Local Evidence Synthesis on Teacher Learning
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The Office of Education Research (OER) as the National Institute of Education’s (NIE) key research arm, has been committed for the past 12 years to leading NIE’s efforts in providing research on education that is timely and relevant to Ministry of Education (MOE) officials, policymakers in government and other ministries working on related issues.

The aim of the Local Evidence Syntheses Series (LES) is to make the results of our research available in a concise and digestible manner in order to inform policy formation, programme design and pedagogical practice in the education realm in Singapore. It does this by synthesising our research that is funded by the Education Research Funding Programme (ERFP) according to key themes of domestic interest and according to how they contribute to their specific fields of research. Each synthesis will highlight key insights that emerge from the projects and future directions are also sought from authors to suggest what we can do or look out for in order to bring our education system to the next level.

Much of this research represented the baseline research and designed interventions that were crucial in our formulation of the Scaling Change through Apprenticing and Ecological Leadership (SCAEL) model. They allowed us to see how comprehensive and sustainable scaling of system change is not a simple process of multiplication. Through these projects, we gained an appreciation that every context differs.

This research also prompted us to formulate the 4-Lives framework to encapsulate our present challenge to bring the Singapore education system past its focus on Live Deep education. These projects have propelled our research forward in search of ways to develop Life Long, Life Wide and Life Wise education to prepare Singaporean students for the future.

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INTRODUCTION

What is teacher learning?

Research on teacher learning examines the various discourses and practices that are related to how teachers develop their professional knowledge, skills and dispositions to become more effective in classrooms. Not only do teachers develop professionally during their pre-service education, they also continue to learn from their own practice and with their peers while they are in the service. Teacher learning varies in form and nature – from workshops to learning communities, from self- and collective reflection of their day-to-day teaching to systematic inquiry of their pedagogical practices. Inherent in this process of teacher learning are issues of teacher agency, dispositions, and identity that are often discussed, investigated and interrogated.

Research on teacher learning is important because it supports teachers’ efficacy in classroom instruction and consequently, their students’ learning outcomes. Literature on such work has consistently pointed to the significant association between the quality of teaching and students’ achievement. What teachers know, do, and care about accounts for about 30% of the variance in students’ performance\textsuperscript{12}. Having well-prepared teachers can have a stronger influence than student background such as poverty, language background, and minority status\textsuperscript{6}. In brief, teacher learning is a significant lever in enhancing the quality of an education system.

Scholars have advocated for various modes of effective teacher learning to bring about more effective, adaptive, and confident teachers\textsuperscript{1, 2}. For example, some \textsuperscript{5, 13} recognise the potential of job-embedded learning where teachers construct their understanding of teaching and learning through their daily practices. Others suggest collaborative learning through sustained engagement in learning communities\textsuperscript{4, 9, 15}. Some researchers have also examined the relationships between teacher knowledge bases (e.g., content knowledge, pedagogical content knowledge) and instructional
effectiveness on various student outcomes\textsuperscript{3, 20, 11, 14, 15, 16}. More recently, there is emerging evidence showing that careful design of teacher learning programmes to foster adaptive expertise can allow teachers to improvise on what they have learnt, thereby adapting their instruction to their learners and their learning contexts \textsuperscript{5, 7, 13, 15}. International research literature\textsuperscript{4, 10, 16} has revealed that high-quality teacher learning programmes afford teachers

- deeper understanding of the subject matter they teach and of how students think of and learn the subject matter;
- multiple opportunities to engage in exploration, reflection, and discussion;
- activities that attend and respond to student thinking;
- constructive and non-prescriptive feedback on tasks they perceive as relevant; and
- contexts for collegial sharing, collaboration, and follow-up support for an extended period of time.

In view of the significance of teacher learning, it is imperative to take stock and reflect on the findings of local research in this area so as to advance developments at various levels: policy, research and practice. The rest of this report will focus on the salient findings from local research on teacher learning that NIE academics and researchers have undertaken in the past ten years.
Current State of Research on Teacher Learning

45 ERFP studies related to teacher learning were completed between 2008 and 2018.

About S$7.3M or 9% of 2nd and 3rd tranche ERFP approved funding was spent on teacher learning research.

50% of these studies were Tiers 2 and 3.

3 in 4 of the studies examined in-service teacher learning.

