What is the interest in research on Challenging Schools? A literature review with scientific mapping

María José Latorre-Medina

Faculty of Education, Economy and Technology of Ceuta
University of Granada, Spain

Abstract

The purpose of this study is to evaluate the scientific production and performance of the concept 'challenging schools' from 2000 to today through a bibliometric analysis complemented by scientific mapping. The study resorted to different processes to quantify, analyse, evaluate, and estimate the scientific output by means of specific software such as *SciMAT, Analyze Results* and *Creation Citation Report*. The concept was run through 88 scientific publications dating from 2000 to 2022 extracted from the Web of Science (WoS) citation database. The findings suggest that the evolution of the study of the schools facing challenging circumstances is constant and continuous and has followed a stable trend. The results also reflect the related themes that are of greatest scientific interest throughout each of the decades, climate being relevant in each of the periods. Furthermore, the study reveals the thematic evolution, the birth of new motor themes as well as others lacking in depth analyses that merit further exhaustive investigation. This study thus paves the way for future research on the subject.

Keywords: Challenging schools, scientific production, bibliometric analysis, scientific mapping, Web of Science

1. Introduction

Analyses of educational centres facing challenging circumstances has received special attention in recent times. In fact, improving the situation of challenging schools appears to be one of the most important aspects of the agendas of researchers and politicians at both national and international scales (Muijs 2003). The most compelling research on this subject is that by Clarke and O'Donoghue (2016), Harris and Chapman (2002a, 2002b), Lupton (2005), Moral et al. (2018), Olmo et al. (2021) and See et al. (2020).

Although the general results suggest that schools in more vulnerable contexts are characterised by instability, changing environments and students characterised by poor performance, low self-esteem, and lack of expectations (Lupton 2005), other studies reveal the ability of certain to excel in the face of adversity (Olmo et al. 2021). These latest articles focus on what are known as 'challenging schools' that have been able to apply processes of change in their search for improvement (Day 2014; Day and Gu 2015; Hargreaves 2007; Moral et al. 2018; Muijs 2003; Stoll 2009).

Despite the headway made on this subject, research on 'challenging schools' remains scarce. The current bibliometric analysis of this subject was thus carried out to identify its thematic evolution, its themes of greatest impact, its most relevant and visible thematic areas, and those devoid of thorough examination that are open to future academic research. The findings identified a wide research gap on this subject stretching over the last decades. This study therefore represents a step in filling this gap as it has attempted to identify the current state of scientific productivity on 'challenging schools' by referencing works on the subject through the platform Web of Science, currently one the most prestigious online databases.

2. Justification of the study

This study therefore explored the concept of 'challenging schools' (henceforth CHASCH) by means of a bibliometric analysis of articles pinpointed through the Web of Science (WoS) database. WoS is an online platform comprising bibliographic databases allowing researchers the possibility of evaluating and examining research themes. The database, most often applied to social sciences, offers a series of tools facilitating concrete searches. It likewise contains the means to carry out scientific mapping (Cobo et al. 2011a) based on different bibliometric indicators which can shed light on the dynamics and structural evolution of the topic of challenging schools.

This study specifically focused on evaluating the trajectory and evolution of challenging schools through the main WoS collection. The first step was to undertake a search to determine the status of the term and identify similar research. It must be noted that this initial phase yielded no publication or scientific mapping which reveals the dearth of research on the theme. The current analysis therefore intends to delve deeper into the subject to reduce the research gap of CHASCH in the specialised literature. The study's findings thus acquire relevance as they contribute both to advance the subject matter as well as to serve as a foundation for successive research.

3. Research objectives

The general objective of this study is to carry out a survey of the scientific literature on the subject of challenging schools (CHASCH) indexed in the WoS database. Deriving from this general objective are the following specific aims:

(a) To determine the frequency of publications linked to CHASCH in the WoS.
(b) To identify the scientific evolution of CHASCH in the WoS.
(c) To identify the most researched themes related to CHASCH in the WoS.

The research questions guiding the study are the following:

(a) What is the performance of CHASCH publications in WoS?
(b) How can one characterise the scientific evolution of CHASCH through the WoS?
(c) What are the most common research themes related to CHASCH in the WoS?

4. Methodology

4.1. The bibliometric analysis

This study resorted to a bibliometric analysis of secondary sources, a type of analysis that allows researchers to identify the general or specific concepts of specific areas of a field and subsequently visualise its evolution (López-Robles et al. 2019). These analyses offer academics valuable information (Rey-Martí et al. 2016) and are currently highly valued to assess scientific quality, productivity, and evolution (Rodríguez-Bolívar et al. 2018).

The current study specifically resorted to co-word analyses (Hirsch 2005) as well as other bibliometric indicators of scholarly output such as the *h*-index as well as the *g, hg* and *q2* indices (Cobo et al. 2011a) yielding node maps serving to interpret the output and position of the conceptual subdomains related to CHASCH. The current study likewise resorted to the WoS to define the thematic development of the concept over time (López-Robles et al. 2019). The records extracted from the database therefore served to obtain the greatest amount of relevant information to carry out the co-word analysis.

4.2. Selecting the database

The most prominent databases for this type of study are WoS, Scopus and Google Scholar

(Martínez et al. 2015). WoS with its greater access to academic literature is nonetheless the most widely accepted and commonly used platform to survey publications from the disciplines of science, social science, arts, and humanities (Norris and Oppenheim 2007). Thus, the data on schools facing challenging circumstances of the present study were collected through WoS, focusing on the timeframe of 2000 to 2022 to determine its recent evolution.

4.3. Procedure and data analysis

The research on this issue, subsequent to selecting the database, adhered to the following procedures: (a) determining the keywords ('challenging schools', 'hard to staff schools', 'vulnerable schools contexts'). This was undertaken after consulting specialised thesauri (ERIC) and (b) constructing a precise search equation to obtain significant results ('challenging school*' OR 'hard to staff school*' OR 'vulnerable school* context*') [TOPIC]) and report the documents containing these terms from the different metadata (title, abstract and keywords).

The first search identified 116 scientific publications, a volume that was reduced to 91 by exploring exclusively through the education categories of the Web of Science. The lot then underwent further scrutiny to eliminate repetitions, articles published in 2023 and prior to 2000, and poorly indexed cases. Inclusion and exclusion criteria (Alexander 2020) led to narrowing the number down to 88 (Table 1).

