Typifying educational research in Singapore and Sweden: a comparative bibliometric approach based on topics 2000–2020

Received 29 December 2021
Revised 18 May 2022
Accepted 16 June 2022

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Abstract

Purpose – With the advancement of novel forms of text mining techniques, new possibilities have opened up to conduct large-scale content analysis of educational research from an international and comparative perspective. Since educational research tends to convey great variation based on country-specific circumstances it constitutes a good testbed for context-rich depictions of the knowledge formation within a given research field.
Design/methodology/approach – In this article, the authors compare the educational research that has been produced by scholars in Singapore and Sweden. The article begins by providing a rich overview of what has characterised the formation and institutionalization of educational research in public policy. After this background they map the knowledge formation of education by means of a comparative bibliometric approach using words from abstracts, titles and keywords published in 9017 peer-reviewed articles between 2000 and 2020. First, the authors describe the dominant topics in each country using topic modelling techniques. Secondly, the authors identify the most distinguishing discourses when comparing the two countries.
Findings – The findings illustrate two ideal-types for conducting educational research: Singapore being more centralised, practically-oriented, quantitative and uncritical, whereas Sweden is decentralised, pluralistic, qualitative and critical in orientation. After having mapped out the prevailing topics among researchers working in these locations, the authors connect these findings to larger debates on rivalling knowledge traditions in educational scholarship, the role of the state and the degree of autonomy within higher education.
Originality/value – Through large scale text mining techniques, researchers have begun to explore the semantic composition of various research fields such as higher education research, research on lifelong learning, or social science studies. However, the bibliometric method has also been criticised for creating "mega-national comparisons" that suffer from a lack of understanding of the national ramifications of various research pursuits. The authors' study addresses these shortcomings and provides a rich depiction of

The authors would like to thank Samuel He (Wee Kim Wee School of Communication and Information at the NTU) for his assistance with the data analysis and the two anonymous referees who provided helpful comments and suggestions on the submitted manuscript. Nylander would also like to thank the Knut and Alice Wallenberg Foundation for awarding him the Wallenberg-NTU Presidential Postdoctoral Fellowship in 2020, which allowed him the opportunity to conduct this comparative study. Furthermore, the authors are grateful to colleagues at the Policy, Curriculum and Leadership Academic Group at the National Institute of Education, Singapore, for providing valuable feedback on preliminary findings of this research during a seminar.

International Journal of Comparative Education and Development
Vol. 24 No. 3/4, 2022
pp. 125-143
Emerald Publishing Limited
2396-7404
DOI 10.1108/IJCED-12-2021-0128

educational research in Singapore and Sweden. It zooms in on the relationship between each country's institutional histories, research priorities and semantic output.

Keywords Educational research, Bibliometrics, Singapore, Sweden, Topic modelling
Paper type Research paper

Introduction

This article aims to analyse the recent history of educational research in Singapore and Sweden (2000–2020), by means of a comparative bibliometric approach of English peer-review articles. With the advancement of novel forms of text mining techniques, new possibilities have opened up to conduct large-scale content analysis from an international comparative perspective. Through large scale text mining techniques, researchers have begun to explore the semantic composition of various research fields such as higher education research (Daenekindt and Huisman, 2020), research on lifelong learning (Nylander *et al.*, 2022), or social science studies (Kang and Evans, 2020).

Marginson (2021) recently argued for the use of the bibliometric method for more context-rich descriptions of national systems rather than conventional scientometric analysis which, according to him, too often convey "mega-national comparisons" that suffer from a lack of understanding in the national ramifications of various research pursuits. Since educational research tend to convey great variation based on country-specific circumstances (cf. Aman and Botte, 2017; Knaupp *et al.*, 2014; Whitty and Furlong, 2017; Zapp *et al.*, 2018), it constitutes a good testbed for context-rich depictions of the knowledge formation within a given research field. With the advancement of data-driven forms of linguistic analysis, such country-specific analysis can subject the manifested content of educational scholarship to systematic bibliometric comparisons in order to identify hidden thematic structures based on large text corpora.

Comparing the educational research contributions from Swedish and Singaporean scholars is interesting for several reasons. Firstly, the institutionalisation and professionalisation of teaching training convey sharp differences in these two countries. Sweden has a much longer history of producing educational research. Over time it has developed a highly decentralised system of educational provision for training teachers paired with independent research councils funding educational research. In Singapore, educational research and teacher training are highly centralised and state-controlled. One single institution grants teachers diplomas and provides much of the research specialising in education, which is largely commissioned by the Ministry of Education (Gopinathan *et al.*, 1999). At the same time, Singapore and Sweden are also similar in that they are small, advanced, innovative and competitive states, with significant investments directed to both education and research. They are also similar in that both countries occupy semi-central positions in relation to the dominant countries within higher education globally (Altbach, 2009; Heilbron and Gingras, 2018).

In what follows, we are going to provide a background description of the institutionalisation of educational research in Sweden and Singapore, after which we present the outline of the study, the findings and the concluding remarks. Our findings portray Swedish and Singaporean scholarship on education as two different ideal-types in the governance and conduct of research and scholarship. After having mapped out the prevailing topics among researchers working in these locations, we seek to connect these findings to larger debates on rivalling knowledge traditions in educational scholarship, the role of the state and the degree of autonomy within higher education.

The institutionalisation of educational research in Sweden

The institutionalisation of educational research in Sweden began with the first professor of education in 1910 under the term "*pedagogik*". Due to the perceived need to develop

competencies among future teachers (Härnqvist, 1997, p. 235), educational research began to break loose from the broad-based knowledge domain of philosophy. Throughout the first part of the 20th century educational research was largely intertwined with psychology, which only became an independent subject in 1948. Among the first and second generations of professors in *pedagogik* there was an overarching tension between those that gravitated towards psychology and others who remained affiliated with the humanities, especially philosophy and educational history (Härnqvist, 1997; Lindberg and Berge, 1988) [1].

