaching practice or mathematics teaching within their school. The audio recordings were transcribed by otter.ai and checked for accuracy.

Mary's written reflections during the Teacher Specialist course and during her master's thesis are used in this paper. In addition, the second author interviewed her about Significant Changes from her perspective.

The data were analysed thematically using Braun & Clarke's (2022) six steps. In this paper themes related to problem of practice, most significant change, and social capital are presented.

Findings

Results are presented under problem of practice, most significant change, and social capital.

Case 1

Problem of Practice

Sarah saw the *M in STEM* project advertised and thought it was an "opportunity to improve the results in maths" by getting support for the school's problem of practice; students were not

engaging in mathematics; hence the school's results had been falling for several years. Sarah aimed to involve the feeder primary schools to smooth the students transition to the high school.

Most Significant Change

Sarah described the most significant change as the enthusiasm of staff which boosted student engagement. The teachers introduced Problem Solving and Modelling Tasks where students completed real world problem solving or mathematical modelling tasks. An excursion was included in each of Year 7, Year 8, and Year 9. The Year Nine students were investigating the statistics in football and travelled to Brisbane (100 km by bus) to see an evening game in the National Rugby League competition involving the Brisbane Broncos.

> I think the enthusiasm of the staff. So, because we focused on engagement, … and introducing, like the football trip to boost engagement, the talk amongst the staff in the department has become more positive and wanting to be involved, ... hoping to translate through to the students. (Sarah)

Anne thought the most significant change was Sarah's willingness to include new ideas so that her teaching now included group work, contexts, and less use of textbooks.

> Sarah being so involved in it, her filtration down to us, and her willingness to incorporate new things, like Building Thinking Classrooms … My pedagogies have changed, more group based, more context-based type stuff, just like less textbook. … Students responded to them. (Anne)

There was also discussion about the connection with the primary schools, even though they did not participate for long, that helped the secondary teachers to get a better understanding of where the students had come from mathematically that made the difference in their practice. Anne said she was "a little bit more patient" now since hearing about behaviours and "how they structure their maths" in primary school. Chloe said she was "thinking more about, like, what the gaps were … instead of just assuming that they [students] knew it".

Reflecting on her engagement with the project Sarah said the best part was the teachers and the students enjoying and engaging with mathematics.

> I enjoy maths but seeing it in my teachers and seeing it in the kids. Even getting back to the football trip, you know, very simple idea to engage students to see real life context of the maths (Sarah)

Ben reflecting on the project said it was teachers "being willing to accept that there are other ways to do things" which has led to more engagement of teachers and students. Anne's reflection included teachers "more willing to learn, more willing to try new things, … maths having this changed mindset that's focused on engaging with kids."

Social Capital

It was Sarah's relationship (social capital) with the Year 9 teachers that encouraged them to respond to the email expressing interest. The principal's trust (social capital) in Sarah allowed her to introduce the mathematics excursions including taking all the Year 9 students to an evening game of football.

Project teachers at the school received support from the DoE facilitators of *M in STEM* over the two years through professional development and follow-up support for Sarah. In this way they were extending their network (social capital).

> I've spoken to [the facilitators in DoE] a fair bit emails just coming across certain questions I've had, and then they've been in meetings where it's like, Oh, hey. Quite supportive, like the Peter Liljedahl stuff [*Building Thinking Classrooms* (Liljedahl, 2020)], they were there. I meet up with them, so in terms of their support, like the encouragements there, like, how's everything going?

There was also support from a university-based critical friend as part of the project with conversations, resources, readings, and professional development (PD) targeted to the needs of teachers in the cluster schools, once again extending their support network (social capital). Sarah acknowledged the value of her critical friend and how she should have utilised her more while the teachers acknowledged the usefulness of the critical friend's PD.

> I love [my critical friend] … You're actually coming out and seeing us in our environment, and meeting more than just me, … you're giving us the additional information and the prodding for thinking, and the support that you know, the offer of support that it's there, (Sarah)
>
> You did have your PD that you have with us one staff meeting that was, that was useful. (Chloe)

Sarah and the teachers, Anne, Ben, and Chloe describe the expressive aspects of social capital (Tomanovic, 2012) - trust, encouragement, and support that there is within the teachers in the mathematics department as well as the network with the feeder primary schools. *M in STEM* provided opportunities for Sarah to build her own instrumental social capital by being able access the *M in STEM* project team and a critical friend for support.