Table 1. The inclusion/exclusion criteria chose to assemble the corpus of articles

Inclusion criteria	Exclusion criteria
Studies identified by the search equations	Studies that do not meet the inclusion criteria
Studies identified by the education categories of the Web of Science (WoS)	Studies that do not line up with the theme under study
Studies published between 2000 and 2022	Poorly indexed studies in the WoS
Studies published in different formats (articles, book chapters...)	Repetition of documents in the WoS

The following flow chart (Figure 1) was drafted following the protocols of the PRISMA-P matrix to improve the understanding and visualisation of the different actions.
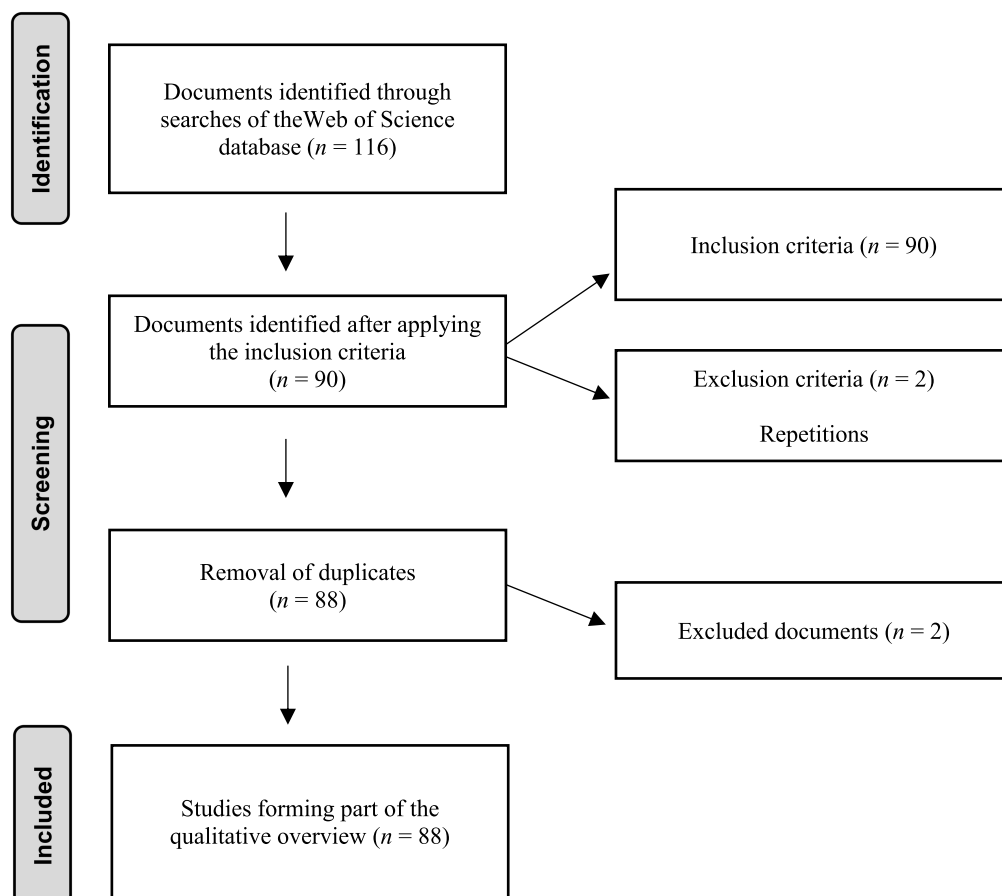
Figure 1. Flowchart according to the PRISMA Declaration

4.4. The analytical tools

Two tools served to carry out the analysis. The applications *Analyze Results* and *Creation Citation Report* that form part of by WoS served, on the one hand, to analyse the performance of the documents. These rendered it possible to qualitatively and quantitatively measure the contribution of the themes and thematic areas to the entire academic field thus identifying the most outstanding, productive and impactful subfields (Muñoz-Leiva et al. 2012). Specifically, each of these tools served to obtain data as to year, authorship, country, type of document, language, institution, source of publication, and determine those most often cited.

The study, on the other hand, resorted to the *SciMAT* software to delve into the structural and dynamic development of the results gleaned from the assemblage of publications. This consisted of a co-word analysis of the topics according to the following processes advanced by experts (Montero-Díaz et al. 2018):

a. *Recognition*. Various actions were carried out in this process. The first was an analysis of the keywords garnered through the literature (*n* = 294). This generated a map consisting of co-occurrence nodes and a standardised network of co-words yielding the most significant (*n* = 186). Moreover, the more predominant themes and concepts were represented by means of a clustering algorithm.

b. *Reproduction*. This process consists of designing a strategic diagram and a thematic network based on the principles of centrality and density according to the guidelines established by Cobo et al. (2011b). Four quadrants appear in the figures: (1) top right (motor themes and highlights), (2) upper left (highly developed and isolated themes); (3) lower left (emerging or declining themes), and (4) lower right (underdeveloped and

transversal themes).

c. *Determination.* This process consists of analysing the evolution of the nodes in specific moments or intervals of time. Here two periods were defined (P1 = 2000-2011; P2 = 2012-2022). The number of matching keywords determine the strength of the associations between the periods.

d. *Performance.* This process delimits the set of production indicators associated with the inclusion criteria serving to pinpoint the scientific publications that align with the themes of the study (Table 2).

Table 2. Production indicators and inclusion criteria

Configuration	Values
Analysis unit	Keywords authors, keywords WoS
Threshold frequency	Keywords: P1 = (1), P2 = (1)
Network type	Co-occurrence
Co-occurrence union value threshold	Keywords: P1 = (1), P2 = (1)
Normalisation measure	Equivalence index
Clustering algorithm	Maximum value: 9; minimum value 3
Evolutionary measure	Jaccard index
Overlapping measure	Inclusion rate