Like most rich and industrialised countries in the West, there was a great increase in public spending on education in Sweden in the period after the Second World War. The drastic increase in public expenditure on education during the build-up of the welfare state generated a need to train more teachers for the rising number of individuals with extended years of formal schooling. This educational expansion also, in effect, proliferated the number of tenured faculty and professor chairs designated to the Teaching Colleges (*Lärarhögskolorna*) and to the various university departments in education, which had to be distributed geographically to meet the ever-growing demand for teachers across Sweden (Härnqvist, 1997, pp. 238–40). In addition, the great injection of public investments also generated the need to evaluate, monitor and administer these activities. Consequently, educational research during these formative years was often formulated at the intersection between the interest the state had in surveying attainment and outcomes, on the one hand and researchers' own interest to understand different facets of the world of education, on the other.

Educational research during this period of intense educational reform usually had very concrete and societally oriented problems as its starting point. However, the late 1960s has also been seen as the starting point of a paradigmatic shift toward more interpretive and critical approaches in Swedish educational research. Husén (1983) has characterised the *modus operandi* of in the 1950s as being heavily tilted toward the Anglo-American tradition of behaviouristic psychology, experimental design and statistical testing, something that gradually began to be reformulated based on research agendas informed by critical sociological theories, ethnographic and qualitative research methods. This shift has in part been explored in the previous research on the formation of educational knowledge in Sweden, for example by detailing how sociological theories of renowned scholars like Bernstein and Bourdieu became imported and translated to' Swedish circumstances and configurations (Englund, 2004; Lundgren, 2015). Two research traditions that gained particular prominence in the decades to follow were the so-called "frame-factor analysis" which paved the way for closer examinations of educational policies and curriculum studies (Lundgren, 2015) and "the phenomenographic approach" which helped increase the emphasis of the didactical theme, subject didactics and varied experiences of learning (Marton and Booth, 1997).

An important reform for Swedish educational research at the turn of the century has been the creation of the *National Committee for Educational Research* (Swedish: Utbildningsvetenskapliga kommitén), which was launched in 2001. A central belief behind the creation of this independent funding scheme for educational research was the necessity of building a stronger research-based knowledge for training of teachers to raise their professional status (Askling, 2006). Even if *The National Committee for Educational Research* was created with the explicit task of distributing resources to research and PhD programs *in proximity* to the teacher programmes, the relationship between educational research and teaching training programmes has remained rather strained and ambivalent (Spord Borgen *et al.*, 2010, p. 71). In addition to the research council specifically devoted to educational research, funding for educational scholarship is also derived from other public agencies (e.g. FORTE, ERC) and private actors and foundations (e.g. Wallenberg).

However, there seems to be no consensus on what direction Swedish educational research has taken since the turn of the century. For example, some have argued that Swedish

educational research has been retaining a rather narrow didactic focus on learning (Sporð Borgen *et al.*, 2010), whereas others have argued that it has been characterised by very little praxis-based didactic knowledge of relevance to teachers' needs (Carlgren, 2012). To complicate things further, educational researchers have come under increasing pressure to publish their results in English-language peer-reviewed journals indexed in the dominant databases, while at the same time encountering expectations to develop knowledge deemed useful for their vernacular settings, for example, to the teaching taking place in training programmes for teachers, principals and educators.

The institutionalisation of educational research in Singapore

As a case of comparison, we are surveying educational research from Singapore. Educational research in Singapore has historically been centred in the *National Institute of Education* (NIE), an autonomous institute within the Nanyang Technological University (NTU) and the sole provider of almost all initial teacher training programmes. When the predecessor of NIE – Institute of Education (IE) – was established by an Act of Parliament in 1973, research was explicitly mentioned as one of its key roles. A few large-scale research projects were launched, some in collaboration with international bodies such as UNESCO and the Southeast Asian Ministers of Education Organisation. These studies examined topics such as primary school students' reading interests and skills and the development of teacher preparation packages (Koay, 2010).

Despite these early efforts, a Ministry of Education (MOE) Study Team report published in 1979 claimed that research was practically non-existent (Taylor, 1980). Taylor's first report, issued in 1980, claimed that there was minimal research capacity available to meet Singapore's considerable educational research needs. Among his recommendations were the suggestion that Singapore set up a national funding body to provide support. However, Taylor cautioned against thinking of educational research purely in terms of empirical studies in school and survey type designs. In a subsequent report in 1983, Taylor noted that a great deal of research related to the improvement of teaching and learning was emerging. However, he also pointed out the value of hiring first-class researchers who, he claimed, were typically unwilling to be confined to institutionally determined priorities (Taylor, 1983).

Taylor's call for a central research council to provide funding for educational research only started to manifest in full force in 1999 with the establishment of an MOE-funded Education Research Fund. The Fund was set up in line with the Ministry's *Thinking Schools, Learning Nation* with one of its key objectives being the promotion of evidence-based policy and planning. In 2002, the MOE announced the award of an initial five-year renewable grant for the NIE to set up a Centre for Research in Pedagogy and Practice (CRPP). The CRPP's mission was the development and implementation of a comprehensive research programme that was focused primarily on classroom-based research, to evaluate the impact of classroom pedagogical practices on student outcomes. The research findings would also provide the MOE with policy advice and would form the basis for a series of intervention studies to test innovative curricular and pedagogical practices (Gopinathan and Hung, 2010; Hogan *et al.*, 2011). By 2004, the centre had become the largest educational and social science research centre in East Asia, with more than 80 school-based research projects and 100 research staff (Luke and Hogan, 2006).

