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What Makes Education Research Impactful? Case Studies of Research Projects in Singapore
Qu'est-ce qui rend la recherche en éducation efficace – Études de cas de projets de recherche à Singapour

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Article abstract

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What Makes Education Research Impactful?
Case Studies of Research Projects in Singapore

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Abstract

This study aims to address the gap in understanding the impact arising from education research, researcher collaborations with stakeholders, and knowledge mobilization activities in Singapore. Eight cases of local research projects are used to understand the phenomenon of research impact in different context-specific settings. The findings reveal differing perceptions of impact among research users and researchers, and cohesion on the factors that contribute to research impact. Drawing from the findings, the authors propose three emerging principles that can enhance research impact efforts: a) frontloading the intended research impact, b) building mutualistic relationships, and c) co-constructing research. The findings and emerging questions from the study contribute to the growing body of scholarship to help researchers and stakeholders strengthen the research-practice-policy nexus.

Résumé

Cette étude vise à améliorer la compréhension de l'impact qu'ont à Singapour la recherche en éducation, les collaborations entre chercheurs et parties prenantes, et les activités de mobilisation des connaissances. Les auteurs se fondent sur huit cas de projets de recherche locaux afin de comprendre l'impact de la recherche dans divers contextes spécifiques. Les résultats révèlent des perceptions différentes de l'impact parmi

les chercheurs et les utilisateurs de la recherche, avec en même temps un accord entre ceux-ci sur quels facteurs contribuent à cet impact. Sur la base des résultats obtenus, les auteurs proposent trois principes émergents susceptibles d'améliorer les efforts en matière d'impact de la recherche : a) l'utilité de mettre au premier plan l'impact désiré pour la recherche, b) celle d'établir des relations de réciprocité, et c) celle de coconstruire la recherche. Les résultats et questions provenant de cette étude apportent une contribution au corpus croissant de recherches visant à aider les chercheurs et les parties prenantes à renforcer les liens entre recherche, pratique et politique.

Introduction

There has been increasing demand for education researchers to generate greater research impact. In Singapore, the Ministry of Education (MOE) has also begun to emphasize the need for education research to improve policies, practice, and teacher education. However, not much is known about how research impact is perceived by Singapore's education researchers and key research users (i.e., teachers, school leaders, teacher educators, and policymakers), and what has been done to optimize the impact arising from the research projects. To address this paucity of knowledge, the following two research questions are framed to provide empirical insights and to contribute to the literature by distilling common lessons and good practices across the various "impactful" education research studies undertaken in the Singapore context.

> RQ 1. How do research users and researchers perceive impact from education research conducted in Singapore?
>
> RQ 2. What factors (e.g., approaches, strategies, relationships) contribute to impact?

Research background

This study is both novel and timely for several reasons. First, little work has been done in Singapore on knowledge mobilization and research impact. To date, only Teh, Hogan, and Dimmock's (2013) work features the system's knowledge mobilization efforts and there is little empirical evidence to show if or how such efforts support impact. Second, the study supports MOE's and the National Institute of Education's (NIE) efforts to strengthen the research-practice-policy (RPP) nexus through knowledge mobilization, research partnerships, and the use of research evidence to inform decision-making. It is timely as MOE and NIE, Singapore's only and national teacher education institute, plans for the fifth tranche of education research funding to ensure that educational research is relevant, accessible, and useful for policymakers, schools, and practitioners. Thirdly, this study will provide a greater strategic vision to synergize and mobilize research knowledge and expertise to support key initiatives in the Singapore education system (e.g., situated professional development, professional learning communities).

There has been growing global interest in the field of knowledge mobilization and research impact (Cooper, 2017; Davies, Nutley, & Smith, 2000; Hemsley-Brown, 2004; Malik, 2020). For example, across educational jurisdictions, there have been increasing calls for education researchers to produce knowledge that will provide practitioners and policymakers with an evidence base to inform and improve the quality of teaching and learning (Davies, 1999; Hargreaves, 1996), as well as calls by school leaders for education research to improve the practice of teachers, school leaders, and school systems (e.g., Carr, 2007; Cochran-Smith & Lytle, 2004; Hargreaves, 1996; Stenhouse, 1975). Educational systems have thus encouraged the use of educational research as part of system-wide reform and capacity-building efforts. This has resulted in a vision of research-generated, evidence-based professional knowledge to improve schooling and education at all levels. Much of this work has generated calls for greater knowledge mobilization efforts to ensure research knowledge impacts policy and practice, as well as efforts to better understand the impact of research knowledge.

However, less is known about how educational research knowledge, produced in universities or schools of education, has impacted policy and practice. Despite the calls for research to inform policy and classroom practice (Farley-Ripple, 2020), there is a gap between the scholarly research knowledge produced in schools of education and the types of knowledge that users find relevant, accessible, and useful. Schools of education, like NIE, that are situated within universities are expected to produce research that raises the status and prestige of the university rather than benefit practitioners (Labaree, 2006), while the intended users of educational research, such as teachers, school leaders, and policymakers, may not perceive the relevance or value of this scholarship (Fischman, Anderson, Tefera, & Zuiker, 2018). This study aims to better understand how this gap may be addressed by examining how research users and researchers perceive impact and the factors that contribute to impact.