5. Results

5.1. Performance and scientific production

The evolution of the scientific publications on the theme of 'challenging schools' is constant and continuous over time, marked by an exponential growth from its beginnings until 2022. A chart (Figure 2) depicting the frequency of these publications by year reveals a gradual growth with a peak in 2019. Productivity from then to the present is linear and stable. A compelling investigation would be to determine the causes behind these peaks. One hypothesis motivating this surge in recent publications in the field of education as well as in other scientific disciplines relates to the penetration of what is known as academic capitalism (Saura and Caballero 2021) imposing a *publish or perish* scenario (Fernandez-Cano 2021) among the teaching staff of universities.
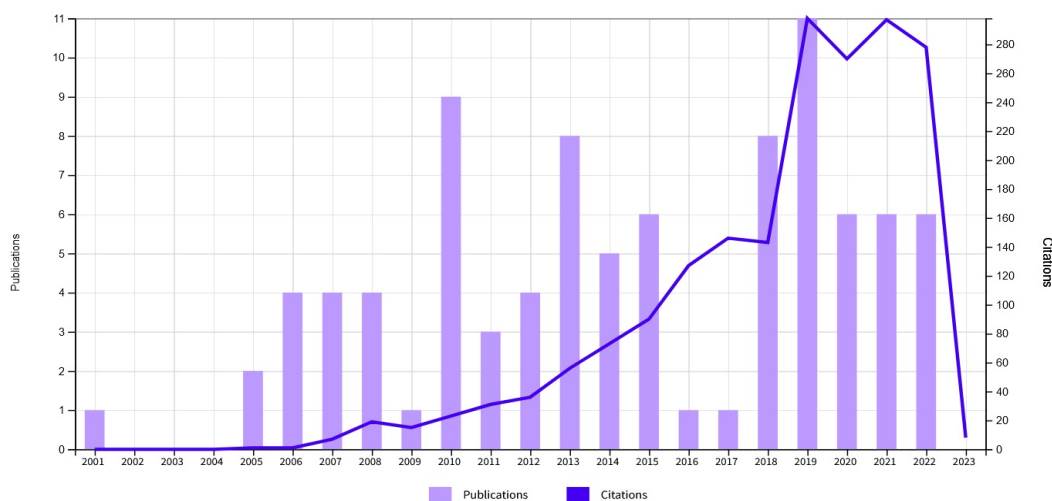
Figure 2. Number of documents per year gathered from the Web of Science (WoS)

Practically all the documents identified in this study were of scientific nature (87 documents, 96.66%) penned in English (87 documents, 96.66%). Moreover, the country contributing the greatest number of publications (52) is the United States (57.77%) followed by the United Kingdom with 13 (14.44%) and Australia with 11 (12.22%) (Table 3).

Table 3. Ranking of the number of documents by country

Countries	Number of documents
United States	52
United Kingdom	13
Australia	11
Chile	3
China	3
South Africa	3
Spain	2
Canada	1
Finland	1
Germany	1
Iceland	1
Israel	1
Singapore	1
Sweden	1
Switzerland	1

The 88 documents linked to research on CHASCH are authored by a total of 174 authors. S. Catapano is the most productive with three publications (3.33%). A series of authors (A. Brantlinger, L. Drysdale, T. Ferfolja, C. Giles, S Huisman, S.L. Jacobson. E. Tamir, H. Tran and R. Ylimaki) signing two articles each (2.22%) makes up most of the scientific output.

Furthermore, the main source of research on CHASCH is the journal *Teachers College Record* with seven articles (7.77%) followed by *Leadership and Policy in Schools* with four (4.44%). The reviews *Journal of Educational Administration*, *Oxford Review of Education*, *Phi Delta Kappan* and *Teachers and Teaching*, each have three (3.33%). Of the total 71 sources, this study selected only those with or greater than two (Table 4).

Table 4. Ranking of the number of publications per source

Source	Number of articles
Teachers College Record	7
Leadership and Policy in Schools	4
Journal of Educational Administration	3
Oxford Review of Education	3
Phi Delta Kappan	3
Teachers and Teaching	3
Educational Administration Quarterly	2
Educational Evaluation and Policy Analysis	2
Educational Management Administration & Leadership	2
International Journal of Leadership in Education	2
International Journal of Qualitative Studies in Education	2
Journal of Teacher Education	2

Policy Futures in Education	2
South African Journal of Education	2
Teacher Development	2

The following institutions are the leaders of CHASCH research: The State University of New York (SUNY), University of London, University of Maryland College Park, University of Warwick and University System of Maryland. Only those with a number greater than two were retained (Table 5).

Table 5. Ranking of institutions by number of publications

Institutions	Number of documents
The State University of New York (SUNY Systems)	4
University of London	4
University of Maryland College Park	4
University of Warwick	4
University System of Maryland	4
Arizona State University	3
Fontbonne University	3
Stanford University	3
State University of New York Suny Buffalo	3
UCL Institute of Education	3
University College London	3
University of Melbourne	3
University of Missouri System	3
University of Nottingham	3
University of Washington	3
University of Washington Seattle	3
Western Sydney University	3

Finally, the authors with the greatest number of citations related CHASCH are Yeager and Dweck (2012) followed by Achinstein, Ogawa, Sexton and Freitas (2010), Grissom (2011) and Reininger (2012) (Table 6).

Table 6. Author/s, number of citations and main conclusions of articles on the subject of challenging schools.

Article	Citations	Main conclusions
Yeager and Dweck (2012)	793	The authors indicate that resilience is the key to success in school and life. They reveal that students who believe (or are taught) that intellectual abilities are qualities that can be developed (as opposed to fixed qualities) tend to achieve greater success in challenging school transitions and have greater completion rates regarding challenging math courses.
Achinstein, Ogawa, Sexton and Freitas (2010)	149	The authors indicate that turnover rates for teachers of colour are now higher than those of white teachers; policy-amenable school-level conditions related to financial, human, social and cultural capital appear to affect permanence; teachers of colour are more

		likely than whites to work and remain in 'hard-to-staff' urban schools marked by higher proportions of students from low-income and non-dominant racial and cultural communities.
Grissom (2011)	116	This author points out that school working conditions help explain both teacher satisfaction and turnover. The study focuses specifically on the role of competent principals in retaining teachers, particularly in disadvantaged schools with the greatest staffing challenges. The findings suggest that policies focusing on hiring the best principals in the most challenging school environments may be an effective strategy in lowering perpetually high teacher turnover rates.
Reininger (2012)	70	This article demonstrates that teachers prefer to work close to where they grew up. The author also explores the implications of this preference for schools facing chronic teacher shortages. The findings indicate that the local nature of the labour force and the differential rates of graduation and production of teachers from traditionally hard-to-staff schools are reinforcing the existing deficits of local teacher supply.