Another research centre, the *Learning Sciences Laboratory*, was established at the NIE in 2005 in order to increase the incorporation of Information and Communication technologies into classroom pedagogies. In 2008 the NIE set up an *Office of Education Research* to provide broad directions for NIE education research, administer education research projects and enhance linkages between researchers, school practitioners and MOE policymakers (Hogan *et al.*, 2011). At about the same time as the CRPP was established, the NIE, an autonomous

institute within the Nanyang Technological University, began placing a much heavier emphasis on research output for staff recruitment, performance appraisal and promotion. A recent bibliometric review of education research in Southeast Asia between 1996 and 2019 found Singapore the most productive country, with the NIE ranking the second most productive higher education institution within Singapore (Barrot, 2021), an outcome that might be linked to the great weightage accorded academic research output and the creation of these research environments.

Besides the NIE, other prominent sources of educational research in Singapore include the National University of Singapore (NUS) and other colleges within the NTU apart from the NIE. For instance, the NUS Yong Loo Lin School of Medicine conducts research on the effectiveness of its medical and nursing degree programmes. Besides medical teaching and nursing education, both the NUS and the NTU house interdisciplinary research centres that are dedicated towards improving teaching and learning in higher education. Due to the size and priority accorded to STEM research in Singapore, educational scholarship is also related to teaching and learning within STEM-related faculties.

Despite the formalisation of research support and strong emphasis on performance-based appraisal, the findings of previous meta-reviews of educational research in Singapore indicate that the institutional setup also brings about some potential shortcomings. For instance, Deng and Gopinathan (1999), in their review of research on teaching and teacher education in Singapore, found the predominant research methodology to be one of gathering empirical data through survey research methods and then using statistical analysis to analyse the findings. What they found lacking were critical and theoretical examinations, as well as research highlighting the social, historical and cultural contexts of teacher education. In a similar vein, Low *et al.* (2012), analysed research in initial teacher education from 1999 to 2010 and found a predominance of quantitative research methods and studies focusing on students' and teachers' beliefs and conceptions. Tan *et al.* (2009, p. 366), argued that this overwhelming dominance of quantitative and outcomes-oriented research could be seen as derived from "a neo-liberal philosophy" in education.

The study

Based on large-scale bibliometric text analysis, our study aims to compare content formulated by scholars working out of Singaporean and Swedish universities that contribute to educational research. Specifically, three research questions are addressed:

RQ1. What have been the dominant topics of Swedish and Singaporean educational research?

RQ2. Why do the discourses of Swedish and Singaporean educational scholarship differ from one another?

RQ3. What is the relationship between each country's institutional histories, research priorities and semantic output?

These research questions require the creation of a descriptive map of which semantic topics have been most prevalent in each of the countries since the turn of the century. Through the second and third research questions, we seek to juxtapose these country-based findings, to outline a discussion on the overarching patterns found on a transnational comparative basis. After having constructed country-specific maps of the bibliometric content, we discuss the epistemological, theoretical and methodological features that lie behind the knowledge production in each of these cases and relate it to previous studies on the conduct and constraints of educational scholarship. In particular, we focus on the relationship between institutional histories, scholarly autonomy and semantic output.

Material and research design

To provide an empirical basis for the bibliometric comparison we have used journals classified as within the subject area of education within the indexed database Scopus. The main reason for building the study on bibliometric content derived from Scopus has to do with the availability and reliability of scholarly metadata (abstracts, titles, keywords). The database Scopus provides a more comprehensive list of educational journals than comparable databases do, while at the same time standardising the information of each of the scholarly contributions to facilitate the kind of large-scale meta-analysis we envision could aid us in the presentation.

The analytic procedure began by downloading all the available meta-data from the articles formulated by authors or co-authors affiliated with Singaporean or Swedish institutions at the time of publication. For the period between 2000 and 2020, Scopus listed 1,615 articles authored or co-authored by academics affiliated with Singaporean institutions and 7,402 articles by researchers affiliated with Swedish institutions. While the Swedish contributions to English-language peer-review journals far exceeded the Singaporean publications, the articles from each country had a similar average citation rate in relative terms.

Each of these large text corpora was downloaded using string search based on the country-specific affiliations and then integrated into the software Python. Within Python we performed *the topic model analysis* that helped capture and sort the words out by patterns of co-occurrences, using a bags-of-words-approach (Blei *et al.*, 2003; DiMaggio *et al.*, 2013; Daenekindt and Huisman, 2020; Nylander *et al.*, 2022). The text corpora that was used for this analysis came from the meta-data provided by Scopus, i.e. titles, abstracts and keywords provided through each of the articles in the sample. To improve the precision of the topic model we took out all stop words and the words that were too frequent or too rarely used to be meaningfully analysed. We also reduced the variation in phrases by using non-pronouns that consisted of alphabetic characters to a simplified form, which we will refer to as tokenized words. The topic model analysis identifies the hidden semantic structure in the text corpora regardless of the word syntax or word location, i.e. based on a probabilistic machine learning algorithm [2].

To decide on the number of topics for each country we tested out multiple models. The reason why we ended up with fewer topics for the Singaporean case (#8) than for the Swedish case (#25) had to do with the relative scarcity of data derived from Singaporean scholars and the strong semantic concentration of much of this research output. In determining the number of topics we have tried to balance our ambitions to capture as much internal variation as possible while, at the same time, providing a model that is robust and interpretative at the more granular level (Daenekindt and Huisman, 2020).

For the analytic work of interpreting each topic we relied on other sources of supplementary bibliometric metadata. These sources were not an integral part of building the topic model but conveyed supplementary information that proved helpful for the analysis of each topic and theme. For example, we compiled lists of top-cited authors and the main journal outlets within each topic, together with the institutional affiliations of contributing authors. We also compiled lists of the articles with the strongest associations to the semantic content within a particular topic and derived data on the top-cited authors in each topic (see Appendixes 1 and 2).

There are of course several limitations with this research design. First of all, it is worth noticing that both Singapore and Sweden are multilingual countries and that scholarly contributions in languages other than English and in other forms than peer-reviewed journal articles indexed in Scopus are excluded from this analysis. Furthermore, because we built the analysis on Scopus data, the classification of which scholarly contributions should be considered as educational research inherits its logic from the way journals have been labelled

in that database. An alternative approach, which could potentially generate a different outcome, could, for example, start out from the institutional affiliations of a predefined collective of scholars.