Most of the studies were Baseline and Exploratory. They examine how teachers are prepared as classroom teachers and as professionals.
In summary, the current state of research on teacher learning can be developed further, particularly in its uptake and translational value. Globally, research has shown that teacher education remains an important area of focus for improving education systems. Provision of research-rich environments (e.g. schools and colleges) are likely to enable teachers (and consequently their students) to self-evaluate and self-improve. Indeed, the research landscape for constructing impact in teacher education is increasingly interdisciplinary, agentic, collaborative and international. It is worth noting that universities in the United Kingdom and European Union are investing significant amount of funding in teacher education. Moving forward, continuing support and resources at NIE will be put in place to help researchers to identify more targeted lines of inquiry to deepen the indigenous understanding of teachers and teaching in Singapore.

REFERENCES


There were 13 studies that examined teacher learning among pre-service and beginning teachers.

**Pre-service teacher education prepares teachers adequately but theory-practice nexus could be strengthened further.** Surveys, conducted in four consecutive studies by a research team over the past decade, consistently revealed that pre-service teachers believed that having a firm grasp of content knowledge, pedagogical content knowledge, and classroom management skills was indispensable in preparing them to be effective classroom teachers. Two studies, which were also undertaken during this period and compared Singapore pre-service Mathematics teachers against 16 other countries, affirmed this importance; researchers found that test scores of content knowledge and pedagogical content knowledge among Singapore pre-service teachers generally outperformed those of their international counterparts. In fact, surveys from one cross-sectional and longitudinal study showed that competencies acquired by beginning teachers during their pre-service programmes remained fairly stable even after two years of teaching. However, retrospective accounts from beginning teachers showed that equipping them with a combination of contextual knowledge of teaching and knowledge about learners in local classroom settings was equally important. This insight suggests that the existing theory-practice link could be strengthened further.

See details of projects 1, 2, 19, 21, 45 on pages 15 to 19

**Supportive school environment, especially structured mentoring helps initial transition but there is uneven provision.** In a cross-sectional longitudinal study on pre-service teacher education, it was reported that having a supportive environment in schools helped beginning teachers in communicating with parents and managing stress, time, and students in class. In particular, schools which placed emphasis on mentoring pointed out that provision of timetabled time for mentoring conversations and lesson observations were most appreciated by beginning teachers. However, these provisions for mentoring beginning teachers was not uniform across schools. Five out of 16 beginning teachers reported not having designated mentors; only half of the 16 schools had structured mentoring for beginning teachers. In view of such constraints, future research may examine how beginning teachers can be better supported and how they can apply what they have learnt at NIE to their early career.

See details of project 22 on page 17

**More opportunities for authentic learning are needed for pre-service teacher education.** In a cross-sectional longitudinal study on pre-service teacher education, pre-service teachers in Singapore appreciated a stronger theory-practice link in their course of preparation to become teachers. This study also noted that pre-service teachers were most interested in the practical aspects of their learning, including how their life experiences could be drawn upon as resources for learning. Pre-service teachers also preferred group work and collaborative learning set in the authentic contexts, and welcome more opportunities for deep reflection. Their learning appeared to be most impactful when their teacher educators modelled the pedagogical practices from classroom and school setting. Unfortunately, such occasions were often found to be limited.

See details of projects 4, 7, 20, 21, 22 on pages 15 to 19

**Contract teaching experiences are valuable and makes a difference on pre-service teacher learning.** Interviews with pre-service teachers who had contract teaching experiences revealed that they generally viewed competencies like pedagogical content knowledge, classroom management,
and assessment, more positively. Student teachers reported that contract teaching provided them with the opportunity to learn about the realities of school culture, and to challenge, clarify, change, or consolidate their prior beliefs about teaching, learning, and students. This unique arrangement of contract teaching in the Singapore education system, which allows potential teachers to experience teaching as a profession for a sustained duration before deciding on teaching as a career choice, is novel in the international educational landscape, and thus, could serve as a model for teacher recruitment.

*See details of projects 21, 22 on page 17*

To sum up, while current research has largely outlined the state of teacher learning among pre-service and beginning teachers in Singapore, it is beneficial to continue monitoring this and identify areas for enhancement and growth. Some of these areas can include:

- investigating the design of pre-service education programme to utilise the knowledge and experiences of student teachers, and to tap into their problem-solving, reflection and reasoning skills to foster their future readiness as classroom teachers;

- examining the preparedness and efficacy of co-operating teachers to support student teachers;

- studying the effects of helping student teachers to problematise their pedagogical practice as a way of shaping and developing their mental models of teaching; and

- searching for ways to narrow the gap between theory and practice in teacher learning, particularly in the context of applying the Singapore Teaching Practice (STP) to improve classroom teaching, and how STP can be diffused into and across schools.
There were 32 studies providing insights into in-service teacher learning.