5.2. Structural and thematic development

The 88 documents extracted from the WoS database yielded a total of 294 keywords, *a priori*, through the *SciMAT* software. These were subsequently refined reducing their number to 186 for the two timeframes of the study. The evolution of the keywords reveals information as to their number in each of the time intervals, the number of matching keywords between periods and the number of keywords exiting and appearing in a certain period in comparison to another. Based on the evolution of keywords among the scientific production, the studies on the topic of 'challenging schools' represent a cultivated and robust line of research given that the values of the periods coincide more often than 50% (Figure 3).
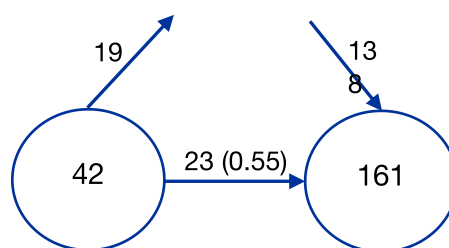
Figure 3. Continuity of the keywords between contiguous time intervals

The performance of the themes by time interval yields evidence as to the subjects with the greatest number of bibliometric indicators. This information is determined through the *h*-index as the main reference and completed data gleaned from the *g*, *hg* and q^2-indices as well as by the number of citations. On the theme of CHASCH, the subject/s with the highest

bibliometric indicators varied between periods. 'Public-schools' was the topic with the greater bibliometric indicator in the initial timeframe (2000–2011) whereas 'teacher-recruitment-and-retention' was that of the second period (2012–2022). These data are key as they reveal changes in the interests of researchers in this field. It is likewise possible to observe changes between periods of the themes of greatest interest to researchers, values that reveal the main lines of research in each of the two time intervals (Table 7).

Table 7. Thematic performance for the two periods of the study

Period 2000–2011					
Denomination	**Works**	**h-index**	**g-index**	**hg-index**	**q^2-index**	**Citations**
Public-schools	7	7	7	7	14.97	391
Novice-teachers	3	3	3	3	6.24	173
Teaching-career	3	3	3	3	9.8	197
Education	2	2	2	2	11.75	84
Financial-incentives	1	1	1	1	3.46	12
Climate	1	1	1	1	4.9	24
Period 2012–2022						
Denomination	**Works**	**h-index**	**g-index**	**hg-index**	**q^2-index**	**Citations**
Gender	1	1	1	1	4.24	18
Implicit-self-theories	1	1	1	1	28.16	793
Improvement	2	1	2	1.41	2.45	7
Immigration-and-schooling	3	2	2	2	11.83	75
Higher-education	2	1	1	1	2	4
Knowledge	2	0	0	0	0	0
Disadvantaged-schools	4	2	3	2.45	4	14
Teacher-training	3	1	1	1	1	1
School-reform	4	3	3	3	3.87	35
Equality	3	2	3	2.45	7.35	46
Climate	3	2	2	2	4.25	12
School-culture	2	1	1	1	2.24	5
Teacher-recruitment-and-retention	9	5	8	6.32	8.37	80
Inclusive education	2	1	1	1	3.16	10
Emotions	1	0	0	0	0	0
Strategies	3	3	3	3	4.24	29
Mentoring	2	1	1	1	1.41	2
Media-literacy	1	1	1	1	3.16	10
Contemptuous-habitus	1	1	1	1	2.24	5
Technology	1	1	1	1	1	1

The next phase of the study was to examine the diagrams generated for each of the two study periods (Figures 4-5) that point to the importance of each of the themes by period. This entailed grouping them according to Callon's indicators which serve to assess the degree of interaction of a network with respect to others from the standpoint of two axes. The first, centrality, analyses the strength of the relationship of external links with other topics revealing the degree of development of a topic in a field of research. The second, density, assesses the internal strength of the network, analysing the internal links between the keywords that are grouped around a specific topic, yielding information on the degree of development of a field of study.
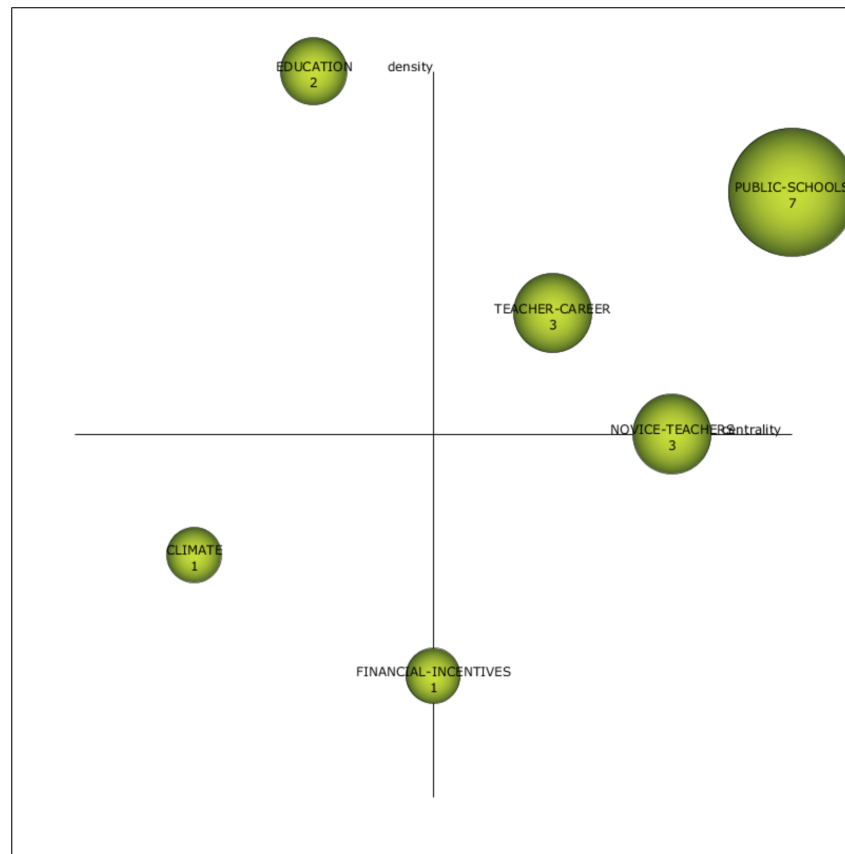
Figure 4. Strategic diagram of Challenging Schools according to the *h*-index for the 2000–2011 timeframe
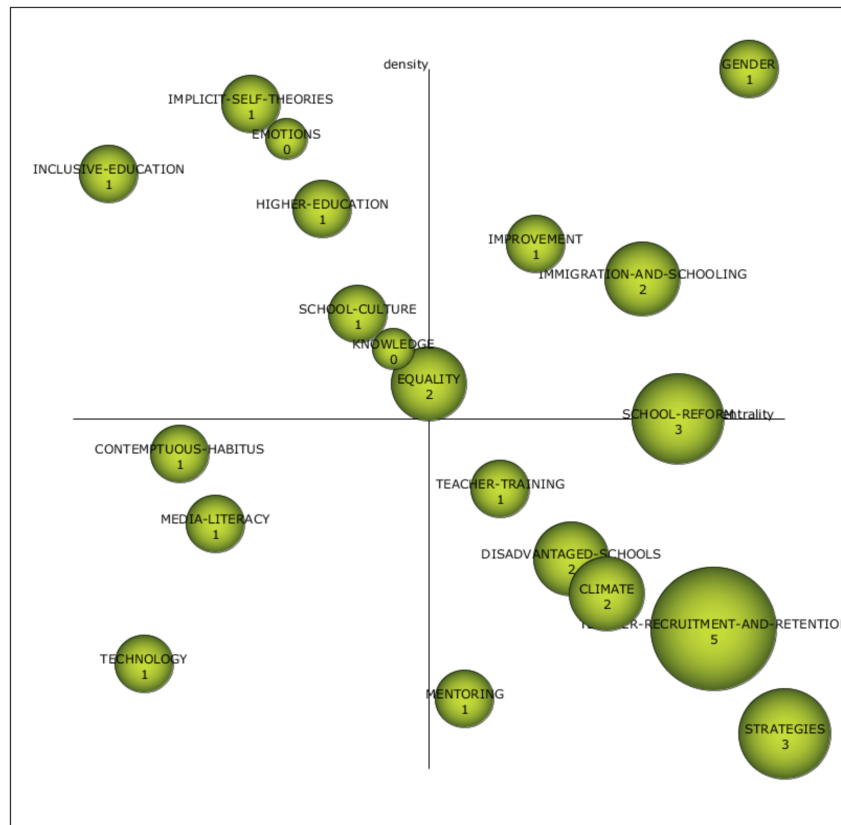
Figure 5. Strategic diagram of Challenging Schools according to the *h*-index for the 2012–2022 timeframe