The findings

Based on the topic model we are now going to map the educational research terrain of each country descriptively, focusing especially on the dominant topics in terms of size and their scholarly content and composition.

Major topics in Sweden

In the Swedish case, the model generates a multitude of topics with no clear centre of gravity. The six biggest of these topics – 1, 8, 11, 20, 22, 23 (Table 1) – together represent around half of the distribution of semantic variation for all the Swedish contributions. As these topics are comprehensive yet fairly distinctive from one another in terms of word-use, top-cited authors, contributing researchers and journal outlets, we take these major topics as the starting point for highlighting what have been the main themes characterising Swedish scholarship in education in the last two decades.

The didactic theme. The biggest topic (#22) in the Swedish text corpus overall, aggregating some 13% of all tokenized words, is characterised by words like: teach and teaching, learn and learning, while also using words like knowledge and development. The focus here is oriented toward *teaching practices, learning, content* and the *development of knowledge in practice*. The most cited authors are the founding father of the "phenomenographic approach", Ference Marton (SWE), followed by one of the classical pragmatists, John Dewey (US) and an author working within the sociocultural paradigm on situated learning, Étienne Wenger (US).

Another fairly sizable topic that assembles research on teachers and classroom practices, is topic 8 with 8.5% of all tokenized words. The most frequent words here are: teacher, student, education, school, study, practice and classroom. Authors that are cited most frequently here are more sociologically and critically oriented (Michel Foucault (FR), John Dewey (US) and Basil Bernstein (UK)) and the articles often focus on *socio-political issues of teaching practice* such as pedagogical processes of inclusion and exclusion, special needs education or various ethical dilemmas *in situ*.

In proximity to these didactic themes approached in Topic 8 and Topic 22, we find three smaller topics (#13, #18, #2). These topics also assemble research where teaching, learning and didactic design are discussed, although they vary from one another by focusing on different educational subject areas or forms. Topic 13 centres on digital design and multimodality, Topic 18 on technology and education whereas Topic 2 gathers much of the pedagogical research related to music education.

The critical research paradigm. The critical approach to education, drawing on various branches of post-structuralist, pragmatist and post-Marxist theory, has made even more clear inroads in another fairly big topic: #20. This topic assembles 6.9% of all words and is characterised by words such as: education, policy, social, article and educational. On a comparative basis, words like: democracy, political, citizen and society are more often evoked within these articles and the main theoretical inspiration stems from the likes of Michel Foucault (FR), Pierre Bourdieu (FR) and John Dewey (US). The topic is mainly *policy-oriented* and focuses on *critiquing educational matters* based on ample use of *social and political theory*. Similar topics of less magnitude for the overall structure of the semantic map include philosophical inquiries in education and norms (#4, #6), research on preschool education (#9), special needs education (#15) and research related to language and bilingualism (#25).

The vocabulary characterising the next biggest topic (#11) also contains a strong focus on educational policy, but this time more oriented toward local schools, problems of governance

Table 1.
Most frequent contributing words in the twenty-five topics of educational research indexed in Scopus by researchers working at Swedish universities, 2000–2020

Topic # | overall contribution in %	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Rank 9	Rank 10
Topic 1 | 8.42%	student	nursing	education	clinical	study	care	medical	patient	nurse	competence
Topic 2 | 1.48%	mobile	music	study	activity	system	research	education	medium	use	learn
Topic 3 | 4.08%	education	student	study	programme	learning	course	learn	online	dental	program
Topic 4 | 3.38%	research	education	child	article	right	theory	educational	social	learn	paper
Topic 5 | 0.97%	study	movement	assessment	dog	view	use	ability	level	country	different
Topic 6 | 1.49%	learn	school	learner	education	learning	article	critical	risk	educational	support
Topic 7 | 3.86%	student	learn	training	study	course	skill	education	model	chemistry	learning
Topic 8 | 8.5%	teacher	student	education	school	study	practice	classroom	use	social	work
Topic 9 | 3.27%	preschool	child	teacher	study	work	children	result	education	play	article
Topic 10 | 3.76%	research	study	health	use	ethic	article	result	education	analysis	care
Topic 11 | 4.53%	school	swedish	policy	local	education	article	governance	educational	immigrant	principal
Topic 12 | 1.7%	student	education	approach	academic	research	practice	reflection	work	study	doctoral
Topic 13 | 3.5%	design	learn	student	digital	study	use	interaction	task	visual	learning
Topic 14 | 2.0%	school	grade	student	education	study	effect	achievement	quality	high	system
Topic 15 | 1.77%	child	school	need	study	research	use	special	different	educational	article
Topic 16 | 5.18%	student	learn	study	feedback	use	experience	group	learning	education	result
Topic 17 | 0.67%	dental	study	student	assessment	use	moral	grade	education	educational	identity
Topic 18 | 4.25%	technology	student	education	system	engineering	study	knowledge	project	science	technological
Topic 19 | 1.8%	student	science	education	school	child	article	study	group	model	use
Topic 20 | 6.92%	education	policy	social	article	educational	high	paper	analysis	knowledge	study
Topic 21 | 2.92%	child	parent	family	study	human	adolescent	game	parental	adult	religious
Topic 22 |12.63%	teacher	learn	knowledge	study	education	research	development	teaching	student	teach
Topic 23 | 6.79%	study	gender	group	student	read	result	effect	test	male	female
Topic 24 | 3.23%	study	school	student	social	pupil	analysis	use	factor	change	result
Topic 25 | 2.89%	language	study	linguistic	swedish	write	word	body	discourse	bilingual	article

and educational leadership. The most frequent words in topic 11, which gathers 4.5% of all words, are: school, Swedish, policy and local. Much of the linguistic and scholarly content is oriented towards *educational reforms and the organisation of schools*. Among the most cited group of scholars, we find Stephen Ball (UK) and Pierre Bourdieu (FR), together with a Swedish researcher, Lisbeth Lundahl, who has conducted research on the consequences of marketization reforms in the Swedish educational system (cf. Lundahl, 2002). Smaller topics with resemblance to the semantic content of Topic 11, feature work related to parental involvement and family relations (#21) or ethics, research and metacognition (#10, #19, #5).

