General Contribution

Research Hotspot and Front Visualization of the Shadow Education System: Data from Web of Science

Pu YU, János Gordon Győri

Abstract: This scientometric review takes 351 documents from 1992–2021 as the research object based on the Web of Science database. With the help of CiteSpace, this study aims to construct visualization mapping knowledge domains, display the research status in shadow education more intuitively, contribute opportunities for further research, and provide a more visual basis for dialog among researchers, policymakers and interested actors in the field. This study, by building coauthor, coword, and cocitation knowledge visualization maps, demonstrates cooperation among authors, research hotspots and frontiers in the field. Our results show that shadow education has experienced a rapid expansion over the last decade but that the scope of the collaborative circle of academia needs to be further expanded. Furthermore, because of shadow education's variable forms, researchers need to pay extra attention to the scope of its definition. Parents are involved in too many of their children's educational choices; learning requires more self-drive and improved self-learning ability.

Keywords: shadow education, visualization, hotspot, frontier

Introduction

Regarding shadow education, which is widely known as private supplementary tutoring, the term 'shadow' has been used as a metaphor for how the curriculum changes as mainstream education changes (Bray, 2017); as schooling becomes increasingly global, so does shadow education (Yung & Bray, 2021). Almost one-third of all students aged 15 years from 64 societies worldwide are involved in shadow education (Entrich, 2020), a phenomenon that has become an inevitable and universal integral part of the learning culture worldwide and progressively evolved into an important sector that can share the functions of the mainstream education system (Kim & Jung, 2021). East Asia is probably the most notable shadow education region worldwide (Zhang & Yamato, 2018); for example, South Korea has the highest participation rate for shadow education globally, though such education is also especially prominent in Japan, Chinese territories, Singapore and so on (Kim & Jung, 2021). Shadow education in Western societies has also expanded visibly, for instance, in Australia (Watson, 2008), North America, and Europe (Kim & Jung, 2019). It is noteworthy that Denmark, which places a strong emphasis on equality in its pedagogy, has also witnessed recent growth in the use of shadow education (Mikkelsen & Gravesen, 2021). Although this phenomenon dates back centuries, its continuous growth is unavoidable (Baker, 2020).

https://doi.org/10.3224/ijree.v10i2.02

Relevant research has become explosive and profound across societies, although this field has been neglected for quite some time (Gordon Győri, 2020).

Zhang and Bray (2020) took the first global comparative study of shadow education as a starting point and summarized the changes in focus and research methods in the associated research worldwide, characterized by an increasing refinement of research themes and scientific approaches. However, given the global diversity of shadow education, which varies across contexts and cultures, more than 20 related terms describe the phenomenon in English only (Kobakhidze & Suter, 2020). Moreover, regulations for shadow education vary, with many governments adopting a laissez-faire approach (Bray & Kwo, 2014). However, the rapid expansion of shadow education and its increasing diversity, in some cases going beyond the 'shadow' metaphor itself, poses the threat of more multifaceted impacts and complexity (Bray, 2021), such as those on educational ecology (Luo & Chan, 2022). Furthermore, learning culture is also affected, as Kim and Jung (2021) pointed out, with students acting like nomads, learning across the boundaries of mainstream schooling and shadow education. Shadow education is now an essential subfield of educational research, with a broad range of sub-disciplines associated (Hajar & Karakus, 2022), which is one of the focal points that need to be increasingly confronted by all actors.

A systematic review and analysis of the literature on shadow education can help us understand the existing research findings and provide ideas for further research, especially concerning insights into research frontiers and trends, which helps narrow the gap between the rapidly proliferating and changing reality of shadow education and subsequent research. However, traditional literature review methods are labor intensive and somewhat subjective, lacking a more visual mapping of the current state of shadow education research and its development. By analyzing and visualizing the scientific literature with the help of CiteSpace +- a free Java application, the rapidly growing study topic identification and research trends presented through the automatically labeled clusters' terms of cited articles (Chen, 2004) not only helps improve time efficiency and enhance visual readability but also provides researchers with more solid evidence of the interpretation and evaluation of research dynamics in the field. Big data plays an essential role in education; for example, Ye (2018) provided a scientometric visualization of the development profile and latest trends of big data research in education with the help of CiteSpace, not only showing the dynamics of the category of big data technology in the education sector but also pointing out the relative lack of research related to educational management, which provides a reference for which future topics need to be strengthened in the field. Moreover, Rawat and Sood (2021) applied CiteSpace and conducted visualized knowledge mapping on information and communications technology (ICT) applications in educational research. The structure of education research using ICT is demonstrated, indicating that higher education (categorized by formal education), distance education (categorized by nonformal education), and mobile devices are presently the most active topics in the field, contributing to the relevant personnel to further grasp the appropriate research path.

Given this, we present the research agenda through a more visual knowledge map based on the database with which we are working and through objective scientific bibliometrics with the help of CiteSpace and answer the following questions. (1) How is the research on shadow education progressing? (2) What does the research focus on regarding shadow education and its evolution? (3) What are the cooperation trends among authors in the shadow education field? (4) What are the research fronts, intellectual base and emergent trends of the shadow

education specialty? This study contributes to the construction of a more visual basis for dialog among researchers, policymakers and interested actors in the field to engage with relevant issues.

Literature Review

The concept of shadow education in this research is guided by the definition characterized by Bray (1999) from the first global comparative study on shadow education, highlighting it as paid academic subject-based tutoring outside the formal schooling system for primary- and secondary-school students. The 'shadow' metaphor used to describe the phenomenon of private tuition or private tutoring, with the aim of preparing students "for the selective national school examinations" (Marimuthu, Singh & Ahmad et al., 1991, p. vi), dates back to early 1990 s, when the term 'shadow education system' was first coined and documented (Zhang & Bray, 2020). Stevenson and Baker (1992) then independently used the term 'shadow education' in the title of their academic research study with an explicit definition: 'a set of educational activities that occur outside formal schooling and are designed to enhance the student's formal school career' (p. 1639). In 1999, Bray gave a more specific definition of shadow education, framing its curriculum in terms of 'provision, privateness, and academic subjects' (p. 20), an approach that has since been widely followed.

However, the fuzzy boundaries of the concept of shadow education are one of the challenges of such studies. The shadow education phenomenon allows for the frequent interchange between private supplementary tutoring and private tutoring (Bray, 1999; Manzon & Areepattamannil, 2014; Bray, Zhan, Lykins et al., 2014), as well as among cram school (e. g., Yung, 2020), private tuition (Jelani & Tan, 2012) and supplementary education (Park, Buchmann, Choi et al., 2016). Kobakhidze and Suter (2020) summarized 22 terms that include shadow education to describe the phenomenon in an English context, but some of these terms, such as 'additional instruction, summer learning, engaged activities' (p. 1), cannot be related to the phenomenon at once. The mutual reference of similar concepts creates confusion. Furthermore, even the same term in different research contexts shapes the different areas of focus (Bray, 2010). Furthermore, due to the global nature of shadow education, which has a local label in each region, and its continued growth, for instance, in Denmark, the phenomenon is slowly entering the market in the form of 'homework help' (Mikkelsen & Gravesen, 2021, p. 550), which may further increase the difficulty of such research.