In-service teacher learning mainly takes the form of one-off workshops and courses, and learning communities. In a large-scale survey conducted with teachers between 2012 and 2015, about 8 in 10 teachers reported that they attended one-off workshops and about 7 in 10 attended courses. More than half of the teachers were engaged in learning communities. Less than 10% of teacher participants attended higher degree programmes and research related professional development. As collaborative and sustained mode of learning is likely to be more effective in fostering teacher growth as compared to one-off workshops and courses, it is important to investigate the underlying reasons behind the existing patterns of teacher learning from multiple perspectives and how our teacher learning system can better support and encourage the more sustained and collaborative learning mode.

See details of project 4 on page 15

Teacher leadership can be developed through collaborative learning and by leading teacher learning across schools. In a mixed-methods exploratory study on fostering teacher leadership in learning communities across schools, it was found that teachers not only learnt in their practice but their professional identity was shaped by the confidence gained from learning collaboratively. Noticeably, pedagogical leadership in teachers emerged as they conducted trial lessons in their classrooms, reported their experiences back and explained the pedagogies they used. Where there was endorsement by school or cluster leaders for teachers to lead learning across schools, teacher leadership thrived as they interacted and forged relationships with other teachers. More systematic opportunities and support for teacher leaders to lead learning across schools can be beneficial.

See details of projects 24, 39 on pages 15 to 19

Provide opportunities for and competently facilitate investigations, applications, reflections and dialoguing in learning communities. Almost all schools have set up learning communities for teachers to collaborate and learn together. In a large-scale mixed-method study that examined the critical success factors in creating effective learning communities, effective teacher learning was observed when teachers in these communities go beyond the sharing of resources and ideas on teaching. Teachers learnt most when their knowledge on teaching was interrogated, particularly when they were given opportunities to apply what they had learnt, and when they had consolidated their experiences through reflective discussions during the meetings. Importantly, the quality of how teachers learn in communities was strongly dependent on the quality of teacher leaders in facilitating the learning communities. Hence, the success of learning communities hinges on teacher leaders’ capacity to guide teachers in pedagogical inquiry productively and how they are supported in this process.

See details of project 12 on page 16

Promoting reflective dialogues can engage teachers better in learning communities. In a mixed-methods study on learning communities, the frequency of reflective dialogues was higher among teachers who displayed higher engagement in their communities. In such dialogues, teachers resolved teaching and learning issues by listening to colleagues’ divergent ideas and exercising open-mindedness in negotiating ideas. The study also reported teachers tended to develop positive attitudes and value towards reflective dialoguing when there were less power differentials in the superior-subordinate relationships. In such situations, teachers were more likely to take risks in presenting their ideas in a group setting and voice their views on any pedagogical changes. However, more research would be needed to understand how reflective dialogues can be facilitated in learning communities.
Reflection as thinking ... (as a form of self-knowledge) ... has at least three kinds of pedagogical value: (1) with the help of self-reflection the teacher can learn about his or her own teaching practice, (2) self-knowledge makes it possible for the teacher to take a position on his or her own practice, (3) self-knowledge makes it also possible for the teacher to teach about his or her own teaching.

- Bengtsson, 1995

ICT learning community can potentially support teacher learning community in meaningful ways. In an intervention study, researchers built an online learning community among primary school teachers. It was found that teachers who used video cases and an online forum for sharing lessons generated productive discussions. They were motivated to upload their own lessons for colleagues' viewing, critiquing, analysing and providing feedback, all of which exemplify what sharing information in ICT learning communities should be like. Teachers enjoyed learning from other teachers' instructional and pedagogical approaches, and shared frequently how to overcome the challenges of designing ICT integrated lessons. The study also noted that teachers who wrote explanatory notes for their video lessons were more productive in the learning community and deliberate in anticipatory reflection, which consequently enabled them to make interpretive and evaluative stances in their discussions. While ICT learning community offers much potential to teacher learning, one-third of the teacher participants did not value the affordances of ICT nor see the benefits of the use of ICT for teacher learning. This finding suggests that more needs to be done to tap into the use of ICT and to see how ICT affordances can productively meet teachers' learning needs.

See details of projects 10, 34 on pages 15 to 19

In brief, the current research on in-service teacher learning has focused on collaborative learning communities. While there is evidence that this mode of teacher learning is supported across the education system, the depth of such learning remains to be developed further. Future research may investigate how to build a sustainable culture for enhancing the quality of teacher leaders in facilitating teacher learning within and across schools, and the breadth and depth of teacher reflection, including how teachers understand and use reflection to add value to their work.