Case 2

Problem of Practice

Mary is a teacher working at a small primary school in Norway. Mary chose to participate in the Mathematics Specialist Program as mathematics is the subject she enjoys teaching the most, and she has previously had some mathematics coordinating roles amongst her colleagues.

> I hope that the study will make me a better supervisor for colleagues and contribute to my ability to develop mathematics as a subject at the school I work at. I also hope that the study will make me better equipped to tackle the new and exciting curriculum. (Mary)

Mary's description of her work environment was positive and collaborative. Students in this course described their schools' problems of practice, and Mary described an issue that some colleagues were not as committed as others and how many changes were introduced at once.

> Too many focus areas or new projects at once leave little time in a hectic everyday life to really get to grips with the new. This often means that you only do the minimum of what you must, and do not fully get the "new" under your skin. (Mary)

Mary's description of her workplace was a good collaborative environment, and a principal who wants her to take a leading role among colleagues. This seems to provide a solid foundation for her to utilise learning from the Teacher Specialist course where she gained more insight into how she can lead her coworkers in developing their mathematics teaching.

The Most Significant Change

Linda noticed significant change during her collaboration with Mary, both as a teacher educator during the Teacher Specialist course and as her supervisor of her master's thesis. During the Teacher Specialist course, the students were expected to lead Lesson Study (Lewis et al., 2019) development in mathematics at their workplace. This way, the students learned about a method for professional development at the same time as they conducted it in their workplace. Lesson Study was chosen, because it is a bottom-up change where the teachers themselves are challenged to identify what part of their teaching they want to further develop. Since leading Lesson Study development in their workplace was a compulsory task in the course, they were given the opportunity to deviate from the method if they could reflect on what they gained and what they lost by these choices.

In Lesson Study teachers work together to improve their teaching and share responsibility for teaching and outcomes. In Mary's case, she was one of the students that chose to deviate from several of the key components of Lesson Study by: doing the teaching herself instead of drawing among all teachers who would teach in the end and providing all the theory and resources for the group of teachers. According to Mary, she made these choices so as not to burden her colleagues unnecessarily with her assignment. However, as she reflected on it, she realised that her colleagues lost ownership of the Lesson Study.

After the Teacher Specialist course Mary decided to write a master's thesis. She made it clear from the beginning that the research would have to be something that could benefit not

just herself, but also her school colleagues. She chose to conduct action research in collaboration with five of her colleagues, where the aim was to further develop their competence in orchestrating productive whole class discussions. When Mary was evaluating how this research went, she described her colleagues' reactions as positive. They experienced it as useful and that it increased their professional and pedagogical knowledge.

From the Lesson Study assignment in the Teacher Specialist course, to how she led professional development at her workplace in the master thesis, is considered a significant change. Although both interventions had the possibilities for teachers' autonomy in the project, Mary was more worried about adding to her colleagues' burden, than to seeing the value that such a collaboration could be for them. This had changed when she started on her master's thesis. To get five colleagues at a small school to put in the work and effort as they did in the action research, is impressive. There seemed to have been a change where the teachers wanted to work on this type of professional development together.

Mary described this change as related to time. When they were doing the Lesson Study, they did not have allocated time for the project from their principal. However, when she conducted her master project, she included colleagues and leadership in the process and decision making from the beginning. They had time set aside, and the action research was conducted over a three-month period, which gave the participants time to delve into issues on how to lead productive whole class discussions in a mathematics classroom.