The study of shadow education started relatively late; the early research on shadow education focused on exploring the reasons for its emergence and mapping out the overall development landscape. Shadow education continues to expand under the combined effect of the demand and supply sides. The demand side expects shadow education to enhance competitive advantages (Fülöp & Gordon Győri, 2021), meet expectations (Yung & Zeng, 2021), contribute to reproduction (Tsiplakides, 2018) or be a means of opportunity hoarding (Hamilton, Roksa & Nielsen, 2018), even though no consensus has been reached on whether shadow education enhances students' academic achievement (Byun, 2014). On the other hand, the capitalized supply side of the industry drives demand (Feng, 2021), which provides space for the ongoing proliferation of shadow education. Zhang and Bray (2020) have

summarized the development of global shadow education since the 1990s, including its the main issues and reflections on the future research agenda, but lack an objective picture of the evolution of the research focus over time. The expanding scale of this global phenomenon, in which diverse and changing manifestations and technology-enabled education models are also permeating, as well as the complexity of collecting evidence on shadow education (Bray, 2010) further pose challenges for researchers in keeping up with the pace of its development. Thus, the visualization of the evolution of research themes in shadow education can help researchers grasp the overall context more intuitively and, thus, inspire future research approaches.

The continued expansion of shadow education has had profound impacts and has evolved from a relatively informal activity to a more systematic operation (Yung & Bray, 2021). Numerous studies have found that participation in shadow education is proportional to family background (e. g., Byun, Chung, & Baker, 2018; Jansen, Elffers & Jak, 2021). The exclusion of low-income families from such education raises issues of educational equity, runs counter to the public sector's emphasis on free and equal education (Matsuoka, 2019) and also results in negative attitudes and behaviors among students (Bray & Kobakhidze, 2015) and teachers (Liu & Bray, 2020) toward mainstream schooling. Thus, it is crucial to regard shadow education as an essential agenda for research, policy and educational development (Yung & Bray, 2021), not only for the maintenance of sound educational ecology but also for the necessity for students' personal growth, family harmony and social order. More needs to be done to keep up with such a changing pace. A growing number of governments worldwide have placed planning for shadow education on their policy agendas (Bray & Kwo 2014), but such planning is still much less evident the relatively robust regulating mechanisms of mainstream education, requiring visualization to attract more attention; policymakers should regulate shadow education before it becomes ingrained in the culture (Bray, 2021). Thus, the analysis of the cocited literature to identify and visualize the knowledge base of shadow education research contributes to policymakers and researchers keeping abreast of the research trends and helps bridge the gap with the fast-moving reality.

Research Methods

Data Source

Based on the Web of Science (WoS) database, a final sample of *351* data points was selected for this study, with the following selection criteria and process. The input data were retrieved from the WoS Core Collection based on the 'Topic' that comes with all years (1975–2021). The shadow education phenomenon is shaped by different contexts and can be manifested in various ways, frequently applying interchangeable terms as mentioned in the text above. As such, this study set the search terms as follows: 'shadow education', 'private tutoring', 'private supplementary tutoring', 'supplemental education', 'private tuition', 'extra-curricular tutoring', 'outside school tutoring', 'cram school', 'afterschool tutoring', and 'extra-school tutoring'. Only articles and book chapters were retained for the document type of this research. In addition, irrelevant documents outside the boundary of shadow education, as defined in this research, were excluded, such as those on shadow education for higher education, preschool,

adult education, peer tutoring, free-of-charge tutoring, school-community-organized collective tutoring, private tutoring for non-academic-based subjects, and institutions that provide tutoring only to students after high school graduation due to their failing of the college entrance examinations. As of December 31, 2021, *351* documents that met the screening criteria from 1992 onward were finally applied as the research data.

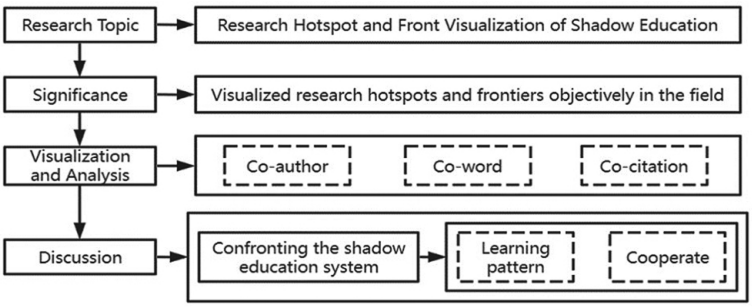
Nevertheless, it should be noted that the database used in this study has its limitations. The phenomenon of shadow education is universal, shaped differently by different societies and manifested in various ways. However, this study draws only on English-language literature, excluding data from the literature in other languages. Furthermore, this study analyses only data exported by the WoS Core Collection. Thus, the published numbers, coword analysis, author collaboration, and construction of cocitation maps all have that as their basis. Hence, the citation frequency of the references in this study is based on the above dataset and not on the citation frequency across all academic communities. Moreover, although the data on shadow education for this research was started in 1992, far earlier historical research on the topic can be found.

Research Tool and Method

The software for scientometric and visualization analysis used in this study was CiteSpace, which is an information visualization software based on the Java application for analysis (Chen, 2004), with the functionality of visualizing research hotspots, detecting emerging trends, labeling specialties, and noting abrupt changes (Chen, 2006), represented by the cooperation network, co-occurrence network, and cocitation analysis network. The coauthor network indicates cooperative relationships among authors in a research area and reveals the distribution, the cooccurrence network reveals the research hotspot, and the cocitation reference network analyzes intellectual bases and research fronts (Chen, Chen, Hu et al., 2014). Thus, this study answers the following questions. (1) How is the research on shadow education progressing? (by presenting database-based annual publications of shadow education research). (2) What are the cooperation trends among authors in the shadow education field? (by constructing a coauthor map). (3) What does the research focus on regarding shadow education and its evolution? (by building keyword co-occurrence and cluster maps). (4) What are the research fronts, intellectual base and emergent trends of shadow education specialty? (by constructing a cocitation knowledge map and its clusters). Figure 1 shows the logic of this study.

First, the dataset shows the trend of the publication volume and author cooperation in shadow education research. Then, the visualization of research hotspots is displayed according to the cokeyword map. Next, we construct cocitation maps to analyze the research fronts. We expect that through these visual knowledge maps, which provide further empirical evidence for the development of the shadow education system, readers can more objectively and clearly distinguish and understand the structures and trends in how the shadow education phenomenon has developed.

Figure 1. Research Route

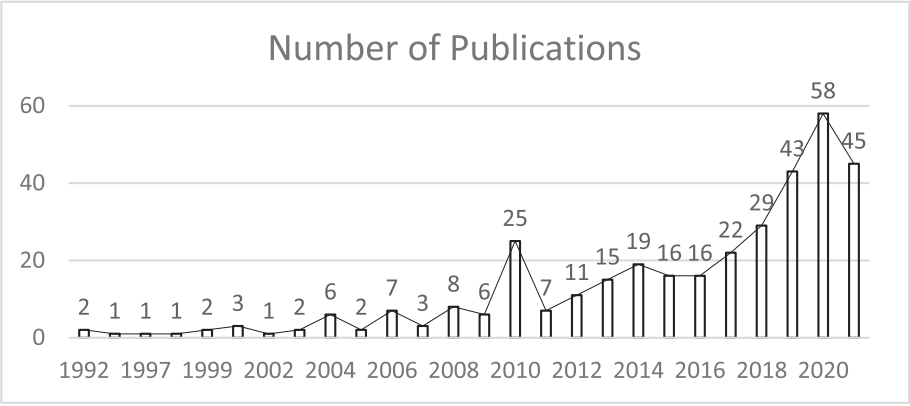


Results

Number of Publications

The output of papers in a research field directly reflects the scientific researchers' attention to that field and the discipline's theoretical level and development speed (Li, Li, Chen et al., 2019). With the help of an Excel spreadsheet, based on the *351* collected publications from the WoS Core Collection, Figure 2 shows the annual research output concerning shadow education from 1992–2021.

