



Unveiling the tapestry of teacher belief research: tracing the present and forging the future through bibliometric analysis

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Accepted: 7 December 2023 / Published online: 20 December 2023
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Abstract

Research on teacher beliefs has gained significant attention from scholars, resulting in a vast body of literature. To understand the current trends, themes, key contributors, and emerging areas in this domain, we utilized *CiteSpace* to review 1,731 teacher beliefs publications from 1951 to 2023 through the WOS database. The findings indicate that: 1) Over recent decades, there has been a consistent increase in publications concerning teacher beliefs, which is still promising in recent years. 2) The research themes can be divided into professional development, teaching practices, self-efficacy, theoretical orientation, and student performance. 3) There is a noticeable lack of collaboration both across academic institutions and among different authors in the field of teacher beliefs research. 4) In terms of research hotspots, it can be roughly divided into the external environment, the belief ontology, and teaching practices. 5) In terms of research frontiers, four main research frontiers were identified in different periods: epistemological belief, implementation, inclusive education, and English. This study contributes to researchers' understanding of the developmental trajectory of teacher beliefs research, thus providing references and guidance for future research endeavors.

Keywords Teacher beliefs · *CiteSpace* · Trends · Hotspots

Introduction

Over the years, the topic of teacher beliefs has gained considerable attention in academic research (Choi et al., 2021; Christou et al., 2022). Specifically, teacher beliefs influence their teaching strategies and attitudes, which in turn shape their expectations and methods of support for students (Derakhshan et al., 2023a; Wang et al., 2022a; Zhi & Wang, 2023;). By delving into the study of teacher beliefs, it can aid teachers in gaining a deeper understanding of their own beliefs and fostering improvements in teaching practices to better cater to students' needs. Also, teacher beliefs have an impact on students' learning experiences and achievements

(Gao & Wang, 2022; Gao et al., 2023; Wang et al., 2022b). An understanding of teacher beliefs facilitates personalized education, enabling teachers to adapt teaching strategies according to students' individual needs, thereby enhancing student engagement and academic performance. In addition, research on teacher beliefs can provide crucial insights for policymakers (Norro, 2021; Gao et al., 2022). It aids policymakers in gaining a better understanding of the challenges and opportunities within the education system, allowing for the formulation of more targeted policy measures aimed at supporting teachers to deliver high-quality education.

Scholars have engaged in various research on teacher beliefs by employing different theoretical frameworks and investigating diverse research subjects. From a theoretical standpoint, scholars adopted the Complex Dynamic System Theory (Gao & Zhou, 2021), Achievement Goal Theory (Kumar & Lauer mann, 2018), sociocultural theory (Nazari & Xodabande, 2022), social cognitive theory (Myrnyy et al., 2022), and self-efficacy theory (Sepp et al., 2023). In terms of research subjects, these studies have encompassed pre-service science teachers (Kızkapan et al., 2023), language teachers (Wang & Pan, 2023; Dai & Wang, 2023; Derakhshan et al., 2023b; Fu & Wang, 2022; Hu & Wang, 2023),

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middle school science teachers (Wagler & Wagler, 2022), and rural elementary school teachers (Findholt et al., 2016).

In recent decades, many scholars have conducted various forms of review research on teacher beliefs. For instance, Basturkmen (2012) reported an interpretive review of several studies to investigate the factors influencing the relationship between teacher beliefs and practices. Similarly, Gao (2014) conducted a historical review of teachers' belief in language teaching, while Bereczki and Kárpáti (2018) focused on a review of in-service K-12 teachers' beliefs about creativity. More recently, some studies have employed systematic review approaches to explore teachers' belief towards students with disabilities or autism (Basckin et al., 2021; Han & Cumming, 2022).

Despite their significant contributions, these review studies have some limitations. Firstly, they may miss the most recent research trends, and their focuses are often limited to certain aspects of teacher beliefs research. Secondly, the existing literature reviews have been limited in scope, with few scholars quantitatively exploring research related to teacher beliefs. To address these limitations, the current study used *CiteSpace* to conduct a comprehensive review of the latest trends in teacher beliefs. Our findings provide valuable insights into teacher beliefs research, which may inform future teacher development and research practices.

In this study, we retrieved 1731 papers about teacher beliefs published in core journals (SCI, SSCI, and AHCI) from 1951 to 2023. By systematically gathering and analyzing these articles, this research aims to provide some guidance for scholars with an interest in teacher beliefs. As such, this study attempts to solve the following questions:

Q1: What is the general trend of the teacher beliefs studies?

Q2: What are the research themes of the teacher beliefs studies?

