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Towards Evidence-based Initial Teacher Education in Singapore: A Review of Current Literature

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Abstract: Initial teacher education (ITE) in Singapore is shifting towards evidence-based practice. Despite a clear policy orientation, ITE in Singapore has not yet produced the evidence base that it is anticipating. This paper presents an analytical review of previous research into ITE in Singapore and makes comparisons to the larger international context. The review begins with a brief overview of some of the main characteristics of the research over the last decade (1999-2010). Our analysis suggests that the field of ITE research in Singapore is relatively new and still struggling to be a focus of educational research. Current published studies are typically small-scale with a large number of one-off studies. Quantitative and qualitative studies are largely carried out in parallel with little dialogue between them. This paper seeks to propose a research agenda for ITE in Singapore that overcomes the limitations from previous research as evident from the literature review. Additionally, this paper discusses the conditions needed to support the successful implementation of the research agenda. This review is the first essential step towards building an evidence-base for ITE in Singapore.

Introduction

Singapore's education system is on the brink of progressive reforms that have the potential to profoundly transform policy, practice and research. In 1997, the "Thinking School, Learning Nation" (TSLN) was launched with a vision for "a total learning environment, including students, teachers, parents, workers, companies, community organisations, and government" (Goh, 1997). Thinking schools is a vision of a school system that can better develop the creative thinking skills and learning skills required for the future, and develop future generations into responsible and committed citizens (Goh, 1997). Learning nation envisions a national culture of lifelong learning, where creativity and innovation thrives at every level of society (Goh, 1997). In 2004, Singapore launched another major policy initiative "Teach Less, Learn More" (TLLM) (Lee, 2004) into the education system. At the center of TLLM is transforming learning from quantity to quality (Ng, 2008). It calls for a fundamental pedagogical change from rote learning, repetitive tests and a "one

size fits all" type of instruction to a more engaged teaching and learning that promote greater innovation and creativity (Ng, 2008). Most recently in 2011, Singapore is moving towards a "Student-Centric, Values Driven" focus in education. This initiative aims at enabling the child to succeed and fulfill his or her potential. The central task is to "bring up a younger generation of Singaporeans who are firmly anchored in values, caring towards family and fellow Singaporeans, and deeply rooted in our nation" (Heng, 2011).

In the midst of all the educational reforms, teacher education is deemed to be essential. It has been established that it is primarily through the quality of teaching that effective schools make a difference, and that initial teacher education (ITE) and professional development can have significant effects on teacher quality (Hattie, 2009; Darling-Hammond, 2010). Qvortrup (2008) pointed out that "the most important single factor for the quality of education and thus for the efficiency and quality of the pupils' learning is the quality of the teachers' training" (p. 2).

As the sole provider of initial teacher education in Singapore, the National Institute of Education (NIE) has a central responsibility to ensure that the graduates from its ITE programmes are well equipped to address new trends and challenges in education (NIE, 2007). With a view to respond to increasingly higher expectations of teacher education, it is posited that "quality has to permeate throughout NIE, from programme development and management, to teaching approaches as well as the staff and graduands" (NIE, 2009, p. 111). Therefore, there is a need within the institute to better understand and support research-informed learning in and for ITE.

Evidence-based, research-informed improvements to teaching and learning are a top priority on the agenda of Singapore's teacher education (NIE, 2009). It is well-recognised that there is an urgent need within NIE to conduct research on teacher education as a means of supporting and enabling the implementation of education reform initiatives to achieve effective, evidence-based, and sustainable pedagogical improvements in Singapore's schools. As indicated in NIE's *3:3:3 Roadmap* (NIE, 2007), the institute commits to "enhance the quality, excellence and relevance" (NIE, 2007, p. 41) of the teacher education programmes via evidence-based research by:

1. Reviewing and conducting meta-analyses of past studies on teacher education.
2. Identifying key areas of research and developing a research framework that will inform and transform the ITP programmes.
3. Establishing international partnerships in research endeavours.
4. Providing platforms to share research findings with NIE staff and programmes offices.