5.2.1. The first decade of research [2000-2011]

The strategic diagram corresponding to the first period (Figure 4) highlights six research themes: *public-schools*, *novice-teachers*, *teacher-career*, education, *financial-incentives* and *climate*. The measurements of performance point to *public-schools* with total of 391citations and an *h*-index of 7 as the motor theme for the period (Table 7). These are among the publications focusing on the areas such as equality, race, teacher recruitment and retention, turnover, job-satisfaction, teacher attrition, teacher salaries and opportunity costs. Likewise, *teacher-career* appears as another motor theme, however with a lesser number of citations and an *h*-index lower than the previous topic (197 citations and an *h*-index = 3). This theme is linked to studies focusing on urban schools, student achievement, diversity, context-specific teacher education, religious teacher preparation, Catholic schools, and Jewish day schools.

On the other hand, *novice-teachers* ceased to be a basic and transversal theme and became a motor theme when analysed from the perspectives of resilience, personal characteristics, teachers of colour, minority teachers, teacher hiring, teacher vacancies, school demographics and hard to staff schools. Similarly *financial-incentives* also ceased to be a basic and transversal theme and became an emerging or declining theme from only two perspectives: educational economics and human capital.

Furthermore, the findings indicate that *education* is a highly developed and isolated theme comprising topics such as religion, school reform, leadership, community relations, insurgency, and school security. *Climate* here appears as an emerging or declining theme only from the perspective of graduate employment and middle class reproduction, indications of initiating an evolution towards other quadrants of the diagram. It is an issue that will be confirmed in the next decade.

5.2.2. The second decade of research [2012-2022]

The strategic diagram obtained from this second period highlights 20 research themes (Figure 5) broken down into 11 main themes when considering the motor and basic themes of gender, improvement, immigration-and-schooling, teacher-recruitment-and-retention, school reform, equality, teacher-training, disadvantaged-schools, strategies, mentoring and climate. Compared to the previous period, this second timeframe offers 20 themes as opposed to six, a difference which influences the performance indicators (Table 7). When comparing the number of works, *h*-index, *g*-index, *hg*-index, *q²*-index and the sum of the citations of the 11 highlighted themes, the following seven themes form the backbone of CHASCH research: teacher-recruitment-and-retention, school-reform, strategies, disadvantaged-schools, equality, immigration-and-schooling and climate.

In the first place it is possible to recognise that *novice-teacher*, a motor theme in the previous decade, now faded and disappeared, ceasing to be a topic of study in the scientific field. Moreover, although the motor themes of this decade are *gender, improvement-and-immigration and schooling*, the research theme with the greatest *h*-index, greater number of works and a highest sum of citations (Table 7) was *teacher-recruitment-and-retention*. Its position in the diagram reveals it to be a highly relevant topic in research on CHASCH albeit not yet internally developed. This may be indicative of its progression as a motor theme in the coming years towards another quadrant of the diagram. To date this emerging research topic relates to financial incentives (a basic and transversal theme of the first period), education (a highly developed and isolated theme of the first period), turnover, commitment, alternative teacher certification, teacher transfer, teacher effectiveness and working conditions (Figure 6). It represents the evolution of a theme in its broadest sense of the previous period –hence basic and transversal– designated as *school-public*.
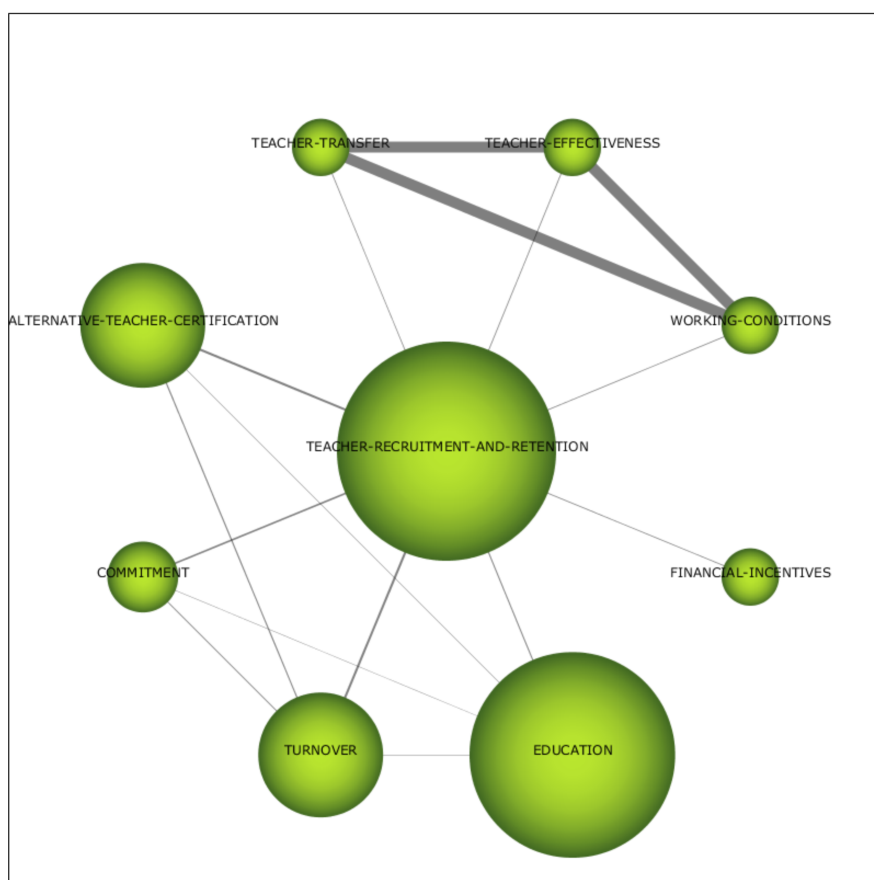
Figure 6. Strategic diagram of the *teacher-recruitment-and-retention* theme for the 2012-2022 timeframe