Q3: Who are the major contributors (authors and institutions) in teacher beliefs studies?

Q4: What are the hotspots and frontiers of the teacher beliefs studies?

Research design

CiteSpace

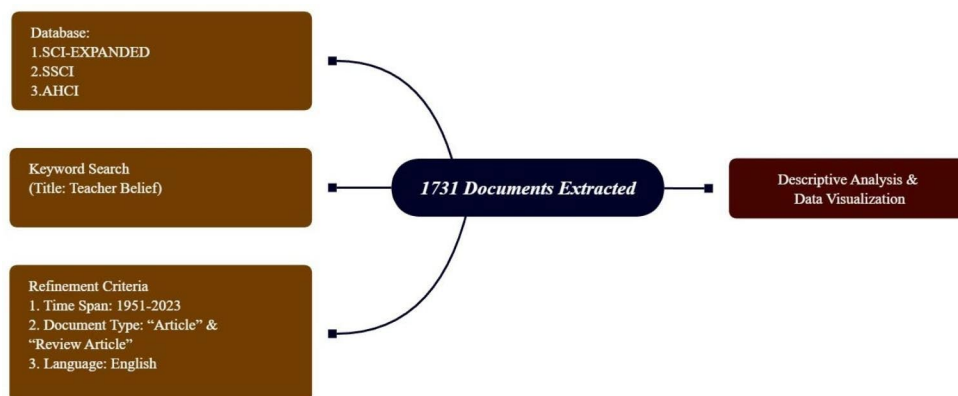
CiteSpace is a Java-powered software designed to link and visualize the citation history and structure of publications in graphic mode (Chen et al., 2012). This tool provides insights from reported publications, aiding in identifying the pivot points of scientific research and strengthening researchers' judgments and viewpoints. In this study, we utilize *CiteSpace* to generate visualization graphs of knowledge covering the following variables: number of publications, keyword clusters, and citation burst of keywords. Leveraging this tool, we delve into specific data and parameters related to the crafting of knowledge maps.

Review papers based on *CiteSpace* have been conducted in many fields ranging from education (Rawat & Sood, 2021), animal science (Yardibi et al., 2021), media literacy (He et al., 2021), risk communication research (Che et al., 2022) to translation theory (Sun et al., 2023). Specifically, studies in the education field have investigated health education (Chen et al., 2022), STEM education (Chu et al., 2023), and peer instruction (Bicheng et al., 2023). In this sense, *CiteSpace* is suitable for reviewing teacher beliefs studies.

Data sources

Web of Science (WOS) has long been acknowledged as the foremost authoritative indexing tool for scientific and technical literature, offering a comprehensive coverage of critical areas in science and technology research (Boyack et al., 2005). It is often regarded as the prime data source for bibliometric studies (van Leeuwen, 2006). To be exact, we chose articles or reviews published in SCI/SSCI/AHCI journals. The search criterion was set to retrieve documents written in English from 1951 to 2023 with "Teacher Belief" as the research title. A total of 1,731 documents were finally retrieved from the database (see Fig. 1). Data were downloaded from WOS in BibTex format with full records.

Fig. 1 The flowchart of this study



Findings

General trend of the teacher beliefs studies

In order to comprehend the general trend of teacher beliefs studies, Fig. 2 presents annual publication statistics. The line in the figure depicts the annual publications of teacher beliefs, while the dotted line represents a third-order polynomial fitting curve based on the annual publications. The R square value of the fitting curve is 73.93%, indicating an exponential growth trend in teacher beliefs research in recent years.

As shown in Fig. 2, there has been a consistent increase in the number of annual publications on teacher beliefs from 1951 to 2023. This growth can be broadly categorized into three stages based on publication numbers: an initial stage (1951–1987), a growth stage (1988–2018), and a rapid stage (2019–present). During the first stage, the number of annual publications was less than ten. The growth stage witnessed an annual literature volume of more than ten, while the rapid stage recorded more than one hundred publications per year.

Overall, the exponential growth in publications indicates a promising trend in teacher beliefs research. Such rapid growth could suggest a growing interest in this field and the emergence of new theories and research methods in the coming years (Sun et al., 2023). Thus, teacher beliefs studies continue to hold great potential for future research.

Research themes

Research themes could reveal the structure and characteristics of the research field (He et al., 2021). Among the existing methods, literature cluster analysis is an exploratory technique to identify the salient terms in the specific research fields. To be exact, *CiteSpace* transforms the data into several structured clusters to reveal the theme distribution and

organizational structure of the research field (Olawumi & Chan, 2018).