(p. 41)

The main research problem of this study is to analyse and evaluate the current situation of research on ITE in Singapore and identify the necessary actions to build a strong evidence-base for ITE. While it is argued that transformative improvement of TE will be unlikely to occur without the establishment of an evidence-base generated by theoretically and methodologically sound research (Cochran-Smith & Zeichner, 2005), it could equally be argued that the building of an evidence-base cannot be realised without an understanding of the status quo of current research. As we look ahead to the future, the authors hope this article would be an impetus to encourage the sort of institutional change that would support intellectually rigorous research in teacher education in Singapore.

Research Questions and Methodology

Research Questions

This review is a vital first step towards the achievement of an evidence-base for ITE. It represents a systematic effort to apply a common set of evaluative criteria adopted by similar reviews from international research community (e.g. Cochran-Smith & Zeichner, 2005; McMaugh, Saltmarsh, & Sumsion, 2008; Nuttall, Murray, Seddon, & Mitchell, 2006). The aims of this review can be best described in the following questions:

1. What is the state of the art of research on initial teacher education in Singapore as a field of study?
2. What are the strengths and the weaknesses of current research?
3. What are the necessary actions to build a strong evidence-base for ITE in Singapore?

Data Source and Limitations

The authors did a comprehensive survey of research into ITE in Singapore from 1999 to 2010. With respect to scope, the literature search was done within 24 E-databases in NIE library (e.g. Academic Search Premier, ERIC). In order to make this study manageable, a decision was made to include only peer-reviewed journal articles. The final database consists of 71 papers published in 40 academic journals. The data has certain limitations, including the exclusion of other important research modes such as non-officially reported action research and official research reports that includes significant research components. As rightly pointed out by one of the reviewers of our article, these types of research may be found to have informed the development of teacher education courses at NIE and this type of data could further enrich the picture of ITE research beyond the peer-reviewed publication format. However, given the scope of this study and our limited access to other research modes (e.g. official reports which are only available to appointment holders of the institute), we have decided not to include them in the current study. It would be of great value for future research to focus on these kinds of data sources. Another limitation pertains to the representativeness of the data. Although an extensive list of databases was included in our survey of literature, there are still possible biases in the sample set due to its non-exhaustiveness. Despite these limitations, peer-reviewed publications is, overall, an outstanding data source for reviewing research on ITE, given that it is one of the major platforms for the dissemination of research findings. Thus, we argue that this data does provide the necessary evidence to depict an overall picture of the key features and trends. Further, the data provides a point for comparison with similar reviews from other countries such as Australia, America and UK.

Data Coding

The following steps were followed to examine different dimensions of the data set.

1. A coding scheme was developed to categorize the papers according to different research topics. It is important to acknowledge the constraints of our coding scheme. Some of the papers cover two or more topics. We needed to identify the main focus. In other words, the topics are not mutually exclusive and only reflect emphases within specific lines of work.
2. The papers are further categorized according to their research methodology and time of publication.

Data Analysis and Discussion

Research Topics

One major feature of current research is the highly fragmented nature of the research as a whole, a trend that has been identified by similar reviews conducted elsewhere (e.g. Nuttall, et al., 2006). Research topics of these studies provide a clear picture of this fragmentation (see Table 1). Within the coding categories, a large proportion of the studies can still be described as 'one-off' (48 papers; 89%). Replication or repeat studies were rare to find (6 papers; 11%). This finding is in line with Nuttall, et al.'s (2006) review of Australian research literature on ITE. Nuttall, et al. (2006) comment that "this is not surprising given that the starting point for research in most cases was a specific context-based problem, question or innovation" (p. 324). In the Singapore context, exceptions to the fragmentation could only be found within the sub-field of pre-service teachers' beliefs and attitudes about ICT (e.g. Teo, 2008; Teo, Chai, Hung, & Lee, 2008; Teo, Lee, Chai, & Choy, 2009). As many studies were focused on ICT, they also show an imbalance in the research foci of ITE research done on Singapore. "Pre-service teachers' beliefs and attitudes towards technology" turned out to be the topic that has received the most dominant research attention. While researchers focus on a wide range of topics in their investigations, overall ITE research in Singapore has a lack of scope compared with those of other countries (e.g. Australia). Research related to many subject and curriculum areas such as 'pre-service teachers' well-being (stress)', 'graduates' perceptions of the efficacy of their pre-service education' are unavailable in the Singapore database. Likewise, the number of studies in most areas is limited.