Gender as a motor theme with the highest centrality is addressed in publications related to learners, performance, effectiveness, instruction, English proficiency, English as a foreign language, language learning strategies and writing proficiency. Other new motor themes such as *improvement* are linked to the areas of leadership, school quality, autonomy, morale, sustaining success, student outcomes, mixed methods, and capacity. *Immigration-and-schooling*, in turn, is developed based on research on pedagogies of the home, teacher labour markets, labour mobility, graduate nursing education, learning experiences, lived experience and adjustment.

School-reform likewise ceased to be a basic and transversal theme and became a motor theme through a focus on the study of race, colour, philanthropy, urban schools, student achievement, meritocracy, mathematics education and educational policy. *Equality* followed a similar trajectory gaining importance for this field of study, ceasing to be a highly developed and isolated theme, and encompassing themes such as teacher career (a motor theme in the previous decade), teacher salaries, programs, stress, burnout, administrators, accountability, and elementary school.

Clearly identified as highly developed and isolated themes in this decade are *inclusive-education, higher-education, implicit-self-theories, school-culture, emotions,* and *knowledge*. Although extremely specialised and closely related, these research themes are no longer relevant in recent CHASCH research.

On the other hand, *teacher-training*, *disadvantaged-schools*, *strategies*, *mentoring,* and *climate* transitioned to being new basic and transversal themes. The theme worth highlighting here is *climate*, which was an emerging or declining topic in the last decade before evolving into a key and transversal theme that today remains internally poorly developed when addressed by research on teacher attrition, aboriginal teachers, identity, novice teachers, determinants, impact and survival. The last years have seen a number of other emerging research themes. *Mentoring* is the focus of research on teacher reflection, sustainability and professional development; *strategies* concerns motivation, behaviour, insights, need and community relations; *disadvantaged-schools* relates to educational change, teacher attitudes, opportunities, job satisfaction, shortages, resources, teacher qualifications and educational inequality; and *teacher-training* linked to topics such as teacher residency programs, veteran teachers, coaching, professional development, mentoring, preservice teachers, teacher reflection, and pedagogical content knowledge.

Finally, the study detected three new emerging or declining themes: (*media-literacy*, *contemptuous-habitus,* and *technology*) marked by a weak and marginal development in the field of CHASCH in the second period. The first, *media-literacy*, relates to digital literacy, 21st century skills and education policy. The second, *contemptuous-habitus,* appears in analyses in the fields of mediation and localised pedagogical capital. The third, *technology*, relates to rural education and music. It is important to highlight them given that their position in the diagram places them among an unknown group that in this field of study in the next few years could transition into either a reference or simply disappear.
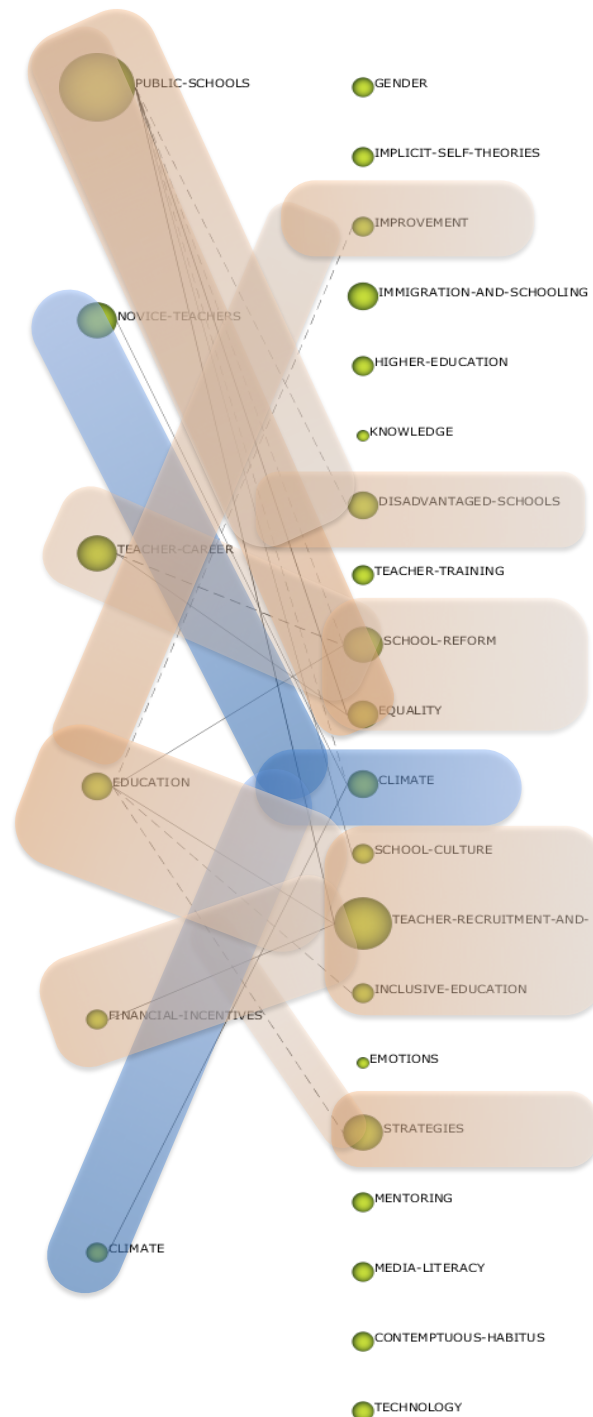
5.3. Thematic evolution of the terms

This study also carried out an analysis of the themes detected in each period considering keywords and their evolution over time. In general terms, the research themes that emerged during the second decade tripled in quantity compared to those of the first. This translates into a surge of interest and bolsters the lines of research on CHASCH.