Notable efforts examining research impact at national levels include Research Impact Canada (2020) and the Research Excellence Framework (2019) in the United Kingdom. These efforts have examined research impact across different disciplines and sectors of society. In response to these efforts, there has also been growing critical research related to the "impact agenda" that highlights the instrumentalization of knowledge and efforts to metricize research impact in corporatized managerial university systems (Machen, 2019). Despite attempts to instrumentalize research, it seldom results in definitive answers to complex educational problems and is only one of multiple factors that shape policy or classroom practice; ideology and dominant discourses, political imperatives, organizational logics, and tacit or folk knowledge, among other factors, may have much greater influence (Nutley, Walter, & Davies, 2007). The multiple case study methodology can enable us to better understand the interplay of contextual factors and research production, mobilization, and usage. Also, while paying heed to these critiques, the authors argue that broader notions of knowledge and research impact derived from this study may have transformative potential for university and education systems through models of engaged scholarship that are more inclusive, participatory, partnership-based, context-sensitive, and integrative of different forms of knowledge.

Based on a model of knowledge co-production by Phipps, Cummins, Pepler, Craig, and Cardinal (2016), this article aims to examine the roles of researchers and co-production partners/stakeholders across the processes of knowledge production, dissemination, uptake, and implementation to understand how knowledge engagements and collaborations across these processes may reveal factors and indicators of impact. For example, in their study of "what works" to improve research use and impact across various sectors (e.g., healthcare, education, social work, criminal justice), Nutley, Walter, and Davies (2009) identify different types of knowledge mobilization processes and knowledge utilization that include five prevalent mechanisms: dissemination, interaction, social influence, facilitation, incentives, and reinforcement. This study will examine some of these mechanisms or factors in the analyses of our case studies.

Drawing on research in an emerging field of scholarship studying knowledge mobilization and research impact. This article defines knowledge mobilization as "the reciprocal and complementary flow and uptake of research knowledge between researchers, knowledge brokers and knowledge users — both within and beyond academia — in such a way that may benefit users and create positive impacts" (Social Sciences and Humanities Research Council, 2021, para 17). Knowledge mobilization also accommodates a range of processes and activities such as practice-relevant knowledge brokerage, translation, dissemination, linkage activities, and capacity building (Malin & Paralkar, 2018). It includes knowledge brokerage to transfer research evidence into policy and practice and efforts to translate knowledge in ways that will support "evidence-based decision making, research utilization, innovation diffusion, knowledge transfer, research dissemination, research implementation, and research uptake" (Estabrooks, Thompson, Lovely, & Hofmeyer, 2006, p. 28).

The authors believe that the purpose of knowledge mobilization is to ensure research knowledge can be mobilized to impact policy and practice. While there is a growing body of literature around different processes of knowledge mobilization, Cooper (2013) provides a brokering framework for knowledge mobilization work that includes linkages and partnerships, awareness and accessibility, engagement, organizational development and policy influence, implementation support, and capacity building. These processes support the uptake of research knowledge and the co-production of knowledge. Knowledge mobilization, then, offers the potential to change or benefit education and society through the development of knowledge that will have direct relevance to the needs of stakeholders and lead to new insights, understandings, and processes or social practices (Research Excellence Framework, 2019). In short, knowledge mobilization aims to result in research impact that can be defined as the "provable effects of research in the real world" (Bayley & Phipps, 2019, p. 3).

This study contributes to a growing body of scholarship examining the role of knowledge mobilization and use to impact policy and practice in education (and other fields). It seeks to develop a Singapore based and empirically informed conceptual model of education research impact that can inform this scholarship as well as knowledge mobilization and research impact efforts in Singapore. The study offers the potential to make practical contributions in terms of developing, through a set of case studies, principles that can enhance research impact efforts and inform re-

searchers and stakeholders with pathways to strengthen the research-practice-policy nexus in Singapore.

Justification for this study includes the increasingly important roles of research, knowledge mobilization, partnerships, and the use of evidence to inform decision-making in policy and practice at NIE and with key stakeholders. These efforts are central to the objectives of the ministry-governed Education Research Funding Programme (ERFP) to ensure education research funded by MOE has high utility and impact in the education system, and is core to NIE's strategic vision to boost the relevance, visibility, and impact of NIE's research. This study supports efforts by both MOE and NIE to align key research-practice-policy priorities in the education system, such as Skills Future for Educators, and networked professional learning communities.

In one of the few articles that records the knowledge mobilization efforts in Singapore, Teh et al. (2013) highlight three key elements of an iterative knowledge mobilization effort: a) informed dialogue between all stakeholders (researchers, practitioners, policymakers, etc.), b) research collaboration between researchers and teachers, and c) active and engaging teacher professional learning. However, little is known as to whether and how such efforts lead to greater knowledge mobilization.

Furthermore, Teh et al. (2013) also described the duplication of roles unique to Singapore's education governance, with NIE researchers, MOE policymakers and administrators, and school practitioners playing more than one role through secondment to NIE and to MOE headquarters and overlapping involvement in MOE-NIE policy meetings and educational research. Such duplication of roles often allows information to flow in multiple directions, helpfully providing different perspectives, but results in an almost impossible feat of understanding how knowledge is mobilized to impact policy and practice and to what outcomes.

Much has evolved in the past several years since Teh et al.'s (2013) article. Educational research efforts in NIE have increased in their knowledge mobilization efforts. However, there has yet to be a consolidated effort to document them and this close tripartite relationship in Singapore between MOE, NIE, and schools presents a unique opportunity to examine how such collaborations could contribute to research impact and inform future efforts. As NIE continues to "establish, extend and deepen collaborations and impact with key stakeholders and strategic partners" (Goh, n.d., p. 2), this study supports the broader institution's objectives by documenting the existing knowledge mobilization efforts of NIE research projects and understanding the factors that contributed to the research impact of the institute's research projects, so that we may strengthen the research-practice-policy nexus and enhance the translation of NIE research.