According to Fig. 3, we can see that there are 14 clusters in the teacher beliefs studies, namely: Professional Development, Performance, Knowledge, Inclusive Education, Teacher Education, Classroom, Teacher Efficacy, Teacher Integration, Achievement, Job Satisfaction, Teacher Belief, Epistemological Beliefs, Teacher Self-efficacy Beliefs and Bullying. However, some clusters show the repetitive and similar content among them. In this sense, we integrated the fourteen clusters into five research themes: Professional Development, Teaching practices, Self-efficacy, Theoretical Orientation, and Students (see Fig. 4).

Professional development

In terms of professional development, scholars primarily focus on the interplay between professional development and teacher beliefs. Specifically, on one hand, some researchers have examined the impact of professional development on teacher beliefs. For instance, Wickham and Mullen (2020) aimed to determine the effects of practitioner-designed professional development on teacher beliefs regarding students living in poverty. Similarly, Wong (2013) investigated whether there were changes in teacher beliefs resulting from their participation in an overseas professional development course. On the other hand, some scholars have explored the influence of teacher beliefs on professional development. For example, Prestridge (2012) investigated how teacher beliefs shape the use of Information and Communications Technologies in learning contexts. Zhi and Wang (2023) examined the significance of emotional factors in teachers' professional development. Wang et al. (2023) explored the moderating influence of EFL teachers' participation in online learning activities and the perceived importance of online learning on their teaching ability.

Fig. 2 Annual publication of teacher beliefs studies

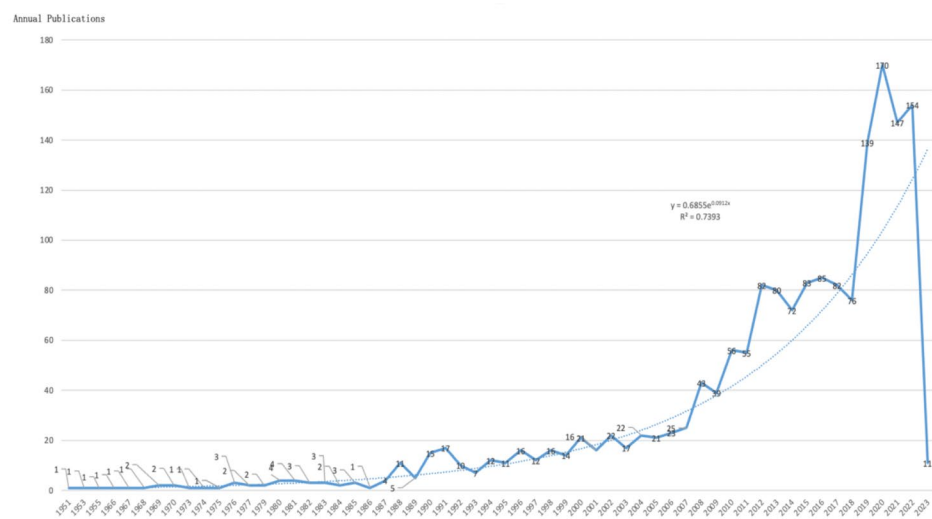


Fig. 3 Main clusters of teacher beliefs (1951–2023)

CiteSpace, v. 5.1.R6 (64-bit) Advanced
February 22, 2023 at 8:50:23 PM CST
Work: C:\Users\1131\Desktop\data17
TimeSpan: 1951-2023 (Slice Length=1)
Selection Criteria: q=0.95, p=0.1, L/N=10, LBY=5, e=1.0
Network: n=181, L=223 (Density=0.0137)
Largest CC: 167 (92%)
Nodes Labeled: 1.0%