Future work can also delve into the uses of research evidence to support teachers’ inquiry about their pedagogical practices. Research on mode of teacher learning can embark on examining the process, outcome and efficacy of new ways of teacher learning that involve the use of digital learning, learning communities across schools, in-situ teacher learning, data analytics to enhance teacher learning, and pedagogical decisions making in classrooms (e.g. posing questions that invite critical and creative thinking).
Teacher Capacity

There were 9 studies providing insights into teacher capacity (i.e., knowledge, skills and dispositions).

**Substantial enhancement of teachers’ capacity is key to enacting innovative assessment and pedagogy.** A few studies examined the implementation of formative assessment, designing game-based learning and curriculum innovation. Generally, teachers appeared to lack confidence, self-efficacy and/ or capacity in making assessment and pedagogical decisions. The enablers that allowed teachers to lead pedagogical change in these studies included the use of metalanguages such as curriculum vision and actionable pedagogic discourse to shape shared goals, provision of opportunities to activate teacher agency in making pedagogical decisions, and deliberate effort in forging a school culture for risk-taking. These enablers supported teachers’ work, allowing them to be critical and reflective of their pedagogical practice.

See details of projects 5, 11, 37, 38 on pages 15 to 19

**Teacher pedagogical shift takes time and incremental changes that are not high stakes are more likely to occur.** School leadership and culture were key determinants in influencing teachers’ pedagogical change. Additional to these and other contextual factors, namely policy, and teacher beliefs, work in a synergistic way. An intervention study showed that primary school English Language teachers in a learning community took three years to learn, familiarise, and master pedagogy. In another explanatory study, teachers were found to be more receptive towards incremental changes that were not high stakes in nature. The process to enable teacher change in bringing innovations into their practice was complex. Policy and programme implementers must allow the provision of lead time so that sustained support can be built in for real change to occur.

See details of projects 11, 28, 37, 38 on pages 15 to 19

**Teachers have limited capacity to engage and challenge learners with diverse backgrounds.** While teachers are equipped adequately with sound pedagogical content knowledge and classroom management, they appeared to have limited agility in making pedagogical decisions and learning design to engage and challenge learners with diverse learning needs effectively. Several studies showed that the number of years in teaching also had no bearing on teachers’ capacity to lead change in pedagogical practices. Such evidence suggests the need for teachers to be more holistically prepared with the capacity to differentiate their repertoires of teaching for diverse learners, so as to engage the learners and provide adequate cognitive challenges for all students regardless of the programmes or academic streams the students are placed.

See details of projects 16, 18, 37, 38 on pages 15 to 19

Teachers appear to lack certain knowledge bases to make informed technological-pedagogical decisions. In a baseline study on IT Masterplans, researchers found that teachers were unable to effectively combine their knowledge in both technology and pedagogical content knowledge to design lessons that would level up students’ learning. Similarly, in a mixed methods study, teachers faced challenges in designing integrated lessons that incorporated the use of technology. These studies suggested that teachers lacked the competency to effectively mobilise and conflate knowledge acquired from different domains, and articulated in a coherent manner.

See details of projects 5, 17, 25 on pages 15 to 19

As seen in the account above, studies that examined teacher capacities call for a more dynamic and coherent approach to address issues on finding appropriate enablers to support in their professional growth and developing their dispositions for teaching. Such challenges often involved changes at the individual (epistemic) and school (institutional) levels, and can be relatively complex. Future research can look into designing of interventions or randomised control trial studies to identify factors influencing pedagogical shifts.
Affective Teacher Factors

In understanding how teachers respond to their competencies in classroom pedagogy, there were 3 studies that provide insights into the affective domain of teachers as professionals.

**Teachers of low progress learners have lower self-efficacy in student engagement.** In a baseline study on teacher efficacy that involved the comparison of teachers teaching high-progress and low-progress learners, those who taught the latter group of learners were found to have a significantly lower level of efficacy in three areas: classroom management, instructional strategies and student engagement. Further analysis of classroom lessons revealed that teachers with low efficacy demonstrated fewer strategies than those with high efficacy level, particularly in student engagement. Crucially, the study pointed to the need for equipping teachers of low progress learners with knowledge about their students (e.g. learning needs and behaviours) and to support them in managing their learning.