Item	Research topics	No.	%
1	Student teachers' perceptions of ICT	15	21
2	Use of online learning	10	14
3	Student teachers' attitudes and beliefs about teaching and learning	5	7
4	ITE policy discussion	5	7
5	Reflection and reflective practice	4	6
6	Use of ICT in ITE programmes	3	4
7	Practicum supervision and mentoring	3	4
8	Student teachers' PCK in English teaching	2	3
9	Student teachers' perceptions of national education	2	3
10	Student teachers' perceptions of PE education	2	3
11	Student teachers' perceptions on ICT & its application	2	3
12	Student teachers' attitudes on inclusive education	1	1
13	Authentic learning in ITE	1	1
14	Student teachers' attitudes and beliefs on creativity	1	1
15	Confidence level towards knowledge and skill after practicum	1	1
16	ITE course evaluation	1	1
17	Critical thinking in ITE	1	1
18	Curriculum innovation in PE	1	1
19	Student teachers' development of Mathematics pedagogical content knowledge (MPCK)	1	1
20	ITE programme for mathematics	1	1
21	Student teachers' motives to be a teacher	1	1
22	Student teachers' PCK in chemistry	1	1
23	Student teachers' PCK in PE	1	1
24	Perceptions of motivation level to be a teacher, teaching competencies, and confidence as a teacher	1	1
25	Student teachers' perceptions of psychology	1	1
26	Student teachers' reading habits	1	1
27	Student teachers' technological pedagogical content knowledge	1	1
28	Preparation of geography teachers	1	1
29	Student teachers' cultural sensitivity	1	1

Table 1: Research topics and number of papers published from 1999 to 2010

The large number of studies in the database considering student teachers' beliefs and conceptions as a main focus warrants further comment. This finding concurs with reviews of research on teacher education in Australia and America (Nuttall et al., 2006; Cochran-Smith & Zeichner, 2005). There has been a clear increase in research concerned with teacher cognition and beliefs. However, as Cochran-Smith and Zeichner (2005) pointed out in their review of teacher education research in the US, the research should be strengthened through closer connections between student teachers' conceptions and beliefs and their teaching practice. They argued that

> These studies pay little attention to how teachers' knowledge and practices are influenced by what they experience in teacher education programmes and even less attention to how teachers are affected over time by their preparation. There is a clear need to look more at how teachers' knowledge and practices are shaped by their preparation including after they have completed their programmes. More longitudinal studies that examine the effects of preparation on

> teachers over time such as Grossman et al.'s (2000) study of teachers learning to teach writing during and after their preservice teacher education programme are needed (p. 742).

Another gap found in this database of ITE research in Singapore is that very little attention (1 paper; 1%) has been paid to reviewing and conducting meta-analyses of past studies on teacher education. However, this is identified as one of the major areas in the key initiatives in ITE (NIE, 2007). Meta-analysis is important in bringing out and addressing the inadequacies of previous research work and to tease out further areas of research that is badly needed to contribute to the development of future policy and practice. Given the pressure and necessity for ITE to respond to the changing education landscapes in 21st century and to make timely and informed decisions, the need to conduct meta-analyses of previous research cannot be overemphasized.

Lastly, there is also a noticeable gap in research on teacher educators. The important role that teacher educators play in the process of educational change necessitates continual and systematic inquiry into the expertise and fundamental characteristics of this occupational group. Arguably, the real agents for change in 21st century teacher education are teacher educators. They need to recognise the need and to have an impetus for change. This is because teacher educators have the responsibility for preparing teachers who are competent and effective in the new educational landscape. A "well-qualified, knowledgeable and skilled workforce of teacher educators" (Murray & Harrison, 2008, p. 109) should be a prerequisite to nurture quality teachers. An inquiry stance on teacher educators would substantially enrich the overall development of teacher education (Cochran-Smith, 2003).