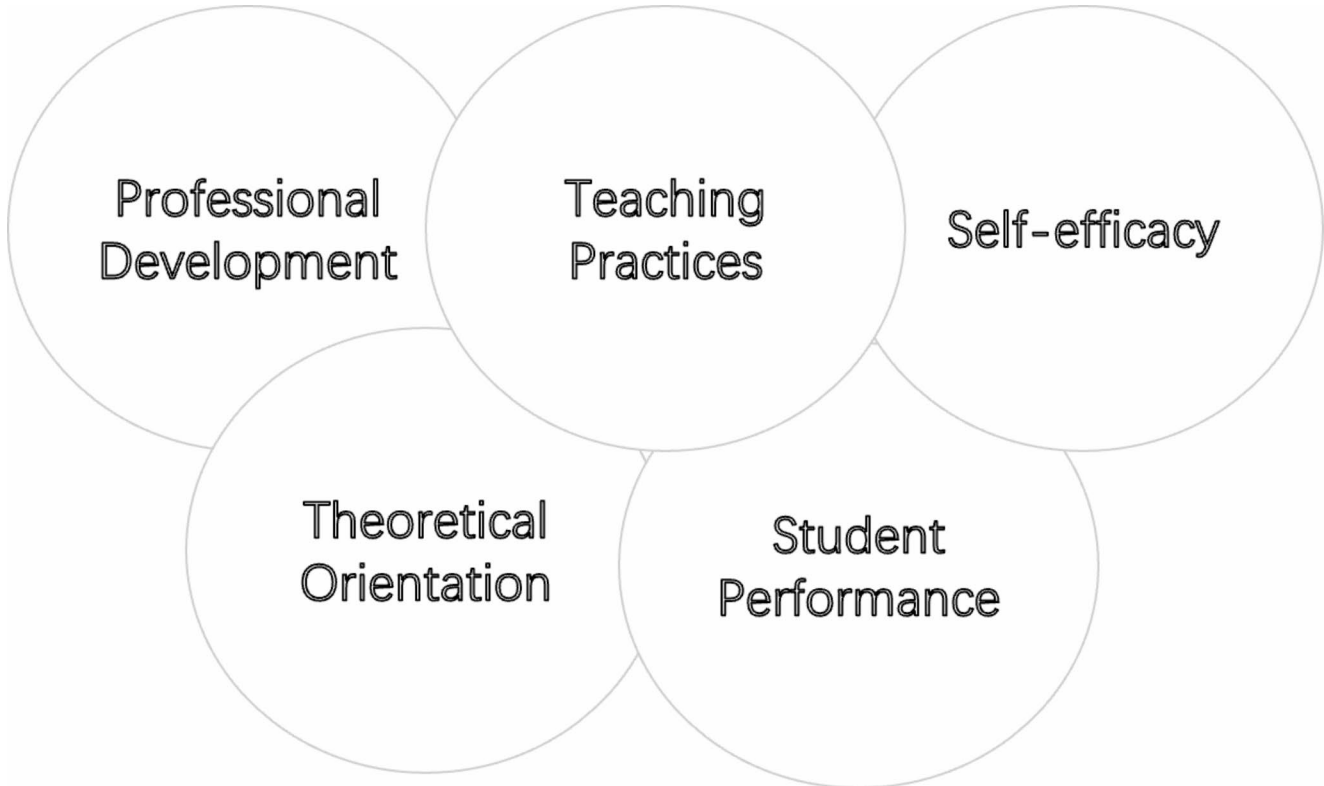
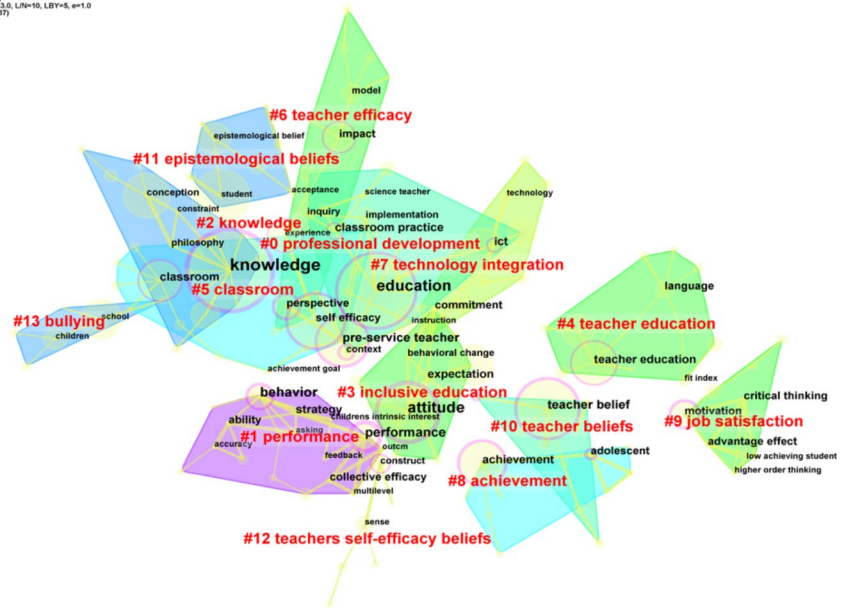