Figure 2. Annual Publications on Shadow Education (1992–2021)



The shadow education phenomenon is regarded as a part of the daily life of contemporary children (Bray & Lykins, 2012), which is the 'subfield' (Zhang & Bray, 2020, p. 335) of relevance to educational research. Nevertheless, this study is restricted to the dataset on which it is based. As shown in Figure 2, 1992–2009 was the initial stage of the topic when the output of studies was relatively small, which coincides with Bray's statement that research in the shadow education field is increasing; however, this field remains in its infancy at that moment (Bray, 2010). Since 2010, shadow education has received more attention than in the previous

period, when publications attained the first small peak in that year. By the end of 2021, this 'infancy' seemed to have grown significantly. The prevalence of shadow education is still increasing in many societies (Yung & Bray, 2021), and research into this topic has become a subfield of education research (Zhang & Bray, 2020).

Shadow education is not a new phenomenon but rather a delayed research discourse. Until Bray's first vital private tutoring transnational research publication in 1999 by UNESCO's International Institute for Educational Planning, shadow education had received gradually increasing attention in the academic literature (Bray, 2009), and it has been disseminated quickly since 2009, when the sequel book was issued.

Intellectual Communities

Authors' Cooperation

Research cooperation is helpful for various resource exchanges and transfers. The microlevel cooperation network of CiteSpace is demonstrated by the coauthor map, visualizing the available research power. An author is selected as a node, and then, the CiteSpace function and parameter setting area are set. Moreover, the span is set to 1992–2021 with a time slice of 3, and the selection criteria are set to 'Top 50', representing the top 50 authors with the highest number of publications within the 3-year span. Figure 3 shows the constructed author cooperation network for shadow education, but only the thirteen core authors' names are shown.

Figure 3. Network Map of Author Cooperation

Each node represents an author. The nodes' connections represent cooperation between authors; when two or more authors appear in the same article, a scientific research cooperation relationship is formed (Chen, 2017). The larger the node is, the more publications by the author, and the thicker the connection line is, the closer the cooperation. Mark Bray is a crucial figure in spreading and carrying forward research on shadow education with the largest node and forming a prominent research community with more than half the most productive authors in the field. This communication circle focuses on the landscape, efficiency, implications, challenges, direction of shadow education, and correlations between mainstream schooling and social justice, which is the mainstay of shadow education research. Hyunjoon Park and Ji-

Ha Kim dominate the other visible knowledge-sharing community with a wide range of cooperation. Other authors have also contributed to the further development of shadow education research and created collaborations but to a lesser extent.

According to price law, half of all papers in the same field are written by a group of high-output authors, and the sum of these authors is approximately the square root of the total number of authors. Based on the formula for calculating the core author, $N = 0.749\sqrt{n_{max}}$ (n_{max} refers to the number of papers by the author with the most significant publications), author Mark Bray, as both an independent author and a coauthor, published the most papers on shadow education based on the dataset, with 29 articles ($N \approx 4$). N is the bottom boundary of the number of papers published by core authors. As such, authors with more than 4 publications are seen as core authors in this study. Thirteen authors are summarized, as shown in Table 1.

Table 1. Top 13 Most Productive Authors in Shadow Education

S/N	*Author*	*Number of publications*	*S/N*	*Author*	*Number of publications*
1	Mark Bray	29	8	Yu Zhang	6
2	Wei Zhang	10	9	Ji-Ha Kim	5
3	Kevin Waiho Yung	9	10	Jung-Hoon Jung	5
4	Hyunjoon Park	8	11	Liang Choon Wang	5
5	Junyan Liu	8	12	Rafsan Mahmud	5
6	Karin Guill	6	13	Vit Stastny	5
7	Magda Nusta Kobakhidze	6			

Data source: summarized by CiteSpace based on our dataset.

Research Hotspots

Cokeyword Network

The keywords in the articles offer a high-level summary of the topic, reflecting the research focus. The word co-occurrence network and its cluster analysis can display the research hotspots using CiteSpace (Chen, Chen, Liu et al., 2015). As such, cokeyword analysis is adopted in this study to search for the subject's hot topics and construct relationships, which term classify extracts from the literature according to title, author keywords, abstracts and keywords.

Figure 4. Hotspots in Shadow Education Studies

Figure 4-a

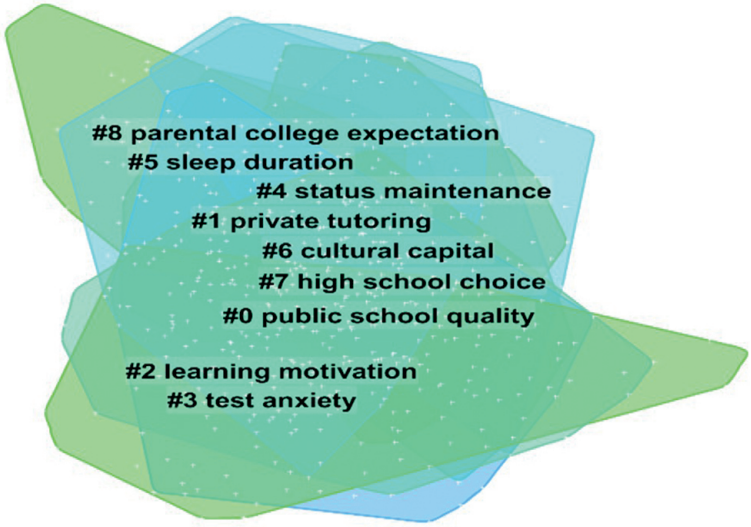


Figure 4-b

Figures 4a and 4b visually depict the hotspots in shadow education research. Figure 4a was constructed by picking the top 50 words for each year processed by the cokeyword network to present the thematic hotspots of shadow education. As shown in Figure 4a, each cross-shaped node represents a keyword, with the larger nodes appearing more frequently. Achievement, demand, pattern, impact, performance, inequality, transition, family, policy, and education policy are the top ten words applied in shadow education studies. Based on the visualization running results in Figures 4a and 4b show a cluster map of cokeywords constructed through the log-likelihood ratio (LLR) algorithm and present the research hotspots on shadow education. Nine prominent clusters are selected, revealing the hotspots in shadow education, the detailed information of seven of which is summarized in Table 2, with the mean year falling in

the period 2010–2016, representing the document's mean year in the cluster. A silhouette value, S>0.7, means that the clustering is convincing (Chen, Chen, Hu et al., 2014).

Table 2. Information Summary Form of the Cokeyword Network Cluster in Shadow Education Research

Cluster ID	Silhouette value	Mean year	Identity term (first five)
0	0.717	2014	public school quality; educational investment; professional misconduct; large family size; shadow curriculum
1	0.752	2010	private tutoring; afterschool program; afterschool participation; private tutoring expenses; high school
2	0.849	2016	learning motivation; learning attitude; learning well-being; annual incidence; incident myopia
3	0.78	2012	test anxiety; middling achievement; parent satisfaction; self-study hour; parent loyalty
4	0.813	2014	status maintenance; social status; low socioeconomic status (SES) family; SES; market competition
5	0.787	2016	sleep duration; somatic symptom; parent-child relationship; parental involvement; emotional distress
6	0.865	2015	cultural capital; private coaching; private tutoring; learning activities; supplementary education

Data source: summarized by CiteSpace according to the dataset employed.