Social Capital

Mary describes a school where the expressive aspects of social capital is part of the work environment and she therefore has trust, encouragement, and support among colleagues. However, she seems to have less security in her own instrumental social capital. The change from trying to lessen the workload on her colleagues during Lesson Study to involving them deeply in her master's project, means she is gaining confidence that she can provide advice and support colleagues to achieve specific goals. This is the second type of social capital described by Tomanovic (2012). At the same time, when Mary describes how her colleagues talked about the master's project and why they felt it was successful, they are mostly referring to issues related to expressive aspects of social capital. Mary's colleagues point to how this project felt safe and had a low threshold, because it was led by a colleague. According to them, external resources do not always understand what it is like at their school. Mary is also experiencing that her participation in the Teacher Specialist course has provided her more trust among colleagues, because she can bring something to the table.

Discussion and Conclusions

This multiple case study investigated how teachers can lead bottom-up change in their schools. We found that these teachers utilised their social capital to lead change in their schools.

In case 1 Sarah had identified the problem practice as the lack of student engagement and hence the school's falling mathematics results. In Case 2 Mary identified the problem of practice as a principal who signs the school up for too many initiatives, leading to some teachers choosing only to do the bare minimum. In both cases there was a lack of engagement by some of the teachers of mathematics. In the Norwegian case the principal was directing too many projects for the staff to engage with whilst in the Australian case, the principal was not directing any. In both cases the teachers chose to participate in a teacher-initiated project that made a difference in their teaching practice similar to Cooper et al. (2016).

In Case 1, by implementing real world problem solving and excursions for the younger students (Case 1), teachers' enthusiasm for mathematics increased and was followed by student engagement. Sarah had built the trust and relationships (social capital) (Li & Choi, 2014;

Uekawa et al., 2006)) with the Year 9 teachers so that when they were asked to participate, they readily agreed. These three teachers had a tight network (social capital) which meant they joined the project together to support each other. Together the teachers decided that it was Sarah's social capital - leadership, willingness to take a risk and encourage teachers to try different pedagogies, including real world problem solving and modelling, group work, and less use of textbooks that was the most significant change from the project. Accessing professional learning for her teachers through *M in STEM* which included the *Building Thinking Classrooms* (Liljedahl, 2020) PD and their critical friend, Sarah ensured they had the support (social capital) they needed to make changes to their mathematics teaching. The changes to teaching practice led to more engagement of students and teachers. Sarah had the confidence and expressive social capital within her school initially and developed her instrumental social capital through *M in STEM* by utilising the project team and her critical friend for staff professional development and advice to support her teachers change their practice.

In case 2 the significant change was in Mary's confidence and social capital to lead an action research project on orchestrating whole class mathematical discussions. Originally, she had tried to support (social capital) her colleagues by relieving the burden of Lesson Study (Lewis et al., 2019) but realised that it reduced their opportunity for learning. With the action research project Mary supported her colleagues (social capital) to participate fully. Mary's instrumental and expressive social capital are intertwined. While she described elements from expressive social capital as being part of her workplace prior to Lesson Study, these are further emphasised as Mary developed her instrumental social capital in the Teacher Specialist course.

Social capital supported the teachers in these studies to successfully lead change in mathematics teaching within their schools. These schools had networks of productive and trusting relationships between the teachers which Cooper et al. (2016) suggested leaders need to enact pedagogical change. These schools also had environments where teachers were allowed to take risks and try different pedagogies and there was access to expertise through the teachers leading the change similar to Li and Choi's (2014) study which highlighted the importance of social capital (collegial trust, access to expertise, and willingness to take risks) on teachers' self-perceived changes in their pedagogies. These schools were not in a situation where a specific pedagogy was being imposed (for example, Australian Education Research Organisation, 2023; State of New South Wales, 2024)

These findings are significant as they highlight the importance of both expressive (trust, encouragement, and support) and instrumental (ability to give advice, problem-solve, and goal achievement support) social capital (Tomanovic, 2012) for teachers leading bottom-up change as identified by Cooper et al. (2017) and Brown et al. (2023). The teacher leading the change needs an environment of trusting and supportive relations between themselves and the teachers that allows for risk taking as well as the ability to seek and give advice, problem-solve, and support colleagues achieve the chosen goal. Without this social capital leading change within a mathematics department would be very difficult. Social capital also has implications for those who support teachers to enact change in the schools. We acknowledge this is a small study and we are continuing to further research.

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