Fig. 4 Main research themes of teacher beliefs

Teaching practices

Research on teacher beliefs in the context of teaching practices primarily focuses on investigating the relationship between teacher beliefs and instructional strategies, as well as the relationship between teacher beliefs and classroom management. Firstly, it examines the influence of teacher beliefs on the selection and utilization of specific instructional strategies. It explores how different types of teacher beliefs impact teachers' preferences and practices regarding instructional strategies in the classroom. For instance, Shahzad et al. (2017) investigated the interrelationship between didactical approaches and teacher pedagogical belief. Gelir (2022) examined teacher beliefs regarding language strategies in monolingual preschool classrooms in Turkey. Secondly, the research explores the relationship between teacher beliefs and classroom management. It investigates how teacher beliefs influence classroom management strategies and practices. This includes examining teacher beliefs and expectations regarding student behavior management, as well as the impact of belief about discipline and order maintenance on classroom management approaches. For example, Po-Lin et al. (2021) explored the effect of classical reading program teachers' teaching belief on the effectiveness of classroom management. Evrim et al. (2009) studied the relationship between teacher beliefs, teaching styles, and classroom management in relation to actual teaching practices.

Self-efficacy

In the research related to teacher beliefs from the perspective of self-efficacy, scholars have focused on the interaction between teacher beliefs and self-efficacy, as well as the influence of self-efficacy on teacher beliefs. Firstly, scholars have examined the impact of the interaction between teacher beliefs and self-efficacy on teaching practices. For example, Heath (2017) explored how teacher self-efficacy and belief help overcome "barrier thresholds" to technology integration. Secondly, scholars have investigated the influence of teacher beliefs and self-efficacy. For instance, Han et al. (2017) examined how technology-centered student teaching experiences differentially affect pre-service teachers with different teaching belief regarding self-efficacy and intention to use technology. Clark and Andreasen (2021) explored elementary teacher self-efficacy and teacher beliefs in teaching culturally diverse students.

Theoretical orientations

The research on teacher beliefs in theoretical orientations primarily focuses on two aspects: the constituent elements

of teacher beliefs and the changes and development of teacher beliefs. On the one hand, scholars investigated the constituent elements and structure of teacher beliefs. They explored the cognitive, affective, and behavioral components of teacher beliefs and attempted to establish models and frameworks for belief. For instance, Gholami et al. (2022) highlighted the predictive role of teachers' knowledge of neuroplasticity in mindset and epistemological belief systems. Zhang et al. (2022) identified the structural model and characteristics of kindergarten teachers' occupational beliefs in China. On the other hand, scholars studied the changes and development of teacher beliefs. They examined the stability and malleability of teacher beliefs and explored factors influencing belief change. For example, Soulios and Psillos (2016) demonstrated that the relationship between epistemological beliefs and conceptual understanding appears to be dependent on the aspect under consideration. Sengul et al. (2020) investigated the relationship between science teachers pedagogical content knowledge of argumentation, epistemological beliefs, and classroom practices. These studies contributed to a deeper understanding of the nature and role of teacher beliefs, providing theoretical foundations for educational practice and teacher professional development.

Student performance

The research on teacher beliefs in relation to student performance primarily focuses on investigating how these two aspects mutually influence each other. First, researchers studied how teacher beliefs impact students' learning abilities and potential. Studies found that those students whose teachers hold high expectations tend to achieve good academic results and have strong motivation to learn. For example, Wang and Derakhshan (2023) examined the role of instructor's confirmation and care in EFL students' willingness to attend classes. In addition, the research conducted by Gao and Wang (2022) revealed that teachers' preferred teaching styles and methods can drive students' motivation to learn, which is consistent with the conclusions drawn in the previous study conducted by Wang et al. (2022b). Both studies demonstrated the impact of teacher beliefs on students' learning abilities and potential. Secondly, researchers investigated how students' behaviors influence changes in teacher beliefs. Studies showed that students' learning performance and behavior can impact teacher beliefs about them. For instance, Hagenauer et al. (2015) discovered that students' behavior and the interpersonal aspect of the teacher-student relationship can influence teacher emotions. Similarly, Banerjee et al. (2017) found a relationship between students' reading growth and teacher job satisfaction.

Main contributors to teacher beliefs research

Currently, teacher beliefs have emerged as a significant area of concern, garnering diverse levels of attention from both scholars and institutions. Investigating the extent of collaborative relationships established among authors and institutions has become an important matter within the field of teacher beliefs. To delve into the cooperative dynamics among authors and institutions and identify the key contributors in teacher beliefs research, we conducted a co-authorship analysis using *CiteSpace*. This analysis enabled us to generate an author cooperation network map and an institution cooperation network map, shedding light on the intricate relationships within the research community.

Influential authors: analysis of author cooperation network

The author cooperation network map was utilized to explore the collaborative relationships among authors and identify prominent authors in teacher beliefs research. In this study, *CiteSpace* was employed to conduct a co-authorship analysis, generating the author collaboration network map presented in Fig. 5. The nodes represent the authors, while the lines depict the authorship relationships between nodes. Nodes with larger sizes, determined by the number of publications, are generally considered significant, indicating their potential influence on the advancement of the research field. Furthermore, a thicker line connecting two nodes signifies a stronger relationship between them.