Based on the cokeyword network with its cluster map and information summary in Table 2 above, the hotspots in shadow education research are classified as follows:

- Prestige orientation to shadow education. One primary purpose of students' participation in shadow education is to achieve better academic performance in terms of mainstream examinations or international tests, especially for high school and university entrance exams, which enhance their competitiveness in terms of their further development. Moreover, shadow education should be used to maintain social status or opportunity hoarding.
- Participation conditions of shadow education. Educational decisions include the determinants of shadow education, such as fierce competition for further schooling, which has intensified the influence of educational determinants on, for example, Japanese students' futures (Entrich, 2015). Such shadow education participation not only represents the students' issue but also incorporates parents' choices and involvement. However, the participation rate of shadow education is closely related to family background, such as SES and cultural capital. Thus, such market-based private supplementary tutoring has stopped some students from low-income families from entering the door to shadow education.
- Implications of shadow education. There has been much discussion among scholars on whether shadow education, as an exogenous aid, can help students obtain high academic achievement, but no consensus has yet been reached. However, the negative impact of shadow education on students (Hajar, 2018), such as their physical condition and sleep habits (Noh, Kim, Cheon et al., 2020), has received more attention. Some scholars have

shown that students' happiness in learning stems from their attitudes and motivations (Lo & Lin, 2020), in which internal impetus plays a vital role in driving self-directed learning and improving academic performance.

- Shadow education as a mirror. The interconnection between shadow education and mainstream education has received much attention. Whether this interconnection reflects the quality of mainstream education from the demand for shadow education or whether shadow education has surpassed the mainstream education that describes it metaphorically, this is an opportunity to reform formal education. For example, the coronavirus disease 2019 (COVID-19) pandemic has profoundly impacted the educational landscape, with the shadow education industry also encountering significant impacts and opportunities (Pimlott-Wilson & Holloway, 2021), and thus, mainstream education should take into account this mirror.

It is worth noting that in Figure 4a, the terms with high frequencies used to represent the shadow education phenomenon, such as shadow education (143), private tutoring (108), private supplementary tutoring (20), supplementary education (14), cram school (9), and private tuition (9), are excluded. The tradition of private tutoring has existed for several generations (Bray & Lykins, 2012), but 'shadow education' with a high rank indicates that this metaphor is widely accepted and recognized in the research field. However, the blurred definition of the shadow education phenomenon should be noted continuously. Table 3 summarizes the broad range of the definitions (in total 23) of shadow education phenomenon ranked by frequency and retrieved from the dataset. In addition to the top six abovementioned concepts, tuition, private education, afterschool programs, extracurricular activity, private supplementary education, remedial education, supplementary education, extra lessons, summer learning, supplementary tutoring, afterschool classes, afterschool tutorials, extra tuition, private coaching, private lessons, supplemental educational services and supplemental lessons also point to the shadow education phenomenon. Moreover, these concepts include only English expressions and not local terms shaped by different societies.

Table 3. 23 Terms for the Shadow Education Phenomenon

Term	Freq.	Term	Freq.
shadow education	143	supplemental education	3
private tutoring	108	extra lesson	2
private supplementary tutoring	20	supplementary tutoring	2
supplementary education	14	summer learning	2
cram school	9	afterschool tutorial	1
private tuition	9	afterschool class	1
tuition	6	extra tuition	1
private education	5	private lesson	1
afterschool program	4	private coaching	1
extracurricular activity	3	supplemental lesson	1
private supplementary education	3	supplemental educational service	1
remedial education	3		

Data source: summarized by CiteSpace according to the dataset employed.

Academic Base and Research Front

The research front in a field is reflected in the articles actively cited by scholars (Chen, Chen, Liu et al., 2015). The references cited in an article provide valuable information about the academic connections among various scientific concepts (Chen, 2012), which reflects the objective laws of scientific development. Cited references constitute the academic base, which is the knowledge unit from a free state to reorganization through which new knowledge can be produced (Li & Chen, 2016).

Academic Base

Figure 5. Visualized Output of the Cocitation and Its Cluster on Shadow Education

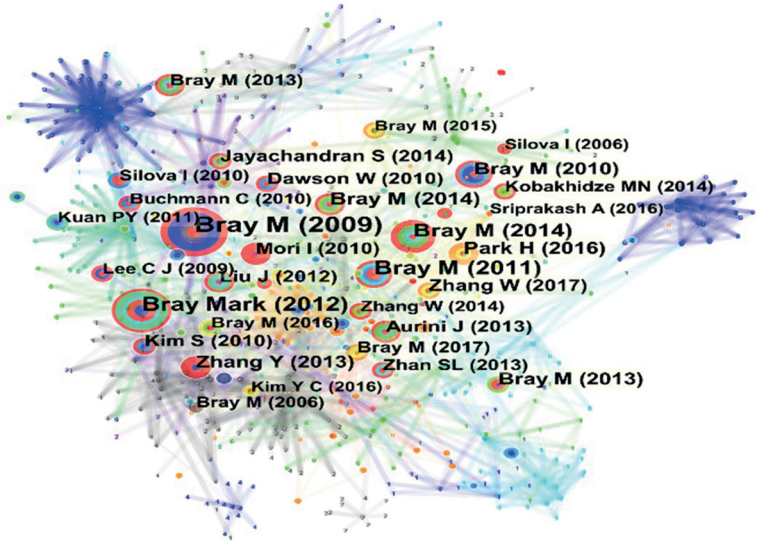


Figure 5-a

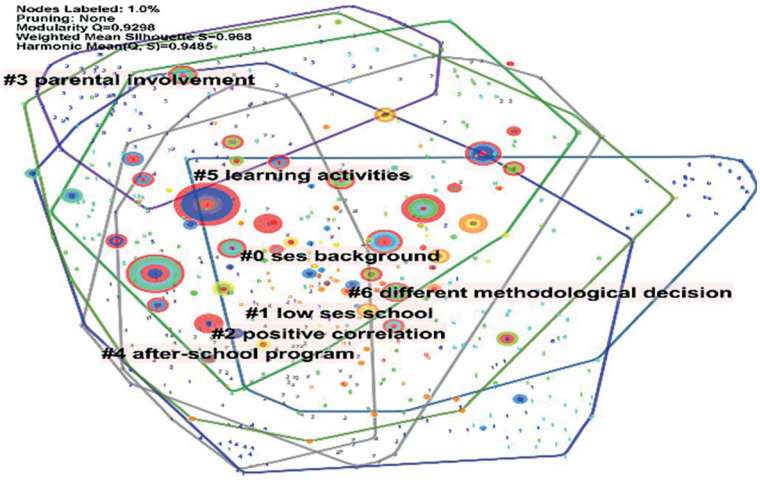
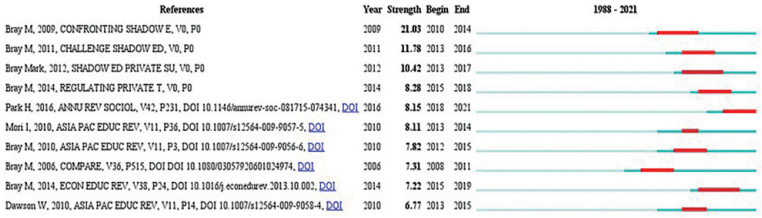


Figure 5-b

Figure 5a is a reference cocitation network map generated by extracting the top 50 cited references in each year for 1992–2021 from the dataset. These citations contain terminology at the forefront of research and indicate the intellectual base of shadow education. However, only the top 27 nodes are selected in the figure. Each node in the figure represents a reference, and the larger the node is, the higher the citation frequency. The links between nodes represent the

cocitation relationship between references. The top five ranked works by citation count are from Mark Bray as either the only author or the first author.