Methodology

The methodology in this study focuses on the perceptions of research participants (i.e., research users and researchers) and the factors perceived as instrumental or facilitative in optimizing the impact of their research. As the participants did not share a common understanding or experience of the concept of impact, an interpretivist

lens was adopted. This was to recognize that there were varying lived experiences and different interpretations arising from similar experiences (Daymon & Holloway, 2011). This issue was particularly salient for the proposed research questions due to the typically dialectic relationship between the researchers (i.e., producer) and the research users (i.e., consumer).

Through this research, the experiences of the research users and researchers involved in impactful research projects were interpreted. Qualitative research in the form of a multiple case study was employed to understand the phenomenon of research impact in context-specific settings through detailed, in-depth data collection involving multiple sources of information and reports, case descriptions, and themes (Creswell, 2013). Multiple cases of local research projects were examined by the research team to understand research impact as being perceived by the stakeholders in their unique contexts. Case study research is increasingly considered an effective methodology to investigate and understand complex issues in real-world settings (Harrison, Birks, Franklin, & Mills, 2017; Nutley et al., 2007).

A multiple case study was proposed in this study for two key reasons. First, the contexts across research projects can be diverse and the lived experiences of the research participants is likely to differ. For example, the research impact of a project involving teacher learning would look and feel different to that of another project examining school libraries. A multiple case study approach allowed the authors to analyze the data within each case and across different cases, picking up the uniqueness, similarities, and differences among them (Yin, 2014). Second, findings from a case study were presented in a way that was easy to understand (Stake, 2006). Vignettes or episodes of storytelling, which are popular modes of reporting in case studies, can help communicate findings illustratively, especially for this article's key audiences, policymakers, and practitioners.

Eight case studies were selected to reflect the diverse impact research had on policy, practice—including teacher education—and student outcomes (Table 1). This study used purposeful sampling to identify local research projects that best helped us understand the research topic. As there were no established impact criteria in education research in Singapore, the cases were identified based on three qualitative criteria: a) is the project relatively well known to the research users, b) are the project findings utilized by research users, and c) does the research project intentionally seek to increase its impact to stakeholders? While the criteria seemed rudimentary, they sufficed for the objective to select cases that were more likely to yield insights into the topic of study. A total of seven research users and eight researchers were interviewed. Data analysis was conducted to ensure triangulation of team members, of multiple sources (Creswell, 1998). Team members read through the raw data several times and analyzed the field notes taken during the interviews and the interview transcripts by coding and noting their thoughts as memos. Codes from across the eight cases were clustered into second order codes, which were then synthesized into broader themes. These were discussed at team meetings to make sense of the data collectively, specifically in answering the two research questions. Some of the codes were referred from the review of the literature, while some emerged from the raw data.

Table 1. Summary of selected projects

Research project/program	Targeted impact level	Types of research
Project 1 on pedagogies across classrooms	System: policy, practice, curriculum	Descriptive, explanatory
Project 2 on preschool education	System: policy, practice	Descriptive, explanatory
Project 3 on teacher growth and teacher education	System: teacher education, policy, practice	Explanatory
Project 4 on school leadership	Programmatic: school leadership, teacher education	Descriptive
Project 5 on teacher leaders	Programmatic: school leadership, teacher education	Explanatory
Project 6 on teachers' collaborative learning in a subject area	System: professional development, practice	Intervention
Project 7 on knowledge building	Classroom: practice, student learning	Intervention
Project 8 on specific innovative pedagogy	Classroom: curriculum, practice, student learning	Intervention, developmental

Findings and discussion

Research users in our study are defined broadly as the beneficiaries of research. These include the related MOE policy owners, teachers, practitioners, and researchers. Arising from the emerging themes about perceptions of research impact, it is useful to make a distinction between conceptual and instrumental impact (Nutley et al., 2007; Weiss, 1979). Broadly, conceptual impact contributes towards the advancement of knowledge and understanding of certain ideas (UK Research and Innovation, 2021). Examples include academic publications, citation counts, and journal impact factors. Conceptual impact may not always be observable or practical in terms of the direct applicability of research findings for use in practice or changes in policy. Instrumental impact refers to the engagement with policymakers and practitioners to share research findings, to inform and influence policy ideas and thinking, and to translate research findings into practice. These outcomes are knowledge generated from research that can be used to increase the effectiveness of education practices and policy. The following section presents the findings on research impact of local education research from the perspectives of the research users, followed by the perspectives of the researchers.

Research impact from the perspectives of research users

Across the case studies, research users usually perceived research findings as having an instrumental impact.

> I think research is impactful when it actually produces a relevant insight that can inform decision making … And if it's able to help to bring about improvements, [such as] design of syllabus, the design of teacher professional development, the design of resource de-

velopment right, such that it leads to benefits for student learning outcomes as well as teaching outcomes and teacher learning outcomes. [Research user – Project 1]

Impact … depends what you want to see and whether you achieve the outcomes of the intent of that particular program or the project. [Research user – Project 6]

It is probable that these research users see research impact as related to the nature of their work and to the intent of being involved in the research projects. Tangible practical benefits arising from the research include capacity building, provision of teaching and learning guides and resources, and how research findings shape policy direction; these outcomes are least likely to occur unless explicitly spelled out in the project intent.