Examining competences, skills and cognition. A topic that differs considerably from these politically and sociologically oriented themes on policy, educational systems and their societal functions is Topic 1 (8.4%). This topic contains research on health-related themes, especially studies oriented to nursing, medicine and clinical work. The most frequent words – student, nursing, education and clinical – illustrate that it is mainly *skills and competencies among health-oriented vocations* that is in focus here. The trio of top-cited scholars – Patricia Benner (US), Etienne Wenger (US), Berit Lundman (SWE) – have all contributed with conceptual frameworks that have proven useful for understanding *health-work practices and interprofessional learning* in various clinical settings and within care-work. A few smaller topics which also deal with training of professional groups within the natural sciences and science departments appear in proximity to Topic 1. For example, topic #7 features work on chemistry, #3 dental education, #16 mathematics and physics and #12 deals with issues related to supervision, PhDs and the training of academic faculty.

A final topic (#23) of some considerable size (6.8%) in the case of Swedish research is dominated by psychological and psychometric research. The top-cited group of researchers in this line of research – Albert Bandura (US), Dan Olweus (NO), Ingvar Lundberg (SWE) – have all done influential work at the intersections between psychology, psychiatry and education. Methodologically, this theme sets itself apart from the main *modus operandi* among Swedish educational researchers as it is firmly anchored in *quantitative research techniques*. The most frequently used words convey the importance of cumulative and statistical research designs as well as some of the main research objects: study, gender, group, student, read, result, effect and test. However, testing abilities among youth and adolescence through quantitative research methods is an interest shared among the scholars contributing to topics #14, #17 and #24. Educational research oriented towards evaluation, grades and achievements has a strong association with this theme but, in contrast to the Singaporean case, it is rather marginal on the whole.

Major topics in Singapore

Turning to the dominant topics in educational research conducted in Singapore we see a more confined, applied and concentrated semantic distribution. The three biggest topics (#1, #6, #7) that assemble more than half of the tokenized words in the text corpora, are all focused on *learning and teaching as pedagogical practices*. Even though the overall distribution of words is highly compressed when juxtaposed with the Swedish case, there are still some linguistic variations within the sample (see Table 2).

Sociocultural perspectives on teaching and learning. A major Singaporean topic by size, which assembles 19% of all tokenized words, is Topic 1. The most frequent words used here are: learn, student, study, teacher, learning, education, research, language, design. Similar to some of the didactically oriented research conducted at the Swedish institutions, this topic is focusing on *learning as a social, cultural and collaborative enterprise*. The top-cited scholars are Lev Vygotsky (RUS), Michael Fullan (CAN), Étienne Wenger (US) and most of the contributing researchers come from the National Institute of Education (NIE). As compared

Table 2.
Most frequent contributing words in eight topics of educational research indexed in Scopus by researchers working at Singaporean universities, 2000–2020

Topic # | overall contribution in %	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Rank 9	Rank 10
Topic 1 | 19.42%	learn	student	study	teacher	learning	education	research	language	design	social
Topic 2 | 6.14%	education	policy	student	medical	high	language	research	study	school	mentor
Topic 3 | 10.76%	teacher	student	study	education	use	school	language	teach	system	analysis
Topic 4 | 11.92%	student	study	medical	education	nursing	program	research	use	result	experience
Topic 5 | 6.59%	child	school	assessment	teacher	student	study	parent	practice	model	research
Topic 6 | 18.95%	student	learn	study	learning	school	group	use	knowledge	education	science
Topic 7 | 18.14%	teacher	learn	study	model	student	knowledge	school	design	technology	learning
Topic 8 | 8.07%	teacher	study	student	classroom	design	use	school	read	knowledge	result

to the pedagogical research conducted in Sweden, more scholarly attention is devoted to learning in relation to didactic design, computer-assisted learning and second language education.

Another sizeable topic which also focuses on empirically applied classroom practices is #7, which assembles 18% of all tokenized words. In terms of semantic contributions the words most utilised are: teacher, learn, study, model, student, knowledge, school, design, technology and learning. As compared to Topic 1, this research cluster is more oriented toward *teachers* rather than students and much of the practical utility of this research relates to *pre-service training or professional development* of teaching staff. As evidenced by the top-cited authors – Andy Hargreaves (CAN), David Jonassen (US), Marlene Scardamalia (CAN) – teaching and curriculum design is often explored in conjunction with educational technology and computer-supported systems [3]. Many of the articles that form part of the topic deal with professional development among *science teachers* and how they can model and design their learning environment in more efficacious ways.

The practical use of any given didactic design in *science education* remains a strong emphasis in Topic 3, which especially highlights the learning processes taking place in physics education. Another small topic (#5) within the sociocultural paradigm, broadly conceived, targets the assessment of children and the role of parents and family for understanding school outcomes.

Educational psychology and student achievement. Another big topic in the Singaporean text corpora (#6), which also comprises 19% of the full-text corpora, has the following series of most frequent words: student, learn, study, learning, school, group, use, knowledge, education and science. Similar to the other main topics, there is a heavy emphasis on *applied empirical research* on specific issues related to students and learning, but this time formulated within a *psychologically-oriented research paradigm*. Looking at the top-cited authors – Paul Pintrich (US), Herb Marsh (UK) Andrew Elliot (UK) – illustrates the more pronounced role of educational psychology within this topic and among the Singaporean researchers overall. Issues related to *achievement, simulation, assessment and cognitive abilities* are important traits of Topic 6 and quantitative methods are the mode of scientific inquiry. A smaller topic that shares a preference for statistical methods within educational psychology is Topic 8. This time the cognitive focus is applied to the work of teachers and various classroom environments which are explored in relation to instructional design of reading and other abilities and skills.