Figure 6. Top 10 References with the Strongest Citation Bursts



Citation bursts also provide evidence for classical references in the field. Figure 6 shows the top 10 strongest citation burst references. The beginning and end of the figure represent the start and end times of the reference burst represented by a red line, respectively; the higher the strength is, the stronger the burst. Table 4 displays the top 3 cited and strongest bursts of literature.

Table 4. Top 3 Cited Studies with Bursts

Citation rank	Published year	First author	Literature title
1	2009	Bray	Confronting the shadow education system: what government policies for what private tutoring?
2	2011	Bray	The challenge of shadow education. Private tutoring and its implications for policy makers in the European Union
3	2012	Bray	Shadow Education: Private Supplementary Tutoring and Its Implications for Policy Makers in Asia

Data source: summarized by CiteSpace according to the dataset employed.

As shown in Table 4, the most cited book, *Confronting the shadow education system: What government policies for what private tutoring?*, was published in 2009 as a sequel to *The shadow education system: Private tutoring and its implications for planners, which was* published in 1999, reviewed the work on shadow education over the past decade and explored opportunities for its further development (Zhang & Bray, 2020). This book is currently available in 15 languages in addition to English, namely, Arabic, Armenian, Azerbaijani, Bengali, Chinese, French, Georgian, Hindi, Kannada, Korean, Mongolian, Nepali, Sinhala, Urdu and Uzbek (Bray & Kwo, 2014). The contribution of this book to exploring the direction of shadow education research worldwide is encouraging.

The second-most-cited reference is *Shadow Education: Private Supplementary Tutoring and Its Implications for Policy Makers in Asia*, which was published in 2012 by Bray and Lykins and provides a vital map of shadow education in Asia. "Geographically, the study embraces a very diverse region, stretching from Mongolia in the north to Indonesia in the south, and from Georgia in the west to Japan in the east" (Bray & Lykins, 2012, p. 2). This study demonstrates the participation, supply, demand, and implications of shadow education

and further highlights that the increasing proliferation of shadow education cannot be ignored in the policy process.

The third-most-cited reference is *The challenge of shadow education. Private tutoring and its implications for policy makers in the European Union*, which is an independent report prepared for the European Commission, authored by Mark Bray in 2011. This report provides a picture of shadow education in the European Union based on geographic patterns, explains that shadow education exists in terms of both supply and demand and further explores its impact on students, families, and mainstream education, as well as its implications for policymakers. The report reveals widespread shadow education within the European context —"an important step in our effort to improve European education and training systems—as appraised by Brussels (Bray, 2011, p. 3).

Frontier Hotspot

The research frontier represents the ideological status of a research field, which can be represented by the clustering of the emergent words of the cited references, exhibited by labels in CiteSpace (Chen, Chen, Liu et al., 2015). Figure 5b is a cocitation cluster network based on Figure 5a, in which each cluster is labeled by extracting nominal terms from the titles, keywords and abstracts of the cited references, constructed through the LLR algorithm. The cluster labels in the map reflect the fronts and the characteristics of shadow education research. The seven largest cocitation clusters are selected, and the number of references in clusters #0–6 decreases successively. Those clusters with labels are cluster #0, SES background; cluster #1, low SES school; cluster #2, positive correlation; cluster #3, parental involvement; cluster #4, afterschool program; cluster #5, learning activities; and cluster #6, different methodological decisions.

To understand the research fronts labeled for each cluster, this work explores the citers through further reading and finds the most relevant citer for each selected cluster, as demonstrated in Table 5, based on the running results from CiteSpace. The frontiers of shadow education research are summarized below.

Determinants of shadow education. Cluster #0 is labeled as SES background. Extensive studies have found that family SES positively influences students' participation in shadow education (e.g., Choi & Park, 2016; Zhang & Xie, 2016; Choi & Choi, 2016) and thus increases inequality when private tutoring, as an enrichment strategy, is effective (Ghosh & Bray, 2018). Cluster #1 is labeled as a low SES school. Addi-Raccah and Dana (2015) found that the intensity of students' participation in private tutoring is positively correlated with school SES. But for students studying in low SES school, which average scores are higher with low private tutoring participation than those with moderate or high attendance intensity. A study from South Korea showed that under a nonequalization policy, students are selected for different high schools based on their academic performance (Wang, 2015), where credentialism drives the demand for private tutoring (Ghosh & Bray, 2018). The global phenomenon of shadow education is still spreading (Yung & Bray, 2021); given the fee-based characteristics of shadow education and educational tracking, SES research is currently at the forefront of shadow education.

Efficiency of shadow education. Cluster #2 is labeled 'positive correlation', and cluster #3 is labeled 'parental involvement'. The effectiveness of shadow education has been heatedly discussed, as research shows mixed results. Many studies illustrate that students benefit from

participating in shadow education in terms of their academic performance (Dang, 2007; Choi & Park, 2016; Ha & Park, 2017). Nevertheless, some studies find the opposite relationship (e.g., Guill & Bos, 2014); some research concludes that the positive effect of shadow education on academic performance is affected by the type, duration and subject of such education (e.g., Byun, 2014; Ömeroğulları, Guill, Köller et al., 2020). Moreover, parental involvement in of the meeting of children's specific needs in shadow education selection and tracking significantly helps students in terms of their academic achievement (Park, Byun, & Kim, 2010). Given that shadow education participation is not always directly associated with academic performance improvement, the further exploration of this area is essential.

Educational pattern and equity. Cluster #5 is labeled learning activities, and cluster #6 is labeled different methodological decisions. As education patterns are changing, learning activities are no longer restricted to mainstream schools but can also reach different types of shadow education, either in person or online (Park, Buchmann, Choi et al., 2016). Many families believe that investment in shadow education is inevitable and that its use is no longer limited to wealthy families (Bray & Kwo, 2013). One study found that participating in shadow education not only improves test scores but also positively affects participants' self-esteem, confidence and interest in learning (Hajar, 2018), thus highlighting the significance of the shadow education curriculum (Kim & Jung, 2019a).

Furthermore, maintaining and promoting educational equity has always been an essential topic in shadow education research. The prevalence of household investment in private and fee-based shadow education is incompatible with the willingness of most governments to support free fundamental education at the official level (Bray & Kwo, 2013). As mentioned earlier, participation in shadow education is often linked to a household's capacity to pay. Cluster #4 is labeled afterschool programs. One study found that afterschool programs organized by public schools contribute to promoting educational equality, with evidence showing that afterschool program participation is more effective for families with lower incomes and in rural areas, compared to other types of families, in terms of reducing private tutoring expenditure (Bae, Oh, Kim et al., 2010). Moreover, afterschool educational broadcasting systems improve educational outcomes among students from low-income families (Ha, 2017), thus providing more opportunities for students whose families are in adverse situations or facing the inconvenience of geographical distance. Given the above factors, the focus on education equity in shadow education research deserves to be tracked, continuously promoted and updated with changes in educational patterns and policies.