The density of the network map was 0.0008, illustrating that only 0.08% of the potential relationships in the teacher beliefs network have been realized; this also reveals that strong partnerships among authors have not yet been formed in the teacher beliefs field. However, according to Fig. 5, actualized partnerships among the authors can be identified, including eight important collaborative groups. The

first four groups, led by Ertmer Peggy A, van Braak Johan, Tondeur Jo, and Valcke Martin, respectively, concentrate on exploring the intricate relationship between technology and teacher beliefs. These teams exhibit a strong internal collaboration and extend their cooperative efforts across the teams, given their shared research focus. Additionally, the study includes two more groups. The fifth team, under the guidance of Vantieghe Wendelien A, investigates the correlation between teacher beliefs and their instructional practices. Likewise, the sixth team, led by Van Avermaet Piet, explores the interplay between teacher beliefs and their practices. These two teams closely collaborate as they delve into the connection between teacher beliefs and the application of belief in their teaching methods. Furthermore, the seventh team, headed by Vanderlinde Ruben, and the eighth team, led by Agirdag Orhan, center their research on the practical implementation of teacher beliefs in the teaching context. These two teams contribute to the study’s collaborative effort, as they share a common focus on examining the practical implications of teacher beliefs. Overall, these eight research teams engage in rigorous collaboration, facilitating a comprehensive exploration of the intricate relationship between technology, teacher beliefs, and instructional practices, as well as the practical implications of these beliefs in the teaching context.

Highly productive authors play a pivotal role in advancing research within a specific domain and are widely recognized as key drivers of progress. In Table 1, we present the top 10 authors with the highest publication records in the field of teacher beliefs. These authors are deemed influential contributors to teacher beliefs research. At the forefront, Scholar Chai, Ching Sing secures the top position with an impressive publication count of 12 papers focused on teacher beliefs. Following closely, scholars Markic, Silvija, and Teo, Timothy share the second position, with each having published 8 articles about teacher beliefs. Notably,

Fig. 5 Author’s collaboration network map for the field of teacher beliefs

CiteSpace v. 5.10.R (64-bit) AuthorView
 Parameters: t=0.015, w=0.1, z=1, q=0.1, p=1, n=100,000, m=10, k=1, l=1, c=1, o=1, f=0, g=1, e=0.0008, modularity=0.9992, silhouette=0.9992, weight=0.1, phi=0.01, lambda=0.1, gamma=0.1, alpha=0.1, beta=0.1, delta=0.1, epsilon=0.1, zeta=0.1, eta=0.1, theta=0.1, i=0.1, j=0.1, k=0.1, l=0.1, m=0.1, n=0.1, o=0.1, p=0.1, q=0.1, r=0.1, s=0.1, t=0.015, u=0.1, v=0.1, w=0.1, x=0.1, y=0.1, z=0.1, aa=0.1, ab=0.1, ac=0.1, ad=0.1, ae=0.1, af=0.1, ag=0.1, ah=0.1, ai=0.1, aj=0.1, ak=0.1, al=0.1, am=0.1, an=0.1, ao=0.1, ap=0.1, aq=0.1, ar=0.1, as=0.1, at=0.1, au=0.1, av=0.1, aw=0.1, ax=0.1, ay=0.1, az=0.1, ba=0.1, bb=0.1, bc=0.1, bd=0.1, be=0.1, bf=0.1, bg=0.1, bh=0.1, bi=0.1, bj=0.1, bk=0.1, bl=0.1, bm=0.1, bn=0.1, bo=0.1, bp=0.1, bq=0.1, br=0.1, bs=0.1, bt=0.1, bu=0.1, bv=0.1, bw=0.1, bx=0.1, by=0.1, bz=0.1, ca=0.1, cb=0.1, cc=0.1, cd=0.1, ce=0.1, cf=0.1, cg=0.1, ch=0.1, ci=0.1, cj=0.1, ck=0.1, cl=0.1, cm=0.1, cn=0.1, co=0.1, cp=0.1, cq=0.1, cr=0.1, cs=0.1, ct=0.1, cu=0.1, cv=0.1, cw=0.1, cx=0.1, 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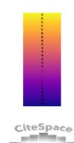


Table 1 The most productive authors in the field of teacher beliefs

Number	Author	Frequency	Year
1	Chai, Ching Sing	12	2008
2	Markic, Silvija	8	2008
3	Teo, Timothy	8	2008
4	van braak, Johan	7	2008
5	Tsai, Chin-Chung	7	2009
6	Verloop, Nico	7	2007
7	Kunter, Mareike	7	2011
8	Eilks, Ingo	7	2008
9	Vanderlinde, Ruben	6	2019
10	Woodcock, Stuart	6	2019

Scholars van Braak, Johan, Tsai, Chin-Chung, Verloop, Nico, Kunter, Mareike, and Eilks, Ingo closely trail behind, with each having published seven papers addressing teacher beliefs. Finally, Vanderlinde, Ruben, and Woodcock, Stuart hold the 9th and 10th positions, respectively, having contributed six papers each in the field.