Policy-level or system-level impact

Some research users at MOE shared about impact at the systems level in terms of policy and practice. As an MOE collaborator in Project 2, the research user reflected on the impact of the project on the policy work in MOE, specifically in providing evidence-based thinking to guide MOE officers in their work, and in shaping the professional development (PD) for MOE kindergarten (MK) teachers:

[Project 2] give(s) us a little bit of a sensing of the impact of MKs or child outcomes … It was conceptualized for looking at the ground practices, the sector… recommend effective practices that's actually, … informed by research and best still evidence-based … And especially if it's local research, I think it's very … very important, …, to show the evidence and provide information that "hey we have actually tested this out. Or this is something that's been distilled from our own … That to me will be convincing and will be really impactful enough for us to communicate and … guide the practitioners, the sector and the educators. … as curriculum developers, we also would like to know what's working, … in our local context. Another one is in terms of maybe impactful communication, … influential communication in terms of to your bosses and also in terms of communication even to the curriculum planning itself … also training of our MK teachers.

The lead principal investigator of Project 1 also noted that the focus on metacognition in the new English language syllabus was likely influenced by the project's English language dataset findings. Besides, Project 1's research findings also shaped the revision of policy on how Character and Citizenship Education (CCE) is taught in school:

[Project 1's] research informs [MOE] PD as part of curriculum review — preparing teachers and helping them become competent is a key component of curriculum review. [Project 1's] research found that (in 2017) CCE was taught in very "teacher-centric manner, teachers did all the talking, kids just listened or went to

sleep … a lot of repetition … kids very often said it was not very meaning(ful)." [Project 1's] study affirmed that through their coding and the conclusion was teacher competency in teaching CCE.

Practice-level impact

Some research users found research outcomes are usually translatable, concrete, practical, functional, and of direct use (e.g., in the form of tools, programs). These came from findings in intervention projects. In Project 8, students in schools were the direct beneficiaries, and the teachers who were engaged in the project using comics as teaching pedagogy had the opportunity to re-think and re-develop their pedagogy. Teachers also reported that the comics approach had improved the performance of students in the Normal Technical stream (Teng, 2016).

> We get the students to relate their life experiences and show how practical math can be in their lives. They are quite surprised by how much chicken rice used to cost, and we used percentages to explain to them …

> (The students) are more engaged and excited. There's a lot of two-way communication, as opposed to the teacher just proving infor-mation," he said, adding that most of his students did quite well in percentage during the mid-term examinations. (Teng, 2016)

From Project 2, there was an acknowledgement that the project supported the up-dating of MK curriculum resources to incorporate implications from research findings.

In the Project 7, a teacher reflected that working on the research findings changed his beliefs and that there were also noticeable changes to students' dispositions:

> I think as the teacher before this project, I used to think that as-sessment is based on what I can see what I can observe in the class-room … But now I understand that … there's really a whole wealth of data behind, behind the screen behind the thinking all that we can tap on.

> So in the beginning of the year, I think when I took over my stu-dents, usually they are very combative in their language …But as we move on … the students who are more strong, strong-willed or more opinionated begin to take a step back and use words like for example, I see where you're coming from, or maybe, to build on to what you're saying.

In Project 6, evidence from research users noted that the outcomes of the project impacted the engagement of the practitioners. They found the subject dashboard, which allowed action-oriented activities to be tracked, to be useful for post-discussion analysis and it showed efficacy in encouraging collaborative practitioner reflections.

> For the more experienced teachers it also helped the … , to correct or see blind spots in their own lessons or in others. Through looking at the reflection of other teachers' lessons. So it was to help them to deepen their practice.

Research impact from the perspectives of researchers

Most researchers expressed the instrumental impact of their research on policy and on practitioners and practice. For instance, the primary investigator (PI) of Project 2 shared that findings from the study were shared with the pre-school education learning framework review committee, and as a result, the committee put more emphasis on the importance of self-regulation skills. The PI of Project 7 noticed that the research team working with the teachers to design computer supported collaborative learning platform lessons, and after they had tried the lessons in their classroom, they expressed excitement on the new experiences: "Hey, this is what I've never done before, but this is working well." The PI of Project 8 reflected that arising from the project, the use of comics had changed the way teachers designed and delivered their classroom lessons. In his project efforts at the upper primary level with a school, it appeared that the comics feature had since become a permanent classroom feature in the school.

The PI of Project 4 reflected that impact can be seen at two levels: at the policy level—"sometimes you need systemic changes, otherwise the impact is not felt"—and at the practice level:

> Both practice and policy impact are important. It's just to what extent we can influence those. I think sometimes you need systemic changes, otherwise the impact is not felt. But I also agree that impact can be at practice level. Especially for teachers but even for [principals]. I mean the reason why I wanted to share, let's say at the LEP [Leaders in Education Programme], was that … these (participants) are potential [principals], maybe good for them to hear what [vice principals] feel … there will always be some issues, so it's good for them to be aware, and hopefully when they become [principals].

While the PI acknowledged that the project had very little impact at the systems level ("[the] publication of papers and journals"), the PI also pointed out that the conceptual framework outlining the roles vice principals (VPs) in Singapore and their perceptions about performing the role of boundary spanners, can contribute to addressing the paucity of knowledge in this area of study.