*See details of project 16 on page 16*

**Teachers frequently defer to organisational hierarchy rather than adhere to their own professional judgement to inform their learning needs.** In a large-scale study on teachers’ engagement in teacher learning, teachers mostly attended courses approved by school leaders rather than courses that they professionally assessed to be necessary and crucial to their professional growth. Such acquiescence also emerged in a qualitative study on how teachers made ethical decisions, as they became transformational leaders. Teachers were inclined to accept decisions made by school leaders or collective decisions, even if they differed from their own professional judgement. Teachers also abided by the hierarchical structure to inform them of the reasoning. Deference to the hierarchy in matters relating to teacher learning might have led to teachers facing difficulties in seeing how they could be agents of change.

*See details of projects 4, 40 on pages 15 to 19*
RECOMMENDATIONS

How can the system do better?

Based on this synthesis, there are three key areas related to teacher learning that would be of interest to NIE and MOE.

**Privilege problem-centred approach and deliberately design learning with authentic contextual issues to enhance pre-service programmes.** The local research evidence shows that the pre-service programmes have provided pre-service teachers sufficiently with a solid content knowledge and pedagogical content knowledge to begin their teaching career. This is particularly so for those with contract teaching experience. However, in becoming future ready educators, the pedagogies of pre-service education programme can be re-designed, framed by tapping into pre-service teachers' existing life experience and knowledge to acquire new learning, including problem-solving, reflecting, and reasoning skills. Designing learning in authentic situations may enable pre-service teachers to identify classroom issues and see multiple possible solutions that they would encounter when they enter the service in school and classroom settings. Teacher mentors can play a significant role by engaging pre-service teachers in deconstructing and analysing practical experiences such as reflecting on authentic pedagogical and classroom management issues. Such learning contexts can enhance the knowledge bases and enable student teachers to navigate the changing educational landscape. However, since experience alone is not sufficient in developing skills to facilitate and mentor beginning teachers’ learning, teacher mentors should also receive appropriate professional development to restructure and expand the repertoires of their expertise. Additionally, the pre-service programme might consider group mentoring over and above the one-to-one mentoring to support pre-service teachers’ learning. The present enhanced Post-Graduate Diploma in Education and other teacher education programmes have utilised these findings and incorporated some of these recommendations into their designs; the impact of the enhancements will be assessed.

**Promote reflective dialogues by enhancing facilitation skills of teachers who lead the professional dialogues to optimise teacher learning in collaborative communities.** Current evidence shows that many schools have provided extensive opportunities and platforms for collaborative learning among teachers. This is a positive development because of the potential benefits for teachers to make preconceptions explicit, and to analyse experiences in the classrooms from this mode of teacher learning. As the extent and quality of learning in these communities varies across schools, the system can do better by enhancing facilitation skills of teachers who lead the professional dialogues. Another approach is to design and embed reflective dialogues and facilitation skills in the daily work of teachers from lesson planning, lesson delivery to the evaluation of their practice. There is also value in studying the growth of teacher knowledge bases and pedagogical knowledge in leading learning within and across schools, and the ways in which teachers draw on these knowledge bases in their practice.
Promote teacher agency and spirit of risk-taking among teachers to encourage change. Changes in classroom practice are largely the results of teacher learning through pedagogical and assessment innovations. Teachers generally can make incremental but not drastic changes, and these changes take time. While the global rate of change is drastic, teachers’ propensity to respond to change tends to be low. The local research evidence on implementing innovations thus far distils some enablers such as the use of metalanguages, embedded opportunities to solve ill-structured pedagogical problems and promote teachers' need to feel the ownership to enact these innovations. Such changes require guidance and immediate feedback to teachers’ modified pedagogical practice. The education system can explore on building teachers' capacity to enact the innovations and allowing teachers the space and time to internalise the innovations in their classrooms by inquiring into their pedagogical practices.

What research gaps exist in our local corpus?

This synthesis of local research evidence in teacher learning surfaced several research gaps that need to be addressed.