Influential institutions: analysis of institution cooperation network

To investigate cooperative relationships among institutions and identify influential institutions, we utilized *CiteSpace* to generate an institutional network map. In Fig. 6, nodes represent the institutions, while lines illustrate the collaborative relationships between them. Nodes with a high frequency, indicating a significant number of publications, are considered influential and likely to have a substantial impact on the development of the research field. Additionally, thicker lines between nodes indicate closer relationships. The density of the network map was calculated to be 0.0021, indicating that only 0.21% of institutions within the teacher

Table 2 Top 10 research institutions in the field of teacher beliefs

Number	Institution	Country	Frequency	Year
1	Nanyang Technological University	Singapore	30	2007
2	Ohio State University	United States	27	2003
3	Ghent University	Belgium	25	2008
4	Chinese University of Hong Kong	China	24	2001
5	Beijing Normal University	China	20	2011
6	Middle East Technical University	Turkey	20	2004
7	University of Michigan	United States	17	2006
8	University of Hong Kong	China	17	2001
9	Education University of Hong Kong	China	16	2001
10	University of Helsinki	Finland	16	2004

beliefs network formed partnerships. This low density suggests weak collaboration among institutions.

Research institutions that demonstrate a high publication frequency are widely recognized as influential contributors within the field of teacher beliefs. Table 2 provides a comprehensive overview of the top 10 research institutions, ranked based on their publication frequency in the area of teacher beliefs. These institutions hold a prominent position as the most influential entities, driving research advancements in the field of teacher beliefs. Notably, the top four research institutions include Nanyang Technological University (30 publications), Ohio State University (27 publications), Ghent University (25 publications), and Chinese University of Hong Kong (24 publications). Ranking fifth

Fig. 6 Institutional collaboration network map for the field of teacher beliefs

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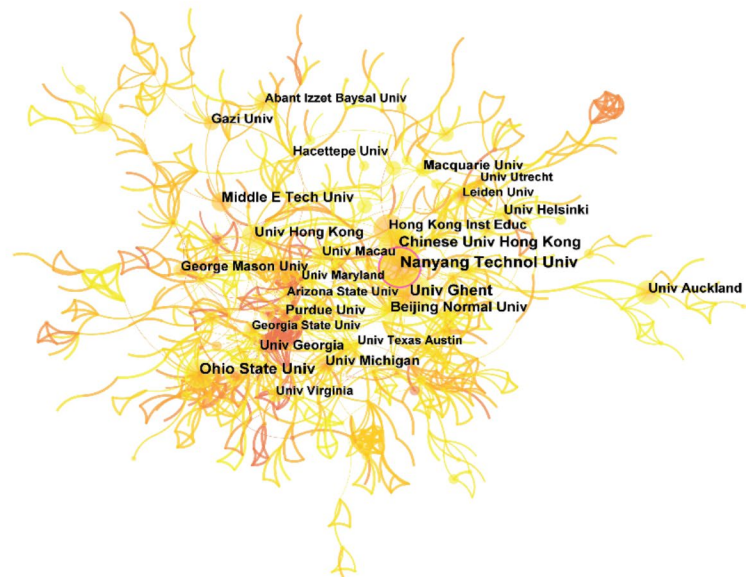
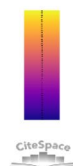
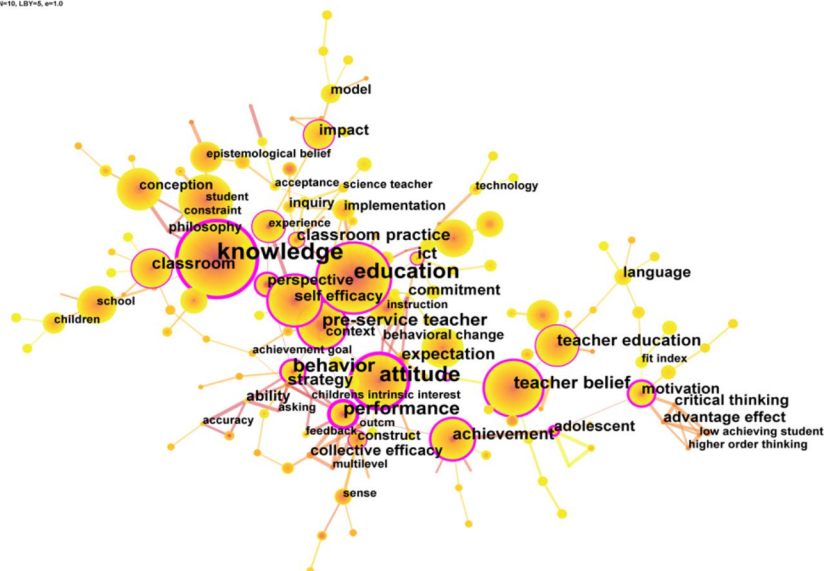
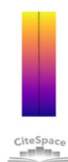