Factors inhibiting research impact

Far from being linear, the trajectory from knowledge production to research impact and its eventual uptake could be complex. Across the projects, although efforts had been made in the dissemination of research findings, for example, through the mandatory sharing at various platforms, and research publications as being part of the project deliverables, dissemination was only a necessary but not a sufficient condition for research impact and to inform change through research uptakes. Research impact could also be confounded by many factors. It was not always immediately clear how evidence from research findings directly shapes decisions related to policy and practice. It was not always the case that impact can clearly be attributable to specific interventions. Perhaps the exception could be an MOE-commissioned study where there were clearly defined deliverables by the funder. The uptake of research findings could also be influenced by many factors and as the PI of Project 4 noted:

our sphere of influence is limited, so that's why if you have an MOE collaborator, at least you spread out the sphere of influence. But even with MOE collaborators, it depends on which divisions they're in, and then they might also feel that they're constrained, but at least it's better than (having) no MOE collaborator.

She also cited one previous study on the Professional Learning Community (PLC) as an example of how MOE's involvement could make a difference in terms of research uptake:

[About the PLC study] … very clear … commissioned by MOE, … we had specific findings that we told directly to [the national Teacher Academy]. Then we developed case study scenarios that they are using in their training, for the SSDs [School Staff Developers]. So that's very clear impact, but that's designed from the start because of MOE's involvement as a sponsoring body.

Besides the challenges in attributing the impact from research, researchers highlighted other possible factors:

Time: Time was clearly needed for research users' enculturation for successful research uptake (e.g., in Project 5), and not all research findings were immediately translatable or scalable. The extent and level of research impact were dependent on the research agenda and questions (e.g., intervention projects, like Project 8, were more amendable for impact). The PI of Project 4 also noted that policy changes can take time, and by the time they changed policy or practice, "you can't say for sure that it's because of your study." The PI of Project 2 also observed that "although I think sometimes the impact … doesn't come immediately."

Buy-in from ground level: Getting teachers' buy-in for research uptake may not be a trivial exercise. There are many contextual factors that need to be considered to effect change in practice. For example, in Project 8, the PI observed that a change of teachers involved in the early part of the project hindered the uptake of project practices later. The extent of influence of the researcher on the end users may add to the complexity of contextual factors that influence research uptake and scaling. In Project 5, the PI reflected that the impact of the research findings on a school may be dependent on school leaders' willingness to receive the findings, their attitude towards the use of research, the prevailing school context, and the relevance of the findings in meeting the school's priorities and current goals:

It all depends on the school leaders … How much the school leaders welcome and value such things [research translation], right? I mean if school leaders [are] not going to do anything, it will send a message to the rest … To HODs … How they value such work. … in a way that's one form of attribution,

isn't it? School principals' attitude towards translation of research work … To the context in practice. It varies … Some principals are more open; some principals are less open.

[About school priority] Let's say my school is currently interested with … differentiation in instruction [a current pedagogical interest]—the impact will be tremendous. Whether you do survey or experiment or even intervention study, … it fits very well with school priorities.

Type of Project: Research impact can generally be dependent on the project type. For large-scale programmatic projects, or for intervention projects, the research deliverables were clearly spelt out. It appeared that unless the intent to influence policy and practice was expressly stated in the project (like the PLC study cited by the PI in Project 4), the findings may have limited impact. But for others, there were always challenges to the uptake of research findings. In Project 4, the PI noted:

If you're looking at impact, then there has to be [an] intervention. But you know certain studies—it's very difficult, I can't do interventions with VPs … with students, you can do interventions. With teachers, in terms of workshop, you can still do some interventions and hopefully there's more impact. But with school leaders, it's a bit difficult.

Lack of platforms to reach out to potential research users: The PI in Project 4 also lamented the lack of platforms to share research findings with different stakeholders:

Tier 1 projects , … we don't have to present to MOE, so in that sense, having impact policy is quite difficult." This perhaps reflected the perception of systemic barriers to sharing possible research finding uptake, specifically when the researchers were not required to deliver these to the funders.

Facilitating factors for research impact

Although the research users and researchers might have different perceptions of attribution of research impact, there was agreement on the factors that can contribute to research impact.

1. Relevance and timeliness to system

Research could be more impactful when the research findings were relevant and timely in informing policy and improving practice. When the timing of research findings matched the MOE's current policy interest, there was a greater scope for uptake. As the PI of Project 2 noted:

[Project 2] came at a time when the MOE was starting to put a lot more emphasis on the importance of early childhood education … So, this

project was done in collaboration with ministry colleagues from pre-school branch and a bunch of us from what was then known as "[development lab]." (emphasis added)

At times, research uptake was also facilitated when the research user saw timely relevance and had interest in the research findings, as the Lead PI of Project 1 reflected about the findings in informing the teaching of social studies and character education:

> Coincidence or serendipity, we knew that intentionally there was a lot of interest in the topic on controversial issues because internationally that is a key research area in the field of social studies and character education. We said we need to sit down and develop a case study on controversial issues, on how our teachers have been doing it or not doing it, how the teachers have failed or completely ignored it. All that kind of stuff we pooled it back together again, and we developed a number of case studies for that. So, when we presented this [to] CCE [Branch at MOE], they were very keen on the case studies. (Project 1; emphasis added)

Similar observation on the timeliness of the relevance of the intervention was seen from the findings of Project 6, as alluded to by the project collaborator:

> When we shared this with [the professional development academy], they were at the same time looking for a video-based application to support teacher PD, because PE or dance, this kind of aesthetic type of subjects right, they are very much action-oriented and a lot of their lessons are videoed. So, it came in very timely to support [the professional development academy] in the initial round of scanning, when the academy was looking for an appropriate tool.