Outlier topics: policy, professionalism and health. There are two very distinct outlier topics emerging from the topic model based on the Singaporean publications. In contrast to all of the topics presented above, Topic 4 and Topic 2 have in common that the scholarly contributions mainly originate outside of the NIE, i.e. from scholars working at the NUS and other departments at the NTU. Topic 4 is the biggest of the outlier topics, with 11.9% of all tokenized words. It is a topic that originates mainly from the NUS and on understanding health-oriented education such as nursing, medicine and psychiatry. Topic 2 is a smaller (6.1%), more heterogeneous and mixed topic by institutional affiliation, that assembles research that explores social processes outside of primary and secondary school classrooms, such as issues related to policy, mentorship, professionalism and careers.

Concluding discussion

In the findings section, we outlined two country-specific semantic maps of the dominant topics of education research based on a text mining analysis. The words used were derived from abstracts, titles and keywords formulated by scholars working in Swedish and Singaporean institutions who published articles in peer-reviewed journals 2000–2020. Our research questions also concerned why these discourses might differ from one another,

particularly when taking into account the relationship between institutional histories, research priorities and semantic output.

The academic knowledge production within education typically occupies a rather elusive place in the landscape of higher education (Lagemann, 2000). Compared to other research fields, educational research is often characterised as relatively low barrier of entry paired with a low degree of internationalisation as well as an absence of theoretical and methodological consensus (cf. Aman and Botte, 2017; Diem and Wolter, 2013; Knaupp *et al.*, 2014; Whitty and Furlong, 2017). Contrasted to the more monolingual, internationally oriented and intra-disciplinary publication patterns typically found within fields in the natural sciences and medicine, educational research follows the general pattern in humanities and social science of being more *pluralistic* in terms of publication languages, more *national* in reach and *inclusive* in terms of incorporating scholarly contributions from other academic fields (Heilbron and Gingras, 2018; Khelfaoui *et al.*, 2020; Whitley, 2000; Whitty and Furlong, 2017).

Two ideal-types of educational scholarship

Doing large-scale comparative bibliometric comparisons of scientific output in education on a country level helps bring to light more fine-grained nuances in how rivalling theoretical and methodological approaches have fared in specific institutional environments and how countries differ in the governing rationales of educational research. As we have seen, the national ramifications of educational research are clearly conveyed in the grammar manifested among the Singaporean and Swedish research communities. By and large, the two countries can be juxtaposed with one another by Singapore being more confined and concentrated both in terms of the main topics and the theoretical and methodological underpinnings of that research whereas Swedish educational research, by contrast, is conducted in a multitude of disparate and dispersed topics with no clear "centre of gravity".

Similar to previous metastudies and bibliometric reviews, we found that Singaporean educational research 2000–2020 rested heavily on quantitative methods, outcome-based assessments and objects derived from primary and secondary classrooms (cf. Deng and Gopinathan, 2001; Goodwin *et al.*, 2017; Tan *et al.*, 2009). Even if Swedish research during the same time period had a more pluralistic and wide-ranging area of inquiry, it was predominantly based on more qualitative lines of inquiry, typically based on interviews, observations or text analysis, paired with ample use of theory from auxiliary disciplines such as social psychology, anthropology, sociology or philosophy. These results are also in line with some previous reviews of Swedish educational scholarship, such as Spord Borgen *et al.* (2010, pp. 52–53) who compared nordic countries and emphasised the dominance of small-scale qualitative research inquiries in the Swedish context, or Hansen and Lindblad (2010) who showed that many contributions to educational research came from institutions outside of the educational faculties such as scholars within the humanities or social science writ large.

Among the top-cited scholars generated by the research conducted in Sweden, we find strong influences from seminal work by French academics (Bourdieu, Foucault), American pragmatism (Dewey) as well as theories centring on experiences and situated learning (Wenger, Marton). In conjunction with the advancement of qualitative and critical research approaches, the educational field in Sweden has gained some degree of independence from the demands of "state utility" or being immediately instrumental for teacher training. At the same time, the findings from Sweden convey an image of rather "separate silos" of knowledge production, which is a problem highlighted among higher education scholars in recent years (Tight, 2014; Daenekindt and Huisman, 2020; Kang and Evans, 2020). Furthermore, what unites most of the Swedish scholarship in education is the heavy reliance of qualitative research methods paired with small-scale inquiries which can be challenging to generalise from and build upon (Knaupp *et al.*, 2014).

As for the Singaporean ideal type, this shift towards critical and qualitative research paradigms has not occurred, at least not anywhere close to the same scale as in Sweden. Instead, the predominance of quantitative methods grounded in psychology and social-psychology has remained its hegemonic role and the entire landscape of educational research seems thoroughly grounded on the priorities formulated by the Ministry of Education in commissioning and funding educational research. The top-cited group of scholars originating from the articles crafted in Singapore still convey an overarching tension between sociocultural (Vygotsky, Wenger) and psychological approaches (Pintrich, Marsh), but have in common that they centre on learning and teaching in a more narrow "technocratic" sense.

Bringing the state back in

These differences in scholarly output and grammar of educational researchers are related, first, to the institutional divergences in terms of organising teacher training; secondly, the way educational research is funded; and thirdly, the governing rationales around "what education is good for". The rather elusive landscape of educational research in Sweden resembles the heterogeneity in many Western countries such as the US (Lagemann, 2000) and the rest of Europe (Aman and Botte, 2017; Knaupp *et al.*, 2014; Zapp *et al.*, 2018). As conveyed by the background description, the Swedish scholarship rests on a much longer history of educational research, the establishment of autonomous research councils for funding, along with a highly decentralised system of teacher training and multiple institutions offering education for adults. In Sweden, as of 2020, no less than 27 different institutions were listed as providers of higher education for the teacher training programmes. Educational research has a lingering relationship to the political culture of the welfare-state, to civic values and societal circumstances circumventing pedagogical practices. While being pluralistic and diverse, critical inquiries on power and policy form an unmistakable and integral part of the *modus operandi* of this type of educational scholarship.