What do teachers need to know? Research in teacher learning showed that pre-service teachers benefit from learning knowledge about the context and about their learners, in addition to the knowledge about content, pedagogical content and classroom management. For in-service teachers, they are expected to learn pedagogical knowledge, knowledge about curriculum/task design and technological pedagogical content knowledge. However, we have yet to examine the development and trajectory of teacher knowledge bases from pre- to in-service and how this will inform the kinds of knowledge bases teachers need at different roles and phases of their career. Currently, there has been limited attempt to research about these knowledge bases in the Singapore context. The Singapore Teaching Practice—a joint production between MOE and NIE on teacher knowledge bases—presents a golden opportunity for MOE and NIE to examine if these articulated knowledge bases suffice for Singapore teachers’ needs, and how these knowledge bases can be tapped into further to help in teacher development and growth. Based on the studies, it seems that content knowledge and pedagogical content knowledge acquired during pre-service training are integral for teachers to survive in and to cope with unfamiliar situations in classrooms. Once they can cope with classroom routines, teachers may then search for more pedagogical knowledge for better theory-practice nexus. In view of this, greater emphasis on content knowledge and pedagogical content knowledge can be given in pre-service education and then reinforced with more pedagogical knowledge focusing on linking theory to their practice. This approach appears sound and is worthy of further investigation.
How can teachers learn better? Teachers learn better when they are engaged in systematic inquiry of their own pedagogical practices and curriculum to resolve dissonance in their practice. While much is known about the method of teacher inquiry (e.g., action research, lesson study), less is understood about the actual extent to which teacher inquiry helps in changing classroom practices and influencing student learning. We need to investigate the practice of teacher inquiry to tease out the elements of developing teachers' capacity to reflect and inquire pedagogical practices that are inherent in different disciplinary contents. We also need to examine to what extent and under what conditions the practice would inform us of the specific method to focus efforts and resources on, and finally identify areas for further enhancement.

Are teachers truly learning in learning communities? Further examination of teacher learning in collaborative platforms such as professional learning community within schools and networked learning community across schools can illuminate how such learning relates to teacher expertise. Right now, there is limited evidence measuring the impact on teacher teaching and student outcomes, as well as the association between teacher learning and teacher quality and effectiveness in the context of learning communities. As teachers spend a significant portion of their time participating in the learning communities, and many resources have been invested by the system to support timetabled time for professional learning, it is crucial to determine the impact of this mode of teacher learning. Future research could also design intervention to enhance the inquiry cycle, and deepen teacher leaders’ facilitation skills. Research into the impact of learning communities that are prevalent across Singapore schools would be of direct relevance and immediate utility to the system.

What other emerging competencies do teachers need? Research into the development and growth of teacher professional capital must also take into consideration the mediation of multiple contextual factors, including teachers’ motivation, readiness, and adaptivity. One emerging development in education research literature relates to the adaptivity of teachers; how teachers with a wide repertoire of instructional approaches decide what and when to adapt certain approaches to suit particular situations and learners. The growth and development of professional judgement and wisdom is an evolving journey with its attendant challenges, struggles, and successes.

Furthermore, there is a need to explore and explain the nexus between theory and practice in understanding teachers’ mental models, their reflexivity and reflections. How do teachers’ mental models and the practice of teacher reflection develop professional judgement and increase teacher confidence and efficacy? Such questions can help inform teacher agency and transformational leadership as extant local and international research suggests the intricate relationship between what teachers think and what they do. Teachers’ interpretation of policy and appropriating these policies into valid and cogent ways for their pedagogical practice is imperative and timely. This is due to a lack of balance between institutional and individual needs as schools’ professional development plans do not give sufficient consideration to teachers’ personal needs as well as the diversity of needs among teachers. Research that explores and explains these implicit and explicit dimensions which are nuanced and responsive to contexts at the classroom, school, and system levels is needed. Research along this strand would place NIE at the pulse of education research.
CONCLUSION