There were also research findings that had direct relevance to teacher education programs and teachers' practice (e.g., in-service courses like Leadership in Education Programme (LEP) arising from Project 4). But knowledge mobilization of research to achieve impact might be far from a linear process. Even if the research findings had direct relevance to MOE, multiple other factors influenced uptake; for example, if relevant MOE division or officers were interested and could see the relevance of the research uptake, and if they had the ability to influence or leverage change, as the PI of Project 4 reflected:

> There are possible policy changes … I don't think [the professional development agency for leadership] … is in a position to do that, so it really depends on. …. I'm not sure who has. Who is in a position? … I've just been trying to reach out to as many people as I can, in the hope that somebody has … some influence …".

2. Relationship building

Research could be more impactful when researchers and policymakers/practitioners had trust and open-mindedness. Specifically, researchers pointed to the need for a team-based approach, close collaboration, and communication between researchers and MOE partners and to focus on the wider intent and ecological ramifications of

research impact. For example, the lead PI of Project 1 reflected on some of the "key ingredients" of the successful narrative about the findings' research uptake by the MOE CCE branch:

> We were very open to deviate from our research questions … if we were very strict and tell everyone "look, we got our grant, we have to focus on this research question, you wait for us to finish our final report, and then you go and read the final report and figure out what you want to do with it." Now, that's one approach. But we were far more flexible …, we really wanted to see how we can help with the CCE branch. Because they were quite nice people, I think that helped as well. … very good, positive relationship and degree of trust I think we had with our MOE collaborators … Almost like the contact person with the other CCE branch people … they really wanted to know more about the research. (emphasis added)

One of the reasons that Project 6 impacted policy at the conceptual level was the team's relationship building with various stakeholders, through the continuous adaptive learning and improvements throughout the project to meet the needs of the MOE users, and also because of the strong support and partnerships with the professional development agency and the education technology department.

> In terms of practice, I would say it's one of my more successful projects partly because of our very strong support and partnership with [the professional development agency], and there's also [the education technology department].

The PI of the project reflected that the professional development agency, a research user of the project, had extended the infrastructure arising from the project for further alignment to the national teaching framework:

> For [the professional development agency], they even aligned to the [national teaching framework] …, a practice where we are very proud to have, the different layers, teacher practice and student outcomes, … that was very intentional, a very deliberate, and definitely meet the needs of teachers.

As part of building relations, the lead PI of Project 1 also noted that it was useful to exchange knowledge with the research users as it raised the awareness of the national context in which research uptake can take place. Specifically, there was a need to be:

> Open to listening to critique, listening to what might be the shortfalls or what might be the gaps that maybe we didn't notice … the researchers also [need] to understand some of the constraints MOE [faces]… We come from a national perspective… a certain agenda."

3. Research collaborators: Building on the network and research design engagement

The NIE's Office of Education Research (OER) has always tried to link researchers to research collaborators. Having someone or a team from the collaborating organization, for instance, as an intermediary connection to the MOE branch, could pro-

vide the researcher with the contextual knowledge they needed. This person/team may support the process of interpreting findings in context so that the findings could be explored further and would not get over-generalized, as reflected by the lead PI and research user from the Project 3:

> Our MOE key collaborators are instrumental at every stage of our project. From conceptualisation, data collection to presentation of findings, we seek their perspectives, assistance, and advice to proceed. They often provide great insights, perspectives and can connect us with the participants we need to reach. They also advise on the appropriate platforms to brief our stakeholders such that the project can make an impact on policy and practice. (Lead PI, Project 3)

> Because they needed someone with the contextual knowledge to help make sense of the instructional mentoring program … From the data you get, which addresses the research questions. But the thing is when it comes to findings, you still need a second layer, which is the interpretation of those findings, against the context, against the nuanced context where the program is situated. So that is mainly where my role comes in, where I will ask questions … ask those questions that are pertaining to, for lack of better word, "so what? (Research user; Project 3)

Similarly, the PI of Project 6 shared how the boundary work from the MOE contributed to the research design as they were more familiar with the local education context:

> The co-PI from [the professional development academy] … was the one who helped us with the contacting of schools, and we co-designed the first fuse … Basically, (for) every trial, we will co-design how we would trial the system, and … we will evaluate and to see how the system can be improved.

The PI for Project 2 likewise shared that the MOE colleagues from the preschool branch who served as the co-PIs or collaborators were closely involved in the design of research from the outset. "So, they were part of the team … involved in the beginning when we were kind of planning … *the* study and trying to think about what was the scope."