As for the Singaporean case, our findings confirm comparative research on higher education systems in which Singapore has been conceived of as a "Confucian model" with high-stake examinations, accelerated public investments, extended tertiary participation and strong involvement of the state (Marginson, 2011). The prevailing focus exhibited among Singaporean scholars on quantitative studies of student teachers and classroom pedagogies should also be viewed in the context of the highly centralised education system in Singapore at primary and secondary levels. The Ministry of Education has since the 1960s steadily assumed centralised control over schools, with only a few non-government-funded private schools still in existence. The high degree of standardisation of matters such as staffing, curriculum and assessment, is based on a strong state policy of aligning schools and their programmes to centrally-determined mandates as well as the streamlined education for teachers within the remit of a single institute (Goodwin *et al.*, 2017, pp. 26–27).

In comparison to Sweden, Singapore thus constitutes a highly densely populated city-state where teacher training is centralised within a single state-funded institute and educational research is largely commissioned and funded more directly through the Ministry of Education. The formidable attention to pedagogical issues of concrete classroom practices within primary and secondary schools and the emphasis on summative assessments and outcomes can thus be seen as reflecting the priorities of the state in the formation of educational knowledge (cf. Gopinathan *et al.*, 1999; Ye and Nylander, 2015). However, it would appear that Taylor's advice from over four decades ago about broadening educational research beyond empirical studies in school and survey type designs (Taylor, 1980), as well as his call for research to not be confined to institutionally defined priorities (Taylor, 1983, para 9.8) has not been heeded. While the heavy concentration of educational research within a confined area of interest might have the advantage of providing knowledge directly

applicable to pedagogical practice in the classrooms, it clearly lacks a layer of meta-pragmatic critique, especially with regard to power relations and the formation of educational policy.

Notes

1. Schriewer (2017) describes a similar tension within the German research field, which was split between the *Gymnasium* teachers who allied themselves with the university departments of philosophy and history and the primary school teachers who mainly sought professional legitimacy on the basis of psychology.
2. In this case the topic model is based on LDA, which stands for *Latent Dirichlet allocation*. For more on the mathematical foundations of LDA, see Blei *et al.* (2003).
3. A likely reason for the pronounced role of research on educational technology and computer supported learning in the Singaporean case is the establishment of the *Learning Sciences Lab* at NIE in 2005, which now forms an integral part of the *Office of Educational Research*.

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Appendix 1

Topic	Top 3 cited authors within the topic (fractionalized)	Top 3 institutions by contributions	Top 3 journals by contribution
1	Benner, P. (US)	Karolinska Inst.	Nurse Education Today
	Wenger, E. (US)	Göteborg Uni.	Nurse Education in Practice
	Lundman, B. (SWE)	Malmö Uni.	BMC Medical Education
2	Vygotsky, L. (RUS)	Göteborg	European Journal of Cultural Studies
	Säljö, R. (SWE_GU)	Stockholm Uni.	Journal of Chemical Education
	Wertsch, J.V.V. (US)	Linköping Uni.	Industry and Higher Education
3	Garrison, D.R. (CAN)	Karolinska	European Journal of Dental Education
	Wenger, E. (US)	Stockholm	Medical Teacher
	Bandura, A. (US)	Göteborg	BMC Medical Education
4	Kant, I. (GER)	Stockholm	Ethnography and Education
	Arendt, H. (US)	Göteborg	Studies in Philosophy and Education
	Deleuze, G. (FR)	Linköping	Educational Philosophy and Theory
5	Foucault, M. (FR)	Göteborg	Womens Studies International Forum
	Steiner, R. (AUST)	Umeå	Journal of Chemical Education
	Merleau-Ponty, M. (FR)	Stockholm	Policy Futures in Education
6	Foucault, M. (FR)	Stockholm	Scandinavian Journal of Educationl Research
	Giddens, A. (UK)	Linköping	Medicine, Health Care and Philosophy
	Marton, F. (SWE)	Göteborg	Educational Philosophy and Theory
7	Marton, F. (SWE)	Umeå	Medical Teacher
	Säljö, R. (SWE)	Stockholm	Journal of Chemical Education
	Dewey, J. (US)	Karolinska	BMC Medical Education
8	Foucault, M. (FR)	Göteborg	Scandinavian Journal of Educational Research
	Dewey, J. (US)	Linköping	Education Inquiry
	Bernstein, B. (UK)	Stockholm	European Journal of Special Needs Education
9	Pramling, S. I. (SWE)	Göteborg	Int. Journal of Early Childhood
	Vygotsky, L. (RUS)	Linköping	European Early Childhood Education Research
	Lenz Taguchi, H. (SWE)	Stockholm	Scandinavian Journal of Educational Research
10	Nordenfelt, L. (SWE)	Linköping	Medicine, Health Care and Philosophy
	Shilling, C. (UK)	Göteborg	European Educational Research Journal
	Bourdieu, P. (FR)	Stockholm	Sport, Education and Society
11	Ball, S. (UK)	Umeå	Education Inquiry
	Bourdieu, P. (FR)	Göteborg	Scandinavian Journal of Educational Research
	Lundahl, L. (SWE)	Stockholm	Journal of Education Policy
12	Hyland, K. (UK)	Stockholm	Studies in Higher Education
	Foucault, M. (FR)	Malmö	European Journal of Dental Education
	Swales, J.M. (UK)	Umeå	Higher Education
13	Kress, G. (UK)	Göteborg	Computers and Education
	Goodwin, C. (US)	Stockholm	Education and Information Technologies
	Säljö, R. (SWE)	Linköping	Instructional Science
14	Gustafsson, J.-E. (SWE)	Göteborg	Scandinavian Journal of Educational Research
	Hanushek, E.A.A. (US)	Stockholm	Economics of Education Review
	Muthén, B.O.O.(US)	Umeå	Education Inquiry
15	Foucault, M. (FR)	Stockholm	Children and Youth Services Review
	Olweus, D. (NOR)	Linköping	Eur. Journal of Special Needs Education
	Säljö, R. (SWE)	Göteborg	Scandinavian Journal of Educational Research
16	Marton, F. (SWE)	Umeå	European Journal of Engineering Education
	Säljö, R. (SWE)	Stockholm	Scandinavian Journal of Educational Research
	Entwistle, N. (UK)	Linköping	Computers and Education
17	von Davier, A. (US)	Stockholm	Studies in Philosophy and Education
	Spinoza, B. (NL)	Umeå	Physics Education
	Wilber, K. (US)	Göteborg	European Journal of Dental Education