In order to have in-depth understanding of teacher learning, research at NIE needs to be coherent, transferable and scalable. One way to address the current state of research in teacher learning is by framing programmatic proposals to achieve the coherence, depth and breadth of understanding. The programmatic proposals will gather a team of researchers with diverse expertise to examine key issues in teacher learning and attempt to answer big questions. Another strategy is to conduct research that is transferable and has impact at the ground level amongst practitioners. This can be achieved by establishing collaboration with practitioners at the zonal level to build teacher leader capacity to use research evidence in their practice. Lastly, NIE research findings on teacher learning curated over the past decade can be scaled by building networks of schools systematically at different levels: system, zone/ clusters, schools, classrooms.
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- school staff developers [9]  
- Math HODs [9]  
- primary 5 teachers [45]  
- primary 5 students [1391] | Quasi-experimental              | 2015               |
| 13 | Ho Li-Ching* jen.tan@nie.edu.sg       | Singapore Teachers’ Perspectives of Diversity and Multicultural Education [OER 15/10 HLC] | Baseline      | 2    | Secondary schools [24]  
Secondary students [60] | Qualitative                    | 2014               |
| 14 | Jennifer Pei-Ling Tan jen.tan@nie.edu.sg | Development of an Outdoor Education Curriculum in Singapore through a “Deliberative” Perspective - Inclusion of the Commonplace of the Teacher [OER 43/12 MT] (Former PI: Michelle Tan) | Exploratory   | 1    | Teachers  
in-service [80]  
pre-service [120]  
Follow-up interviews  
in-service teachers [15]  
| 15 | Jennifer Yeo jennifer.yeo@nie.edu.sg | Designing a Physics Curriculum for Developing Students’ Science Competencies [OER 11/11 JY] | Intervention | 1    | - one junior college (JC)  
- JC 1 students [2 classes] | Design-based           | 2015               |
| 16 | Josh Wang Li-Yi* leong.leong@nie.edu.sg | Teacher Efficacy in the Context of Teaching Low-Achieving Students in Singapore [OER 23/12 JW] | Baseline      | 1    | - secondary schools [34]  
-teachers teaching English and/or Science to NT Stream and Express stream [596] | Mixed Methods, Sequential Explanatory | 2015               |
| 17 | Koh Hwee Ling Joyce*                 | Understanding and Profiling Teachers’ Technological Pedagogical Content Knowledge (TPACK) Development Patterns [OER 12/10 KHL] | Baseline      | 1    | Pre-service teachers [134]  
In-service teachers [165] | Quantitative             | 2014               |
| 18 | Leong Yew Hoong leong.yewhoong@nie.edu.sg | Mathematical Progress and Value for Everyone [OER 09/12 LYH] | Exploratory   | 1    | - secondary school [1]  
- teachers in Math department  
- Sec 1 and 2 NA stream  
- students [140] | Mixed Methods             | 2015               |
| 19 | Low Ee Ling eeling.low@nie.edu.sg     | Building an Evidence-base for Initial Teacher Preparation (ITP) in NIE: A Formative Project [OER 13/09 LEL] | Baseline      | 2    | -pre-service teachers [324]  
| 20 | Low Ee Ling eeling.low@nie.edu.sg     | Building an Evidence-Base for Initial Teacher Education (ITE) in NIE: A Bridging Project [OER 04/10 LEL] | Baseline      | 2    | Survey Respondents  
- PGDE (Sec)  
- BEd (Year 3) student teachers  
Interview Participants  
- student teachers [16]  
<table>
<thead>
<tr>
<th>No</th>
<th>Principal Investigator (PI)’s Contact</th>
<th>Title of Study</th>
<th>Type of Study</th>
<th>Tier</th>
<th>Participants</th>
<th>Methods</th>
<th>Project Closure Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Low Ee Ling <a href="mailto:eeling.low@nie.edu.sg">eeling.low@nie.edu.sg</a></td>
<td>Building an Evidence-Base for Teacher Education - Phase I [OER 15/11 LEL]</td>
<td>Baseline</td>
<td>2</td>
<td>- student teachers (PGDE &amp; Dip programmes) - academics - Survey Participants (n=1037) - PGDE (Sec) (July 2012 intake) Pedagogical characterisation - one class of 25 student teachers (Dip prog and one NIE academic)</td>
<td>Mixed Methods</td>
<td>2014</td>
</tr>
<tr>
<td>22</td>
<td>Low Ee Ling <a href="mailto:eeling.low@nie.edu.sg">eeling.low@nie.edu.sg</a></td>
<td>Building an Evidence-Base for Teacher Education: Phase II [OER 14/13 LEL]</td>
<td>Baseline</td>
<td>2</td>
<td>Survey and Interview Participants - student teachers from BA/BSc (Ed) (July 2010 - 2013 intakes) - beginning teachers (BTs) (primary, secondary and junior colleges) Interview participants - Principals/Vice Principals [10] - School Staff Developers/ HODs from schools where BTs were posted [12].</td>