4. Research communication engagement

Researchers attributed having continuous engagement with relevant stakeholders throughout the project lifespan as another factor contributing to research uptake. For example, they acknowledged the importance of sharing research findings not just at the different levels of leaderships at MOE and NIE (e.g., at the MOE Professional Directors' Meeting, MOE professional development workshops, and the NIE senior leadership team), but also in other formats such as creating research briefs for different stakeholders, engaging different stakeholders, parents, the public, and MOE via talks, media coverage, symposiums, and conferences. The research user of Project 3 reflected on how to facilitate buy-in of research findings with schools for the uptake of the mentoring program:

The best is [to] continually engage your stakeholders right from the conceptualization stage so that they have also some voices to shape the research towards impact. In the middle, when you're collecting data and some unexpected insights or findings came out, it is also a good time to check in with the stakeholders to understand why certain things happen because it offers an opportunity for deeper exploration of the findings, while data is still being collected. Then at the interpretation of the findings, because a researcher should also take into consideration the context where those findings are based, especially education research, it's really a social science research, so context matters. And we need to also get the stakeholders' views with regards to the context against which the findings are situated …, at the end, … the finalized version of the research to be presented, you will also need to talk to the presenters, talk to the stakeholders again, and show them that this is what your research finally concluded. So, … throughout the project, continual engagement is very important, and which is why I say do not just engage the stakeholders at the end, because … it leads to a lot of questions and a lot of expectations on the part of the stakeholders if there were no such continual engagement along the way.

Sometimes, however, research communication engagement could be hampered by the lack of interest to take up the research findings, and the tangible and intangible costs and resources of mobilizing the research, such as the cost of converting the findings into applications:

I rode on LEP. Because LEP is an existing platform for VPs … that's one way to go through but it's still dissemination, … I do know more [school superintendents], I could potentially reach out to more … I tried (MOE) Schools' Division and you know I asked [superintendent 1], I said "would the zonal cluster Supt be interested?" And [superintendent 1], said that [s]he would be interested but [s]he never got back to me. I think schools are also busy , … the superintendents are also very busy, especially with COVID and then they have so many other things to deal with … So, what would motivate them to want to hear your findings unless it's really very, … big deal. (Project 4)

I need time for translational work to convert it [research findings] to a YouTube presentation. I know I can do it myself, but the thing is sometimes I don't have the resources. I don't have the expertise and I don't have the time. Some resources need money, some resources need time, some resources need expertise in order for me to translate it to convey the findings in a much more accessible way to members of the public. (Project 5)

To develop this application takes some dollars and cents right. And where … will these dollars and cents come from? And how do you ensure that whatever you develop will be sustainable? (Project 6)

So, you have all the teachers interested but where do you get all the resources, the manpower, the money to support all these ongoing things? (Project 8)

It appeared that there is little incentive for knowledge mobilization for researchers, unless that is a deliverable explicitly stated for the project. Further examination woud be needed on whether the availability of explicit systemic structures would promote research uptake and implementation, and if so, to what extent.

Emerging principles for research impact

Findings from this study resonate with the wider research and conversation on research impact (e.g., Farley-Ripple, 2020; Neal, Neal, Kornbluh, Mills, & Lawlor, 2015; Oliver, Innvar, Lorenc, Woodman, & Thomas, 2014, Wentworth, Khanna, Nayfack, & Schwartz, 2021) and provide an insight into the less-documented processes of achieving impact, which can be arduous even in a system like Singapore's where there exists a close partnership between the MOE and the NIE. Hence, drawing from the facilitating factors for research impact, and considering the related inhibiting factors, we propose some emerging principles that can guide improving research impact, as shown in Table 2.

Table 2. Emerging principles of research impact

Emerging principles	Factors for research impact	Inhibitors of research impact
Front loading the intended research impact	Relevance and timeliness: research can be more impactful when the research findings are relevant and timely in informing policy and improving practice.	Challenge of attribution of impact Time factor for implementation and scaling
Building mutualistic relationships	Relationship building: research can be impactful when efforts are invested to build trust and open-mindedness between researchers and policymakers and practitioners in deeper and more effective partnerships.	Buy-in from ground level
Co-constructing research	Research communication engagement: research can be impactful when engagement between researchers and users is sustained and regular, even beyond the duration of the research project. Research collaboration: research can be impactful when research collaborators facilitate or support knowledge mobilization and translation efforts, work hand-in-hand with the researchers	Lack of platforms to reach out to potential research users Types of project

1. Front loading the intended research impact
Across the studies, there was often a lack of clarity or consensus on what the intended impact was unless it was explicitly stated. A common understanding between the researcher and users at the onset of the project can mitigate this challenge. It can

also clarify expectations of the project outcomes and address the time limitations for implementation and scaling.

2. Building mutualistic relationships
Building relationships between the researcher and the users that are mutually beneficial can provide the needed support to obtain buy-in for the implementation of the research findings. The engagement of the recipients on research impact is important for uptake of research findings.

3. Co-constructing research
The researcher, funder(s), and recipient(s) must agree on a clear trajectory of the research and the research impact. This can help to manage expectations about research dissemination, such as the lack of structured reach-out efforts for sharing of research findings and the nature of the research outputs arising from the type of project.

These locally nuanced principles can serve as a guide to enhance research impact efforts and inform researchers and stakeholders to strengthen the research-practice-policy nexus in Singapore. They can better enable NIE and stakeholders to empirically demonstrate the impact of research arising from projects. These can potentially contribute to a better understanding of how the research-practice-policy nexus can be strengthened and research impact be optimized.

In their systematic review across 145 studies, Oliver, Innvar, Lorenc, Woodman, and Thomas (2014) identify timely access to good quality and relevant research evidence, collaborations with policymakers, and relationship building with policymakers to be the most important facilitators to the use of evidence by policymakers. This aligns with the findings of this study that identifies research collaboration between researchers and research beneficiaries, and relationship building between researchers and policymakers and practitioners, as important factors for impactful research. Though access to good quality research evidence has not been a concern for our local research participants for research impact, the availability of timely and relevant research evidence was crucial in informing local policy and improving practice. Our findings on impact from education research, therefore, reveal similar facilitators to the use of research. Though in research impact, research users' perceptions of the timeliness and relevance of research to their practice apparently affect their research uptake.