(*continued*)

Table A1. Supplementary bibliometric data of top-cited authors, top-institutional affiliations, top-journals and the most contributing authors by topic, Sweden, 2000–2020

Topic	Top 3 cited authors within the topic (fractionalized)	Top 3 institutions by contributions	Top 3 journals by contribution
18	Marton, F. (SWE)	Linköping	Int. Journal of Technology and Design Education
	Dewey, J. (US)	Stockholm	European Journal of Engineering Education
	Wenger, E. (US)	Uppsala	Int. Journal of Engineering Education
19	Reid, K. (UK)	Stockholm	Physics Education
	Foucault, M. (FR)	Linköping	International Journal of Science Education
	Bohman, M. (SWE)	Göteborg	Education Inquiry
20	Foucault, M. (FR)	Stockholm	European Educational Research Journal
	Bourdieu, P. (FR)	Göteborg	Sport, Education and Society
	Dewey, J. (US)	Linköping	Education Inquiry
21	Foucault, M. (FR)	Stockholm	Children and Youth Services Review,
	Latour, B. (FR)	Göteborg,	European Journal of Special Needs Education
	Goffman, E. (US)	Linköping	Medicine, Health Care and Philosophy
22	Marton, F. (SWE)	Göteborg	Scandinavian Journal of Educational Research
	Dewey, J. (US)	Stockholm	Int. Journal for Lesson and Learning Studies
	Wenger, E. (US)	Umeå	Environmental Education Research
23	Bandura, A. (US)	Göteborg	Scandinavian Journal of Educational Research
	Olweus, D. (NOR)	Stockholm	Children and Youth Services Review
	Lundberg, I. (SWE)	Linköping	Journal of Youth and Adolescence
24	Bourdieu, P. (FR)	Stockholm	Scandinavian Journal of Educational Research
	Flege, J.E. (US)	Göteborg	Journal of Youth and Adolescence
	Gustafsson, J.-E. (SWE)	Uppsala	Children and Youth Services Review
25	Foucault, M. (FR)	Stockholm	Sport, Education and Society
	Pavlenko, A. (US)	Linköping	Scandinavian Journal of Educational Research
	Blommaert, J. (NR)	Lund	Education Inquiry

Table A1.

Appendix 2

Topic	Top 3 cited authors within the topic (fractionalized)	Top 3 institutions by contributions	Top 3 journals by contribution
1	Vygotsky, L (RUS)	NIE	Computers and Education
	Fullan, M. (CAN)	NTU	Educational Research for Policy and Practice
	Wenger, E. (US)	NUS	Journal of Computer Assisted Learning
2	Foucault, M. (FR)	NIE	Medical Teacher
	Ellis, R. (AUS)	NUS	Asia Pacific Education Review
	Ball, S. (UK)	NTU	Higher Education
3	Bandura, A. (CAN)	NIE	Computers and Education
	Vygotsky, L. (RUS),	NTU	Physics Education
	Bourdieu, P. (FR)	NUS	International Journal of Science Education
4	Bandura, A. (CAN)	NUS	Medical Teacher
	Duit, R. (GER)	NIE	BMC Medical Education
	Treagust, D.F. (AUS)	NTU	Journal of Chemical Education
5	Gopinathan, S. (SING)	NIE	Early Childhood Education Journal
	Luke, A. (AUS)	NTU	Educational Research for Policy and Practice
	Boud, D. (AUS)	NUS	Assessment and Evaluation in Higher Education

(*continued*)

Table A2. Supplementary bibliometric data of top-cited authors, top-institutional affiliations, top-journals and the most contributing authors by topic, Singapore, 2000–2020

Topic	Top 3 cited authors within the topic (fractionalized)	Top 3 institutions by contributions	Top 3 journals by contribution
6	Pintrich, P.R. (US)	NIE	Asia–Pacific Education Researcher
	Marsh, H.W, (UK)	NUS	Advances in Health Sciences Education
	Elliot, A.J. (UK)	NTU	Computers and Education
7	Hargreaves, A. (CAN)	NIE	Computers and Education,
	Jonassen, D.H. (US)	NTU	Educational Research for Policy and Practice
	Scardamalia, M. (CAN)	NUS	Asia–Pacific Education Researcher
8	Fraser, B.J. (AUS)	NIE	Asia Pacific Education Review
	Tan, A.G. (SING)	NTU	Asia–Pacific Education Researcher
	Cohen, J (US)	NUS	Journal of Creative Behaviour

Note(s): National Institute of Education (NIE), Nanyang Tech. University (NTU) and National Uni. Singapore (NUS). Appendixes 1 and 2: In order to derive a good representation of the top 3 journals and cited-authors we have used weighted and fractionalized measurements. For the journals we have combined both the absolute and relative importance of a given journal for each topic. In relation to citations we have fractionalized each contribution to take into consideration the number of authors. This was done in order to avoid a bias toward journals with the most number and highest frequency of publications and authors with multiple co-authors

Table A2.

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