The thematic evolution reveals the strength of the relationship between the themes of the various periods generated according to the Jaccard index. This is determined if a theme characteristic of a particular interval shares keywords or notions with subsequent or previous periods. The greater the number of keywords between the themes of consecutive intervals, the more solid their evolution. These potential connections are marked by continuous lines when

their associations are thematic and discontinuous lines when they are linked through keywords. Line thickness depicts the strength of the relationship. It is also worth noting that sphere size is proportional to the number of documents it houses.

The scientific map generated by the *SciMAT* software identified the conceptual evolution and the thematic areas related to the research on CHASCH over the last two decades (Figure 7). Specifically, it reveals more connections between themes than keywords.

Figure 7. Thematic areas and evolution of research on CHASCH identified by the *h*-index throughout the two decades study timeframe [2000–2022]

Following the recommendations of experts as to the configuration of the thematic areas (Cascón-Katchadourian 2020), this study identified two cases which are shaded differently in Figure 7: *climate* and *teacher-recruitment.*

Climate is a curious, practically monothematic area given that in the first decade it is not in the foreground (it only has ties to two themes, *climate*, an emerging or declining theme, and *novice-teachers*, a basic a transversal theme). Yet in the second decade it makes gains (although *novice-teachers* ceases to be crucial, *climate* emerges in the later timeframe). This is due, among other aspects, to the fact that in the first period it reveals fewer documents but many more citations than in the second period where the inverse takes place. This thematic area touches on issues related to teacher attrition, aboriginal teachers, identity, novice teachers, determinants, impact and survival. When observing the connections between the two periods (Figure 7), it is possible to conclude the following:

- There is a conceptual connection between two themes from the first period [2000-2011] and one theme from the second period [2012-2022]: *novice teacher-climate* and *climate-climate.*
- There is a connection by keywords respectively from the first to the second period through the research topics *public-schools* and *climate.*

The other thematic area, *teacher-recruitment,* appears as the most relevant to research on CHASCH as it englobes a greater number of research topics and more citations in more publications than the first thematic area. Based on the themes (and their conceptual connections), as well as the shared keywords, it is possible to identify this second thematic area consisting of five from the first timeframe and eight from the second. It is in fact an area that addresses issues related to teacher retention, teacher turnover, alternative teacher certification, teacher transfer, teacher effectiveness, commitment and working conditions. Furthermore, it delves into strategies that allow schools facing challenging circumstances to strive for greater equity. It is possible to advance the following notions when observing the connections between the two periods within this thematic area (Figure 7):

- There is a conceptual connection between one theme from the second decade [2012-2022] and three themes from the first [2000-2011], notably teacher recruitment and retention-public schools, teacher recruitment and retention-financial incentives and teacher recruitment and retention-education (education, in turn, relates to school reform, another theme from the second decade). The same occurs with two themes from the second period [2012-2022] and one from the first [2000-2011], notably equality-teacher career and equality-public schools (public schools, in turn, relates to school culture, another theme of the second decade).
- Keywords also serve to create a connection between the research topics of public schools (first decade) and disadvantaged schools, school reform and climate (second decade), teacher career (first decade) and school reform (second decade), education (first decade) and strategies, and inclusive education and improvement (second decade).
- The timeframe bearing the strongest connection between 'public schools-teacher recruitment and retention' and 'public schools-equality' reveals the founding bases of the research topic.

6. Discussion and conclusions

The data gathered in this study indicates it to be the first bibliometric analysis of CHASCH based on academic publications ranging from 2000 to 2022. There is in fact no bibliometric study on this subject among all the documents gathered through the WoS and analysed by *SciMAT.* In this sense, the current investigation sheds new light on the matter.

Specifically, the intent of this study is to define the general state of productivity and scientific performance related to the subject of CHASCH by attempting to contribute compelling notions as to its evolution and referencing of its most frequent aspects developed by researchers. After collecting and analysing 88 publications (practically all of the known publications on CHASCH in the WoS) by means of WoS *Analyze Results*, *Creation Citation Report* and *SciMAT* software, it was possible to identify the subject's main themes and areas of study.

The scientific performance analysis of the subject reveals an increase in research in the last decade evidenced by the number of documents published that passes from 28 in the first decade to 60 in the second. This indicates that CHASCH is a theme that has gained greater relevance over time, especially in the last decade, and is currently in a stable phase. The United States produced the greatest number of publications. The data also reveals the great diversity of journals publishing CHASCH related articles. Worth highlighting in this sense are *Teachers College Record* and *Leadership and Policy in Schools*. Furthermore, S. Catapano is the most prolific author of these types of articles. However, Yeager and Dweck (2012), Achinstein, Ogawa, Sexton, and Freitas (2010), Grissom (2011) and Reininger (2012) stand out in terms of the number of citations.

Furthermore, Achinstein, Ogawa, Sexton, and Freitas (2010) and Grissom (2011) can be highlighted for their work in the first decade [2000-2011]. They focus on working contexts such as the challenges of staffing schools and disadvantaged schools characterised by a high multicultural presence. They also focus on the crucial role of principals in the sense that hiring the most competent for highly challenging school environments may be an effective strategy in lowering perpetually high teacher turnover rates. Yeager and Dweck (2012) and Reininger (2012), in turn, pertain to the second decade [2012-2022] and delve into the implications of certain factors on challenging schools such as teacher location preferences and school improvement. They come to the conclusion that resilience is essential for success in school and life. In sum, this first analysis suggests that CHASCH is the object of study by numerous researchers from different institutions in different parts of the world.

On the other hand, the structural and thematic development analysis carried out with *SciMAT* identified the research topics of greatest interest related to CHASCH in each of the two timeframes. The first 2000-2011 (*the initial stage of the analysis*) comprised six predominant research topics: public-schools, novice-teachers, teacher-career, education, financial-incentives and climate. The first three were found to be motor themes leading that decade's field of study. CHASCH in the initial decade also began to concern experts from the field of education.