Research Methodology

The results in Table 2 reveal an imbalance in the use of qualitative and quantitative research methods and a paucity of mixed methods studies. Quantitative studies takes up a much larger proportion than qualitative studies. In addition, it seems that quantitative method is becoming increasingly popular in the Singapore context. For example, from 1999 to 2007, 24% of the studies employed quantitative methods. However, this figure grew to 35% in the period between 2008 and 2010. Therefore, there seems to be a 'quantitative bias' in the Singapore context.

In addition, the results show that in the current literature, research in the area of teacher education had been carried out largely in parallel. There had been no tradition of dialogue between quantitative and qualitative methods. For example, only a small portion of studies employed mixed methods design.

Item	Method	No.	%
1	Qualitative	22	31
2	Quantitative	36	51
3	Mixed-methods	7	10
4	Review & Policy discussion	6	8

Table 2: Research methodology of previous research on ITE in Singapore

Both quantitative and qualitative methods have their own strength and weaknesses. Quantitative studies have been limited in their usefulness. As critiqued by Zeichner (1999), although they can provide some basic information about teacher education programmes such as student teachers' confidence and motivation, "they have not gone beneath the surface to probe the substance and quality of these experiences and how they are interpreted and given

meaning by teacher education programme participants" (p. 9). For example, knowing that a programme influences student teachers' beliefs about teaching and learning does not tell use much about how and why are their beliefs changed. By contrast, many qualitative studies are either too fine grained and small-scale to be generalisable or else focuses on only one aspect while excluding others.

Both quantitative and qualitative methods have great potential for informing future policy and practice of ITE. Quantitative and experimental study should not be regarded as the "gold standard" of all teacher education research (Cochran-Smith & Fries, 2005). It is true that research requires substantial grounds for "ensuring that such research meets stringent standards of validity, intersubjectivity, and generalizability" (Fenstermacher, 2002, p. 246). However, the possibility of meeting such stringent standards is not restricted to quantitative, statistical, or large-scale studies (Fenstermacher, 2002). Qualitative and interpretive work may equally meet such standards. Moreover, such work can also provide insights and understandings in cases where quantitative methods "lack the needed levels of proof and verifiability to guide policy" (Fenstermacher, 2002, p. 246).

Number of Publications per Year

Table 3 presents the journal papers published each year from 1999 to 2010. The gradually increasing numbers indicate that Singaporean researchers are becoming more and more focused on research in ITE.

Item	Year	No.
1	1999	1
2	2001	1
3	2002	3
4	2003	8
5	2004	8
6	2005	2
7	2006	10
8	2007	6
9	2008	12
10	2009	18
11	2010	3

Table 3: Number of publications on ITE from 1999 – 2010

Although we have seen a growth in research papers since 1999, this is a somewhat unsatisfactory profile, given the actual number of academics involved in initial teacher education in Singapore's sole teacher education institute (full-time faculty stands at about 450) and the commitment in this context to ensure initial teacher education is a research-informed and evidence-based profession. Despite the fact that evidence-based research is emphasized in several policy initiatives (e.g. NIE, 2007; NIE, 2009) to increase and enhance research activities in/on ITE, this field of study still requires more attention and sustained systematic efforts.

A weak research evidence-base will impact a country's educational system (Leitch, 2009). Today, the linkage between research and practice in teacher education is so tight that no country or institution would dream of ignoring the value of rigorous research. It is therefore vital for ITE in Singapore to scale up its research activities to build a strong evidence-base, particularly if educational researchers wish that research could help to enhance the quality of ITE programmes.

Implications and Recommendations

The discussion above has revealed a weak evidence-base, and the existence of small-scale and isolated studies. It is obvious that this field in Singapore is relatively new and still struggling to be a focus in educational research. If we accept the logic that evidence is the basis for policy and practice in teacher education, teacher educators must engage and devote their research attention to this area in order to attain the crucial evidence-base.