<td>Cross-sectional and a longitudinal Mixed Methods</td>
<td>2017</td>
</tr>
<tr>
<td>23</td>
<td>Lum Chee Hoo <a href="mailto:cheehoo.lum@nie.edu.sg">cheehoo.lum@nie.edu.sg</a></td>
<td>Images of Practice in Arts Education in Singapore [OER 07/10 LCH]</td>
<td>Exploratory</td>
<td>2</td>
<td>-arts educators/artists [24] -schools [24+1 pre-school, 13 primary, 1 international, 1 tertiary, and 8 secondary schools]</td>
<td>Case Study</td>
<td>2014</td>
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<td>No</td>
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<td>28</td>
<td>Rita Silver <a href="mailto:rita.silver@nie.edu.sg">rita.silver@nie.edu.sg</a></td>
<td>The Impact of Negotiation for Meaning on Reading Comprehension among Singapore Primary Students [OER 29/08 RS]</td>
<td>Intervention</td>
<td>2</td>
<td>One primary school Teachers [11] - school's regular remedial teachers - research team members [2] as teachers in experimental group Students [183] - primary 4 - classes [6]: experimental reading group; structured reading group; lesson as usual group</td>
<td>Qualitative</td>
<td>2012</td>
</tr>
<tr>
<td>29</td>
<td>Rita Silver <a href="mailto:rita.silver@nie.edu.sg">rita.silver@nie.edu.sg</a></td>
<td>Comprehending Reading Comprehension: An Intervention in P4 Reading [OER 09/10 RS]</td>
<td>Intervention</td>
<td>2</td>
<td>one primary school - 3 levels of education (Primary 3, 4, &amp; 5) - teachers [9]</td>
<td>Qualitative</td>
<td>2015</td>
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<td>36</td>
<td>Tan Liang See <a href="mailto:liangsee.tan@nie.edu.sg">liangsee.tan@nie.edu.sg</a></td>
<td>Arts Research on Teachers and Students (ARTS): Pedagogies and Practices, Phase 2 [OER 08/10 LC] (Former PI: Libby Cohen)</td>
<td>Exploratory</td>
<td>2</td>
<td>- principals - dean of studies - heads of department - subject heads</td>
<td>Mixed Methods</td>
<td>2014</td>
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<tr>
<td>38</td>
<td>Tan Liang See <a href="mailto:liangsee.tan@nie.edu.sg">liangsee.tan@nie.edu.sg</a></td>
<td>Curriculum Innovation and the Nurturing of 21st Century Learners [OER 54/12 TLS]</td>
<td>Exploratory</td>
<td>1</td>
<td>Schools [3] Participants -Principals, middle management and teachers -2013 Y1 Express and IP students</td>
<td>Mixed Methods</td>
<td>2017</td>
</tr>
<tr>
<td>39</td>
<td>Tan Liang See <a href="mailto:liangsee.tan@nie.edu.sg">liangsee.tan@nie.edu.sg</a></td>
<td>A Study on Developing Teacher Leadership and Engendering an Emerging Teacher-led Culture [AFR 01/14 TLS] (PI: Tan Liang See)</td>
<td>Exploratory</td>
<td>1</td>
<td>-Principal, Programme Directors and Master Teachers of STAR -Art and Music teacher leaders (about 50 from each group) - 5 Art and 4 Music teacher leaders -cluster workshop participants (subsequently conducted by teacher leaders)</td>
<td>Mixed Method</td>
<td>2017</td>
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<tr>
<td>40</td>
<td>Tan Liang See <a href="mailto:liangsee.tan@nie.edu.sg">liangsee.tan@nie.edu.sg</a></td>
<td>A Teacher-led Interpretation of the Teacher Growth Model: Inquiry into Professional Identity of Singapore Teachers [AFR05/14 LHL] (Former PI: Daphne Lee Hui Lin)</td>
<td>Exploratory</td>
<td>2</td>
<td>101 teacher participants (selected through purposeful stratified random sampling)</td>
<td>Qualitative</td>
<td>Awaiting Closure</td>
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<td>42</td>
<td>Teo Chin Soon Peter <a href="mailto:peter.teo@nie.edu.sg">peter.teo@nie.edu.sg</a></td>
<td>Integrating Classroom Discourse Corpus for Reflective Practice and Professional Development [OER 11/12 HHQ]</td>
<td>Exploratory</td>
<td>1</td>
<td>-primary, secondary schools and junior colleges -English Language teachers [450]</td>
<td>Mixed Method</td>
<td>2016</td>
</tr>
<tr>
<td>43</td>
<td>Teo Tang Wee <a href="mailto:tangwee.teo@nie.edu.sg">tangwee.teo@nie.edu.sg</a></td>
<td>Curriculum Evaluation and Change for a Re-envisioned NIE Chemistry Program [OER 02/12 TTW]</td>
<td>Evaluation</td>
<td>1</td>
<td>- BA/BSc student teachers [104] (Year 1, 2, and 3)</td>
<td>Mixed Methods</td>
<td>2014</td>
</tr>
<tr>
<td>44</td>
<td>Teo Tang Wee <a href="mailto:tangwee.teo@nie.edu.sg">tangwee.teo@nie.edu.sg</a></td>
<td>Design Study Approach to Teacher Professional Development to Support the Implementation of the Revised 2013 Lower Secondary Science Curriculum [OER 10/12 WJS]</td>
<td>Exploratory</td>
<td>1</td>
<td>-secondary schools [4] -a group of teachers from each refined the ICBL package for their students in their class</td>
<td>Multiple Case</td>
<td>2015</td>
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</tbody>
</table>
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