Table 5. Most Relevant Citer in Each Cluster

Cluster ID and label	First author	Published year	Reference title
#0 SES background	Zhang	2017	Micro-neoliberalism in China: public-private interactions at the confluence of mainstream and shadow education.
#1 low SES school	Bray	2013	Behind the façade of fee-free education: shadow education and its implications for social justice.
#2 positive correlation	Dang	2008	The Growing Phenomenon of Private Tutoring: Does It Deepen Human Capital, Widen Inequalities, or Waste Resources?

Cluster ID and label	First author	Published year	Reference title
#3 parental involvement	Park	2013	Re-evaluating education in Japan and Korea: De-mystifying stereotypes.
#4 afterschool program	Bae	2010	The impact of afterschool programs on educational equality and private tutoring expenses.
#5 learning activities	Bray	2017	Schooling and its supplements: Changing global patterns and implications for comparative education.
#6 different methodological decision	Zhang	2015	Shadow Education In Chongqing, China: Factors underlying Demand And Policy Implications.

Data source: summarized by CiteSpace according to our dataset.

Discussion

Based on the dataset used, this study visually explores the research on shadow education from 1992–2021. CiteSpace is employed to review the overall research and development in shadow education research. Shadow education began relatively late, but it has received increasing attention from scholars in recent years. Since 2010, the number of publications on shadow education have been increasing yearly.

The expansion of the shadow education phenomenon has become a space in which tutors, managers, and families can seek autonomy and alternate educational options; its institutional power has been strengthened in postmodern society (Mori & Baker, 2010). Over the past decade, the updated conceptualization of shadow education from a multilevel, interdisciplinary, and interdepartmental concept seeks transferability between shadow education and mainstream education; in fact, shadow education, as an innovative laboratory, aims to promote educational reform (Zhang & Bray, 2020). This area is no longer an overlooked research field, regardless of whether studies explore its underlying logic or further development. The role and practice of shadow education have steadily changed from a specific national logic to a global universalist ideology (Baker, 2020). However, the reality of shadow education is evolving much faster than is the related research, coupled with the fact that planning for shadow education is only on the agenda of a small portion of governments worldwide. Narrowing the reality of the rapid proliferation of shadow education and its research and regulation thus requires the concerted efforts of multiple actors.

The coauthor network constructed in this study reveals the existence of cooperation among researchers; only one circle of scholarly communication is more prominent and plays an essential role in shadow educational research. Even though other authors outside this circle have made vital contributions to the field, there is less widespread collaboration. The phenomenon of shadow education started much earlier than did the related research, and such a global phenomenon manifests itself in different forms in different places, even with various terms for the same region. Therefore, the expansion of communication and cooperation in the field of shadow education research can help scholars further deepen the connotation of and

learn from the phenomenon, hence helping promote the research and governance of shadow education and sound educational ecology.

The study demonstrates those research hotspots and fronts that have been paid attention by researchers in the field by the cokeywords and cocitation networks. The summary of research hotspots shows that the focus on shadow education research is diverse and has been integrated into contemporary family life: to demonstrate the exploration of students' achievement; the interactions among shadow education participation, education acquisition and family background; the influence of shadow education on mainstream education and its backlash; the challenge of shadow education in terms of policy enactment; and the discussion of its impact on social equity. Its underlying logic involves the motivation and attitudes of individual students, parents, teachers, family structure, economic status, cultural capital status, school education system and different cultural value orientations.

Nevertheless, it should be noted that even though the term 'shadow education' emerged much later than did the actual phenomenon, the metaphor used to describe it as mimicking mainstream school education has been widely recognized. However, the rapid expansion of shadow education is inevitable and universal and may continue to intensify in the foreseeable future (Baker, 2020). In its diverse forms, part of shadow education has surpassed its mainstream-education-based 'shadow' metaphor, resulting in more complex problems and impacts, particularly its negative impact on children's physical symptoms, as visualized above.

The shadow education system is complicated; moreover, in the era of big data and artificial intelligence, the development process of teaching and learning models for formal and shadow education is changing rapidly. Therefore, the further legalization and standardization of the industry and market of shadow education comprise an essential step for the facilitation of a sound education ecology, which needs more attention in the field, not only from researchers but also from the government, families, schools and society. Moreover, parents being involved in too many of their children's educational choices may intensify children's growth, especially their self-learning ability to adapt to the rapidly changing world, emphasizing and exploring the significance of self-driven learning, which is the basis for improving survivability and maintaining the continuity of lifelong learning.

Especially since 2020, COVID-19 has seemed to be creating a natural experiment in terms of school education and shadow education, as the latter can be compared to the former in a virtual space (Zhang & Bray, 2020), which challenges the trust crisis aspect in formal education. Although research on shadow education is trending in terms of vitality and maturity, its development faces the challenges of curriculum, nature, mode, scale, technology, innovation, development speed, regulations, governance, and legality with the transformation of mainstream education. Furthermore, especially for the comparative study of shadow education, 'the time is right to push forward a broader view of its origin, consequences, and future' (Baker, 2020, p. 5).

Reference

Addi-Raccah, A., & Dana. (2015). Private tutoring intensity in schools: a comparison between high and low socio-economic schools. *International Studies in Sociology of Education*, *25*(3), 183–203. https://doi.org/10.1080/09620214.2015.1069719

Bae, S., Oh, H., Kim, H., Lee, C., & Oh, B. (2010). The impact of after-school programs on educational equality and private tutoring expenses. *Asia Pacific Education Review*, *11*(3), 349–361. https://doi.org/10.1007/s12564-010-9088-y

Baker, D. (2020). An inevitable phenomenon: Reflections on the origins and future of worldwide shadow education. *European Journal of Education*, *55*(3), 311–315. https://doi.org/10.1111/ejed.12410

Bray, M. (1999). *The Shadow education system: private tutoring and its implications for planners.* Paris, France: UNESCO International Institute for Educational Planning.

Bray, M. (2009). *Confronting the shadow education system: What government policies for what private tutoring?.* Paris, France: UNESCO International Institute for Educational Planning.

Bray, M. (2010). Comparative education and international education in the history of Compare: boundaries, overlaps and ambiguities. *Compare: A Journal of Comparative and International Education*, *40*(6), 711–725. https://doi.org/10.1080/03057925.2010.523224

Bray, M. (2011). *The Challenge of Shadow Education: Private Tutoring and its Implications for Policy Makers in the European Union.* Retrieved from http://www.nesse.fr/nesse/activities/reports/activities/reports/the-challenge-of-shadow-education-1

Bray, M. (2017). Schooling and Its Supplements: Changing Global Patterns and Implications for Comparative Education. *Comparative Education Review*, *61*(3), 469–491. https://doi.org/10.1086/692709

Bray, M. (2021). Geographies of shadow education: patterns and forces in the spatial distributions of private supplementary tutoring. *Compare: A Journal of Comparative and International Education*, 1–18. https://doi.org/10.1080/03057925.2021.1915749

Bray, M., & Kwo, O. (2013). Behind the façade of fee-free education: shadow education and its implications for social justice. *Oxford Review of Education*, *39*(4), 480–497. https://doi.org/10.1080/03054985.2013.821852

Bray, M., & Kwo, O. (2014). *Regulating Private Tutoring for Public Good: Policy Options for Supplementary Education in Asia.* Hong Kong, China: UNESCO and Comparative Education Research Centre, HKU.