A Coherent Programme for Researching ITE

The results reveal that current efforts in the field of ITE research in Singapore are constrained by its highly fragmented nature. This finding implies an urgent need for the development of a coherent and focused programme for research on teacher education. When we look back on Singapore's research on ITE in the past decade, we notice scholars and researchers have touched on quite a number of issues and questions. Through these studies, a variety of questions have been addressed, utilizing different methods of investigation. However, thus far, the picture of research on ITE that emerges is still fragmented. Many of those issues can never be encapsulated in small scale and one-off studies. Shulman (2002) pointed out that we might be asking the wrong questions and focusing on the wrong units of analysis in individual studies. He further asserted that

> …individual studies rarely can be adjudged as valuable or trivial per se. Instead, we need to think about extended programmes of scholarship, in which a variety of types of research are pursued, to maximize the value to be gained from studies of teaching. I want to tell a story of research programmes that cumulated into a meaningful knowledge base, an enduring policy initiative, and the spinning off of a number of significant lines of research (p. 248).

One of the most urgently needed programme of research both locally and internationally is the establishment of the chain of links between teacher education and student learning (see Cochran-Smith, 2004a, Densimone, 2009, Grossman, 2008, Hattie, 2009). While we do know, from Hattie's (2009) syntheses that teachers make a difference to student achievement, there is very little systematic and credible evidence of how teacher learning, be it during ITE or later professional learning and development, translates into or impacts classroom practices and subsequent student outcomes. Grossman (2008) calls for "programmatic research on teacher education, research that focuses on a critical set of questions, that over time, and through a variety of approaches, tries to provide better answers" (p. 16). We need programmatic research that links activities designed to support teacher learning to the achievement of teacher learning, and teacher learning to classroom practices, and classroom practices to student learning outcomes.

A Dialectic Mixed Methods Approach

The need to build a coherent research programme on ITE would inevitably necessitate the advancement of methodology in research. Results from this study suggests that previous research on ITE have been carried out largely in parallel. There has been no tradition of dialogue between quantitative and qualitative methods in this field. Here we would like to argue for the adoption of a dialectic mixed methods approach towards research on ITE (Cochran-Smith & Boston College Evidence Team, 2009). This is because teacher education

requires multidisciplinary evidence derived from diverse methodological perspectives that links the impact of ITE, student teachers' learning and pupil's learning. As pointed out by Cochran-Smith et al. (2009), no single research design and no single research outcome can capture the impact of teacher education. The dialectic mixed methods approach regards different research designs and approaches as providing valuable, partial and complimentary understandings of the phenomenon under study (Cochran-Smith et al., 2009).

Teacher educators are limiting their capacity to generate the requisite scholarship to improve teacher education if we are not using the full range of qualitative, quantitative and mixed methods approaches. As a research problem, teacher education involves a large set of complex educational issues, questions, and conditions (Cochran-Smith, 2004b). Designs accommodating this complexity are required by research connecting teaching, teacher preparation, and pupil's learning that seeks causal explanation (Schalock et al., 2006). In order to make progress on the complex problem of establishing an evidence-base, researchers need to stay open-minded and be willing to accept more voices and methods of inquiry. It is believed that "many educational issues and problems require research that draws on multiple perspectives, approaches, and procedures" (Florio-Ruane, 2002, p. 213). To restrict educational research to one or two methodological paradigms would unacceptably restrict our ability to address the complex challenges of educating all learners in this complex, multicultural society of ours to their full potential (Florio-Ruane, 2002).

In light of the findings discussed above, we would argue that mixed methods research ought to become a more prominent approach in the area of ITE research in the Singapore context. As a natural complement of traditional quantiative and qualitative approaches (Johnson & Onwuegbuzie, 2004), mixed methods research has the potential to empower researchers to arrive at more nuanced explanations and synergistic understandings of complex realities (Day, Sammons, & Gu, 2008). A key characteristic of mixed methods research is its "methodological pluralism or eclecticism, which frequently results in superior research (compared to monomethod research)" (Johnson & Onwuegbuzie, 2004, p. 14).

Appropriate for the overall research program, the dialectic mixed methods approach is a way of purposefully engaging with frameworks, models, concepts, or ways of knowing from multiple research traditions that gives us richer understandings (Cochran-Smith et al., 2009; Greene & Caracelli, 2003). Within the research programme, different projects and/or sub-projects can work seperately on their respective area of focus. More importantly, they simultaneously work together on the larger programme. It is essential that the whole research team "engage in discussion about research questions, designs, analyses, and interpretations for all of the studies" (Cochran-Smith et al., 2009, p. 461). Through dialogue, different pieces of research can be linked together to form a strong evidence-base.