Twenty research themes emerged during the second study period between 2012-2022 (*development stage analysis*). Eleven were motor and basic research themes: gender, improvement, immigration-and-schooling, teacher-recruitment and retention, school reform, equality, teacher-training, disadvantaged-schools, strategies, mentoring and weather. When considering the main performance indicators, the research themes that are the backbone of the field of study in this second decade are summarised by seven cases: teacher-recruitment-and-retention, school-reform, strategies, disadvantaged-schools, equality, immigration-and-schooling and climate. Thus, this second period saw greater contributions to the field of knowledge about CHASCH.

Two themes attracted the interest of the scientific community and could continue to do so in the future. (a) The first relates to *teacher-recruitment-and-retention* and benefitted from the greatest number of documents during second period (respectively through *h*-index and the second through citations). They are linked to public schools, the motor theme of the first period, but in a more widespread manner, hence becoming a basic and transversal theme in recent years. The second is (b) *climate*, a research theme that endures throughout the two periods but yielded a greater number of publications in recent times.

This second decade saw the emergence of new research themes: media-literacy, contemptuous-habitus and technology which could either possibly become references in the next few years in this field of study or disappear. Research in this field will certainly not be devoid of interest in the coming years.

This study analysed the evolution of the concept of CHASCH over two timeframes. The scientific map generated through specialised software renders it possible to state that (a) there are conceptual and keyword connections between the topics identified and analysed in each timeframe and that (b) CHASCH research is concentrated over time in two large thematic areas: *teacher recruitment* and *climate*.

Thus, the evolution of keywords linked to scientific production reveals a level of coincidence throughout each of the two decades greater than 50% indicating the stability of the line of research on CHASCH, which has been progressively cultivated and bolstered over the years. Taking stock of the data presented above, the interests of CHASCH researchers now focus on aspects related to public schools, teacher recruitment and equality as these are the foundations of these studies. Among the adversities facing challenging schools that stand out are the high level of teaching staff turnover which renders it very difficult for principals to attract and retain well-qualified and experienced staff. To this problem must also be added the need of training teachers in these centres as noted in the studies by Brown (2015), Maier (2012), Muijs et al. (2004), Opfer (2011), Qin (2019), See et al. (2020) and Tamir (2010).

The results obtained inform us of the themes that have been the focus of analysis and study in each period, driven by the interests of the researchers. It is they who have marked the thematic preferences and/or rhythms in research on challenging schools over the last twenty years. In this second wave of research (second period), they leave the door open to the study of several topics that appear to be challenging in order to make progress in school improvement in these contexts.

7. Implications for educational authorities and professional practice

In line with the above evidence, it is considered interesting to point out a number of policy and educational implications:

- Teacher training in higher education. This aspect is key and decisive in order to achieve a real curricular adaptation to the current demands, circumstances and/or future situations of challenging schools. Teachers must be sufficiently prepared to work in these contexts. This measure would avoid the permanent rotation of teachers entering these schools.
- Another challenge for policymakers and education practitioners is to harness the teaching and student potential in/of all challenging schools, working both inside and outside organisational boundaries, thus ensuring the creation of educational macro-networks that facilitate collaboration and contribute to a real educational transformation. To this end, administrative and political support is indispensable.
- Promoting change and school improvement. Organisational changes are necessary to help these schools engage in a continuous process of improvement. The development of initiatives aimed at supporting management teams and teachers to engage in improvement actions is a measure that would contribute to the improvement of the professional situation of these individuals as well as to the development of a school capable of influencing progress and social transformation. Previous research on the topic provides us with an insight into the profile of the itinerary followed by several schools that have embarked on their process of change towards improvement, with a focus on the 2030 Agenda. Specifically, the study by Coma et al. (2023) analyses the emerging processes in the journey of these schools towards school improvement, identifying the most relevant elements to facilitate future directions for improvement.

–   Leadership in challenging educational frameworks. It is essential to have committed leaders who motivate and generate innovative ideas, foster collaboration and create strong links through distributed, transformational and pedagogical leadership, which ensures the existence of commitments and improvement plans in challenging schools. These environments require management teams who actively energise, bolster and build innovative actions that improve school cultures (Bolívar 2010) thereby generating resilience spaces (Day and Gu 2015).

8. Limitations and future lines of research

This study suffers nonetheless from certain limitations. The first is that it only resorted to the WoS database to determine the current state of research on challenging schools. Therefore, a potential future line of research is to replicate the analysis resorting to other databases of impact such as Scopus or ERIC. Scopus, like WoS, is recommended for the following reasons: a) the efficiency of their analytical techniques, b) the quality of the studies indexed due peer review processes and c) their importance worldwide. The ERIC database is recommended for its notability in education. This search will yield further articles that could be subjected to a twofold analysis process. Firstly, a quantitative bibliometric analysis (scientific output of the documentation found). And secondly, a qualitative bibliometric analysis. To this end, a thematic analysis of the content of the articles found can be carried out with the help of the qualitative analysis software NVivo 12 or MAXQDA. This analysis could follow the principles of grounded theory, which will allow future researchers in the field to identify emerging themes after reading and analysing the different studies.

A second limitation concerns the debugging of the data gleaned from WoS which was hampered by repetitions or unrelated documents. The same can be said as to the way the time intervals were selected as an attempt was made to maintain an equal density (10 years) for each. In this way, it is recommended that these limitations be considered for future research. It is therefore interesting that other researchers extend the present study by working with other databases, which may serve as a complement to the results obtained in the present research.

The study of the identity of challenging schools becomes a fundamental part of understanding this educational reality. In this sense, it might also be worth increasing the use of the biographical-narrative approach when conducting this type of research, since this is the most effective and complete way of studying the identity, in this case, of challenging schools (Bolívar, 2014).

Others important future lines of research could be highlighted: a) development of longitudinal studies to analyze the evolution or the process of improving these schools; b) professional identity of teachers working in challenging schools; c) factors contributing to the improvement of school climate in these educational contexts; d) creation of networks and collaborative work between challenging schools; and e) role played by competent principals in retaining teachers, particularly in disadvantaged schools with the greatest staffing challenges. Grissom (2011) suggest that policies focusing on hiring the best principals in the most challenging school environments may be an effective strategy in lowering perpetually high teacher turnover rates.

Finally, hopefully this study will spark a continuous international flow of discussion and research focusing on these challenging educational contexts through, for example, ethnographic approaches. In this sense, future researchers should request international projects to continue generating knowledge about CHASCH. The information of this study thus sheds light on lines to follow in the near future.

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