Bray, M., & Lykins, C. (2012). *Shadow education: Private supplementary tutoring and its implications for policy makers in Asia.* Hong Kong, China: Asian Development Bank and cooperative education research centre, HKU.

Bray, M., & Kobakhidze, M. N. (2015). Evolving ecosystems in education: The nature and implications of private supplementary tutoring in Hong Kong. *PROSPECTS*, *45*(4), 465–481. https://doi.org/10.1007/s11125-015-9353-2

Bray, M., Zhan, S., Lykins, C., Wang, D., & Kwo, O. (2014). Differentiated demand for private supplementary tutoring: Patterns and implications in Hong Kong secondary education. *Economics of Education Review*, *38*, 24–37. https://doi.org/https://doi.org/10.1016/j.econedurev.2013.10.002

Byun, S. Y. (2014). Shadow education and academic success in Republic of Korea. In H. Park and K.-k. Kim (Eds.), *Korean education in changing economic and demographic contexts* (pp. 39–58). Singapore: Springer. https://doi.org/10.1007/978-981-4451-27-7_3

Byun, S. Y., Chung, H. J., & Baker, D. P. (2018). Global patterns of the use of shadow education: Student, family, and national influences. In *Research in the Sociology of Education.* Emerald Publishing Limited. https://doi.org/10.1108/S1479-353920180000020004

Chen, C. (2004). Searching for intellectual turning points: Progressive knowledge domain visualization. *Proceedings of the National Academy of Sciences*, *101*(suppl 1), 5303–5310. https://doi.org/10.1073/pnas.0307513100

Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for Information Science and Technology*, *57*, 359–377. https://doi.org/10.1002/asi.20317

Chen, C. (2012). Predictive Effects of Structural Variation on Citation Counts. *Journal of the American Society for Information Science and Technology*, *63*, 431–449. https://doi.org/10.1002/asi.21694

Chen, C. (2017). Science Mapping: A Systematic Review of the Literature. *Journal of Data and Information Science*, *2*(2), 1–40. https://doi.org/doi:10.1515/jdis-2017-0006

Chen, Y., Chen, C., Hu, Z., & Wang, X. (2014). 引文空间分析原理与应用 *CiteSpace*实用指南 *[Principles and Applications of Analyzing a Citation Space]*. Beijing, CN: Science Press. [in Chinese]

Chen, Y., Chen, C., Liu, Z., Hu, Z., & Wang, X. (2015). CiteSpace 知识图谱的方法论功能 [Methodological functions of CiteSpace knowledge graph]. *Studies in Science of Science, 33*(2), 242–253. [in Chinese]

Choi, H., & Choi, Á. (2016). Regulating private tutoring consumption in Korea: Lessons from another failure. *International Journal of Educational Development*, *49*, 144–156. https://doi.org/https://doi.org/10.1016/j.ijedudev.2016.03.002

Choi, Y., & Park, H. (2016). Shadow education and educational inequality in South Korea: Examining effect heterogeneity of shadow education on middle school seniors' achievement test scores. *Research in Social Stratification and Mobility*, *44*, 22–32. https://doi.org/https://doi.org/10.1016/j.rssm.2016.01.002

Dang, H.-A. (2007). The determinants and impact of private tutoring classes in Vietnam. *Economics of Education Review*, *26*(6), 683–698. https://doi.org/https://doi.org/10.1016/j.econedurev.2007.10.003

Entrich, S. R. (2015). The Decision for Shadow Education in Japan: Students' Choice or Parents' Pressure? *Social Science Japan Journal*, *18*(2), 193–216. https://doi.org/10.1093/ssjj/jyv012

Entrich, S. R. (2020). Worldwide shadow education and social inequality: Explaining differences in the socioeconomic gap in access to shadow education across 63 societies. International Journal of Comparative Sociology, 61(6), 441–475. https://doi.org/10.1177/0020715220987861

Fülöp, M., & Gordon Győri, J. (2021). Japanese students' perceptions of the role that shadow education plays in competition in education. *Hungarian Educational Research Journal*, *11*(2), 143–165. https://doi.org/10.1556/063.2021.00059

Feng, S. (2021). The evolution of shadow education in China: From emergence to capitalisation. *Hungarian Educational Research Journal*, *11*(2), 89–100. https://doi.org/10.1556/063.2020.00032

Ghosh, P., & Bray, M. (2018). Credentialism and demand for private supplementary tutoring. *International Journal of Comparative Education and Development*, *20*(1), 33–50. https://doi.org/10.1108/IJCED-10-2017-0029

Guill, K., & Bos, W. (2014). Effectiveness of private tutoring in mathematics with regard to subjective and objective indicators of academic achievement. Evidence from a German secondary school sample. *Journal for Educational Research Online*, *6*, 34–67.

Gordon Győri, J. (2020). Shadow education—Opportunity for development. *European Journal of Education*, *55*(3), 305–310. https://doi.org/10.1111/ejed.12415

Ha, Y. (2017). Can the Korean educational broadcasting system help to improve academic outcomes? *KEDI Journal of Educational Policy*, *14*, 97–116.

Ha, Y., & Park, H.-J. (2017). Can after-school programs and private tutoring help improve students' achievement? Revisiting the effects in Korean secondary schools. *Asia Pacific Education Review*, *18*(1), 65–79. https://doi.org/10.1007/s12564-016-9451-8

Hajar, A. (2018). Exploring Year 6 pupils' perceptions of private tutoring: evidence from three mainstream schools in England. *Oxford Review of Education*, *44*(4), 514–531. https://doi.org/10.1080/03054985.2018.1430563

Hajar, A., & Karakus, M. (2022). A bibliometric mapping of shadow education research: achievements, limitations, and the future. *Asia Pacific Education Review*, *23*(2), 341–359. https://doi.org/10.1007/s12564-022-09759-4

Hamilton, L., Roksa, J., & Nielsen, K. (2018). Providing a ''Leg up'': Parental involvement and opportunity hoarding in college. *Sociology of Education*, *91*(2), 111–131. https://doi.org/10.1177/0038040718759557

Jansen, D., Elffers, L., & Jak, S. (2021). A cross-national exploration of shadow education use by high and low SES families. *International Studies in Sociology of Education*, 1–22. https://doi.org/10.1080/09620214.2021.1880332

Jelani, J., & Tan, A. K. G. (2012). Determinants of participation and expenditure patterns of private tuition received by primary school students in Penang, Malaysia: an exploratory study. *Asia Pacific Journal of Education*, *32*(1), 35–51. https://doi.org/10.1080/02188791.2012.655238

Kim, Y. C., & Jung, J.-H. (2019). Worldwide Shadow Education Epidemic: From East Asia to Western Hemisphere. In Y. C. Kim & J.-H. Jung (Eds.), *Shadow Education as Worldwide Curriculum Studies* (pp. 25–60). Springer International Publishing. https://doi.org/10.1007/978-3-030-03982-0_2

Kim, Y. C., & Jung, J.-H. (2019a). Conceptualizing shadow curriculum: definition, features and the changing landscapes of learning cultures. *Journal of Curriculum Studies*, *51*(2), 141–161. https://doi.org/10.1080/00220272.2019.1568583