A Strong Support System for Research

The fairly small amount of research on ITE in the last decade, its modest and unstable growth, and its highly fragmented nature suggest, to a large extent, the lack of an effective support system in this field in Singapore. To build an evidence-base for ITE, it is important to set up a strategic system that supports and nurtures the advancement of high quality research. Quality research would not flourish without a healthy, supportive and stimulating environment. Efforts that support research on the entire continuum of teacher education can lead to interesting, fruitful and significant research findings. More than that, such efforts can ultimately make a difference over the long term to students, to teachers, and even to the community as a whole. As such, the systemic environment we call for is premised on the idea that it bears the conditions which enable researchers to work in a way that will produce

valuable and desired results. It would be an environment under which quality research on teacher education, in a way, must happen. If not, it means that the right conditions for those processes were not created in the first place.

The need for such an environment has never been more urgent than it is now. It is beyond the scope of this study to draw a comprehensive plan for the establishment of a support system for ITE research. However, the following are some tentative suggestions that may warrant consideration.

1. That there exists provision of adequate funding for research on ITE.
2. That a desirable research programme is worked out to guide the research funding.
3. That specific strategies should be developed to promote buy-in and sustained engagement by faculty working in the field of ITE research.
4. That Singapore taps on the strong tripartite partnership that exists between the Ministry of Education (MOE), NIE and schools. It is important that academics value and make use of the expertise of school practitioners as well as policy makers. Their insights and expertise should be regarded as an indispensable element. The partnership in research endeavours would help to ensure that research on ITE put the benefit to teachers and students as a significant factor rather than a pious hope.
5. That structures are built to institutionalize a data-rich environment and culture, in which decisions about ITE policy and practice are informed by quantitative, qualitative, and mixed methods assessments and studies generated locally and beyond (Cochran-Smith et al., 2009).
6. That ITE research moves beyond institutional significance alone to focus on contributing to the field of teacher education as a discipline of study in the international arena.

Conclusion

Research is critical to initial teacher education and a strong basis in research is essential to enhance the quality, excellence and relevance of ITE programmes (NIE, 2007; Nuttall et al., 2006). In our view, there are at least three related ways in which initial teacher education researchers in Singapore might attempt to build weight and cohesion in this field. The first way is to develop a coherent programme for studying ITE. The second is to adopt a dialectic mixed methods approach in research on ITE to arrive at more synergistic understandings. The third way is to set up a support system to nurture high quality research.

This review hopes to act as an impetus for the development of programmatic research activities, which will contribute to the development of a rich and contextualised understanding of the nature, substance and professional impact of ITE programmes. The core aim of the research is to provide an evidence-base by which to review and enhance the core assumptions and processes of ITE and ultimately, benefit student learning in schools. In this regard, a series of funded longitudinal projects from which this paper arose, is clear evidence that initial steps have been taken.

However, research alone is not enough to respond to the shifting landscapes in the new era. It has been noted that there is a loose coupling between research and actual practice in ITE (Cochran-Smith & Fries, 2005). Simply because something has been studied does not necessarily tell us much about what people actually do or should do in ITE programmes (Cochran-Smith & Fries, 2005). Nel Noddings (1986) argued that we should engage in research ‘for’ teacher education rather than research ‘on’ teacher education. As we focus on studying ITE in the shifting landscapes of the new century, we should simultaneously

consider how we could effectively make use of the findings to enhance the quality of ITE programmes.

In the present climate of education reform, teacher educators are well advised to be proactive and highly visible participants in the enhancement of ITE programmes of their respective institutions (Goodlad, 2002). After all, "the security of their research careers depends on public belief in their contribution to the production of competent, qualified teachers" (Goodlad, 2002, p. 221). And teacher quality has been upheld internationally as being ultimately responsible for the success or failure of any education system (Darling-Hammond, 2010; Qvortrup, 2008).

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