Conclusion

Researchers and research users work with different values, languages, and reward systems to the point that they "live in separate worlds" (Harris, 2013). Both acknowledge the existence of some form of conceptual impact arising from research, and there is a general agreement in the importance of research impact beyond academia. There is increasing awareness of the importance of research collaborations with policymakers like MOE in supporting policy and practices. Two questions emerge from this study.

Who is responsible for research impact?

Even if funders mandate some form of research uptake, it is not always executed, except perhaps for MOE-commissioned projects. Projects with direct and strong

MOE engagement, such Projects 1, 2, and 3, show clear ownership of research impact. Beyond the mandatory project requirements in terms of academic publications after project completion, it appears that intervention projects, such as Projects 4 and 8, have seen little demonstrable ownership on research impact after the project completion. In Project 5, the PI did not consider it the research team's responsibility to ensure the use of the project software and the continued use of the project software after the project. But the PIs interviewed acknowledged that MOE involvement is useful for research impact uptake, for example, in the form of research collaborators (Projects 4 and 8).

Interestingly, the PIs did not mention the research support provided by the institution. The authors noted that several teams within the institution provided bridging support in terms of research ideations, collaborations, dissemination, and outreach, but such support was not attributed by participants when asked who was involved or contributed to the impact of the project. Commonly referred to as boundary workers or research intermediaries (Ion, Iftimescu, Proteasa, & Marin, 2019), these teams support bridging work directly or indirectly with researchers, practitioners, policymakers, communities, and other stakeholders. For example, they provide infrastructure/platforms that bring these stakeholders together to stimulate discussions that are critical for encouraging inclusivity of other voices, finding shared language or common ground, and engaging the mass media to promote the applicability of research findings. Alluding to the importance of such intermediaries, Harris (2013) notes that if researchers do not engage themselves in the wider research impact processes, these intermediaries, either as individuals or as institutions, may have to take on this role. They can promote the research findings and hence increase uptake among "professionals who may be unaware of their availability or potential but who would be in a position to direct research capacity towards real-world problems in search of resolution" (p. 1). But the PIs did not mention these types of support. Perhaps from their perspective, the work of boundary workers is implicit, that is, belonging to the institution, and that they are not directly responsible for bringing about research impact and translation.

In pushing for more use of productive research-based evidence in policy development and shaping of education practices, policymakers and research funders may want to provide clarity on the ownership of the work on research impact. More fundamentally, should the translation of research be viewed separately from the research itself? Such clarity would provide the impetus and the direction for both researchers and research users to work on research impact. Even for projects that are descriptive or exploratory in nature and where researchers are, as part of grant submission, required to point to possible translational potential, it would also be helpful to have a systemic way of over-seeing the possible implementation.

What counts as good research impact and research impact implementation?

Policymakers may have different conceptions of research impact and what "counts" as evidence for the implementation and scaling of research findings. There is the challenge of documenting the evidence of impact (beyond the narrow focus on the number of post-project presentations and publications) and the general lack of eval-

uation of research impact and its implementation. These can create uncertainty on what could be a successful uptake of research findings. As the PI of Project 4 reflected:

> I shared the closure report with [the professional development agency for leadership], I shared … but I still won't be able to document the impact unless the stakeholders come back to me and say "oh okay, because of what you said, we have done this" … Or "because of your finding we've done that." Otherwise, I still wouldn't know the impact.

> It's very awkward for us to know whether there is impact beyond the sharing. I have shared the findings with one group of LEP … that's because …, my co-PI teaches LEP …, so we could do that. What is the impact? I have no idea beyond the fact that we shared and they had some feedback … like I mean in terms of how they view their VPs and how they treat their VPs. But … whether there is, I wouldn't really know. … Based on the feedback (of the sharing), it was generally positive. One [principal] said … it makes her … reflect on how she works with her VPs. But there's always some resistance as well, … I think it's only personal impact in the sense that I think … when people are asked to reflect on what they're doing, sometimes they'll tell you … that reflection process itself, …, benefits them.

There can also be tension between what counts and what is useful in research outputs. Examples include research users' preferences for research translation in areas that are actionable, relevant, and connected to daily practices versus those areas that are valued by policy and research communities (e.g., issues of study design, validity, and conclusiveness of findings). What matters are the roles of the research recipients and the context in which they are working. Education leaders may turn to different kinds of research evidence to inform practice for different activities in their respective roles, such as heads of departments or as school leaders. Planning for research uptake therefore needs to take into consideration what is useful for leaders across the full range of activities and the different role profiles. Another challenge is the sustainability of research impact, especially if there is no scaling. To address these complexities in research impact implementation, we can consider lessons from the field of implementation science. These lessons can guide both researchers and research users on: what counts as translatable; the different layers of research transfer (from school-based or individual class-based intervention to systems-level implementations); different translation methods and measures to utilize for different stakeholders; the sustainability of research impact; and how to mitigate the long tail of effecting research impact.

Answering the two research questions by situating them in the uniquely Singapore education landscape can provide a good basis to build an enabling research ecosystem to support research impact. A whole-system approach is needed to address these complexities. Beyond a close working partnership between funders and researchers, there must be a clear collective vision of the purpose of education research and its impact and uptake to effect change in policy and practice.

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