Kim, Y. C., & Jung, J.-H. (2021). Theorizing Shadow Education and Academic Success in East Asia: Understanding the Meaning, Value, and Use of Shadow Education by East Asian Students (1st ed.). Routledge. https://doi.org/10.4324/9781003097860

Kobakhidze, M. N., & Suter, L. E. (2020). The global diversity of shadow education. *European Journal of Education*, *55*(3), 316–321. https://doi.org/10.1111/ejed.12411

Li, J., & Chen, C. (2016). *citespace*科技文本挖掘及可视化*[Citespace technology text mining and visualization]*. Beijing, CN: Capital University of Economics and Business Press. [in Chinese]

Li, J., Li, H., Chen, W., & Zheng, W. (2019). 国内社会科学研究中知识图谱应用现状[Analysis of the application status of knowledge graphs in domestic social science research]. *Library and Information Research,* 12(1), 74–81. [in Chinese]

Liu, J., & Bray, M. (2020). Private subtractory tutoring: The negative impact of shadow education on public schooling in Myanmar. *International Journal of Educational Development*, *76*, 102213. https://doi.org/10.1016/j.ijedudev.2020.102213

Luo, J., & Chan, C. K. Y. (2022). Influences of shadow education on the ecology of education–A review of the literature. *Educational Research Review*, 100450. https://doi.org/10.1016/j.edurev.2022.100450

Lo, C. F., & Lin, C. H. (2020). The impact of English learning motivation and attitude on well-being: cram school students in Taiwan. *Future Internet*, *12*(8), 131. https://doi.org/10.3390/fi12080131

Mikkelsen, S. H., & Gravesen, D. T. (2021). Shadow Education in Denmark: In the Light of the Danish History of Pedagogy and the Skepticism Toward Competition. *ECNU Review of Education*, *4*(3), 546–565. https://doi.org/10.1177/2096531120983335

Matsuoka, R. (2019). Concerted cultivation developed in a standardized education system. *Social Science Research*, *77*, 161–178. https://doi.org/https://doi.org/10.1016/j.ssresearch.2018.08.011

Marimuthu, T., Singh, J. S., Ahmad, K., Kuan, L. H., & Osman, S. (1991). Extra school instruction, social equity and educational quality. http://hdl.handle.net/10625/12376

Manzon, M., & Areepattamannil, S. (2014). Shadow educations: mapping the global discourse. *Asia Pacific Journal of Education*, *34*(4), 389–402. https://doi.org/10.1080/02188791.2014.969194

Mikkelsen, S. H., & Gravesen, D. T. (2021). Shadow Education in Denmark: In the Light of the Danish History of Pedagogy and the Skepticism Toward Competition. *ECNU Review of Education*, *4*(3), 546–565. https://doi.org/10.1177/2096531120983335

Mori, I., & Baker, D. (2010). The origin of universal shadow education: what the supplemental education phenomenon tells us about the postmodern institution of education. *Asia Pacific Education Review*, *11*(1), 36–48. https://doi.org/10.1007/s12564-009-9057-5

Noh, J. W., Kim, J., Cheon, J., Lee, Y., & Kwon, Y. D. (2020). Relationships between Extra-School Tutoring Time, Somatic Symptoms, and Sleep Duration of Adolescent Students: A Panel Analysis Using Data from the Korean Children and Youth Panel Survey. *International Journal of Environmental Research and Public Health*, *17*(21), 8037. https://doi.org/10.3390/ijerph17218037

Ömeroğulları, M., Guill, K., & Köller, O. (2020). Effectiveness of private tutoring during secondary schooling in Germany: Do the duration of private tutoring and tutor qualification affect school achievement? *Learning and Instruction*, *66*, 101306. https://doi.org/https://doi.org/10.1016/j.learninstruc.2020.101306

Park, H., Buchmann, C., Choi, J., & Merry, J. J. (2016). Learning Beyond the School Walls: Trends and Implications. *Annual Review of Sociology*, *42*(1), 231–252. https://doi.org/10.1146/annurev-soc-081715-074341

Park, H., Byun, S., & Kim, K. (2010). Parental Involvement and Students' Cognitive Outcomes in Korea: Focusing on Private Tutoring. *Sociology of Education*, *84*(1), 3–22. https://doi.org/10.1177/0038040710392719

Pimlott-Wilson, H., & Holloway, S. L. (2021). Supplementary education and the coronavirus pandemic: Economic vitality, business spatiality and societal value in the private tuition industry during the first wave of Covid-19 in England. *Geoforum*, *127*, 71–80. https://doi.org/https://doi.org/10.1016/j.geoforum.2021.09.009

Rawat, K. S., & Sood, S. K. (2021). Knowledge mapping of computer applications in education using CiteSpace. *Computer Applications in Engineering Education*, *29*(5), 1324–1339. https://doi.org/https://doi.org/10.1002/cae.22388

Stevenson, D. L., & Baker, D. P. (1992). Shadow Education and Allocation in Formal Schooling: Transition to University in Japan. *American Journal of Sociology*, *97*(6), 1639–1657. https://doi.org/10.1086/229942

Tsiplakides, I. (2018). Shadow education and social class inequalities in secondary education in Greece: The case of teaching English as a foreign language. *International Journal of Sociology of Education*, *7*(1), 71–93. https://doi.org/10.17583/rise.2018.2987

Wang, L. C. (2015). All work and no play? The effects of ability sorting on students'non-school inputs, time use, and grade anxiety. *Economics of Education Review*, *44*, 29–41. https://doi.org/https://doi.org/10.1016/j.econedurev.2014.10.008

Watson, L. (2008). Private expectations and public schooling: The growth of private tutoring in Australia. *AARE 2008 International Education Conference*, 1–15.

Ye, C. (2018). The Research Development of Big Data in Education: A Bibliometric Analysis Based on Citespace. *2018 Seventh International Conference of Educational Innovation through Technology (EITT)*, 116–122. https://doi.org/10.1109/EITT.2018.00031

Yung, K. W.-H. (2020). Comparing the effectiveness of cram school tutors and schoolteachers: A critical analysis of students' perceptions. *International Journal of Educational Development*, *72*, 102141. https://doi.org/https://doi.org/10.1016/j.ijedudev.2019.102141

Yung, K. W. H., & Bray, M. (2021). Globalisation and the expansion of shadow education: Changing shapes and forces of private supplementary tutoring. In J. Zajda (Ed.) *Third International Handbook of Globalisation, Education and Policy Research* (pp. 679–697). Cham, CH: Springer Nature Switzerland. https://doi.org/10.1007/978-3-030-66003-1_39

Yung, K. W. H., & Zeng, C. (2021). Parentocracy within meritocracy: parental perspective on lecture-style English private tutoring in Hong Kong. *Language and Education*, 1–17. https://doi.org/10.1080/09500782.2021.1981924

Zhang, W., & Bray, M. (2020). Comparative research on shadow education: Achievements, challenges, and the agenda ahead. *European Journal of Education*, *55*(3), 322–341. https://doi.org/10.1111/ejed.12413

Zhang, Y., & Xie, Y. (2016). Family Background, Private Tutoring, and Children's Educational Performance in Contemporary China. *Chinese Sociological Review*, *48*(1), 64–82. https://doi.org/10.1080/21620555.2015.1096193

Zhang, W., & Yamato, Y. (2018). Shadow education in East Asia: Entrenched but evolving private supplementary tutoring. In *Routledge international handbook of schools and schooling in Asia* (pp. 323–332). Routledge.