Fig. 7 The keyword co-occurrence map for the field of teacher beliefs

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 Largest CC: 167 (92%)
 Nodes Labeled: 1.0%



and sixth are Beijing Normal University and Middle East Technical University, both of which have published 20 articles about teacher beliefs. The University of Michigan and the University of Hong Kong secure the seventh and eighth positions, respectively, with each institution having contributed 17 publications. Following closely behind are the Education University of Hong Kong and the University of Helsinki, each with 16 publications to their credit. Furthermore, it is worth noting that among the top ten institutions with the highest publication frequency, four are based in China. This highlights the significant influence of China in the realm of teacher beliefs research.

Research hotspots and frontiers in teacher beliefs research

Research hotspots: keyword co-occurrence analysis

In order to identify the research hotspots in the field of teacher beliefs, we conducted a keyword co-occurrence analysis using *CiteSpace*. This analysis allows us to generate a keyword co-occurrence network map, where the size of the nodes represents the frequency of co-occurrence with other keywords and the thickness of the lines reflects the strength of the co-occurrence between two keywords (Dang et al., 2021).

According to Fig. 7; Table 3 presents the top ten keywords with the highest frequencies and strongest betweenness centralities. Keywords with higher centrality are considered more significant in the field of teacher beliefs research. In this study, keywords such as teacher beliefs, education, knowledge, self-efficacy, attitude, achievement and pre-service teacher had Betweenness Centralities exceeding 0.1,

Table 3 Top 10 keywords in the field of teacher beliefs

Rank	Keyword	Frequency	Betweenness centrality	Year
1	teacher belief	404	0.31	1999
2	education	295	0.37	1991
3	knowledge	293	0.6	1991
4	student	253	0.07	1996
5	self-efficacy	238	0.39	1992
6	attitude	181	0.56	1995
7	perception	165	0	2002
8	achievement	123	0.36	1992
9	classroom	122	0.1	1991
10	pre-service teacher	117	0.25	1996

indicating that these keywords play pivotal roles and have connections with other keywords in the network.

Among the top 10 keywords extracted in our study, “teacher belief” exhibited the highest frequency and occupied the first position. However, as this term served as a retrieval term rather than a research focus, it was not taken into consideration in this study. The remaining nine keywords were categorized into three groups, representing the research hotspots related to teacher beliefs from different perspectives. The first group, focusing on the external environment, comprised three keywords: “students”, “achievements” and “classrooms”. The second group, emphasizing belief ontology, consisted of four keywords: “knowledge”, “attitude”, “perception” and “self-efficacy”. The third group, centered on teaching practices, included two keywords: “education” and “pre-service teachers”. By categorizing the keywords into these three groups, this study effectively identified the research hotspots in teacher beliefs research

from various angles, encompassing the external environment, belief ontology, and teaching practices.

Research on teacher beliefs regarding the external environment primarily focuses on three key areas: “students”, “achievements” and “classrooms”. At the student level, studies investigate the influence of teacher beliefs on students’ cognition, attitudes, and behavior. This encompasses exploring teacher expectations, trust, understanding of student characteristics, and perspectives on student learning abilities and development. For example, Redding (2019) conducted a review examining the impact of student-teacher racial/ethnic matching on teacher perceptions of students, as well as student academic and behavioral outcomes. In terms of achievement, research delves into the relationship between teacher beliefs and student academic performance. Such studies explore teacher beliefs about student learning abilities, assessments of student capabilities, and expectations regarding student achievement. For instance, Gao and Wang (2022) adopted a Sociocultural perspective to explore teacher mentoring, learner-written corrective feedback beliefs, and learner revision practices through peer review feedback. Regarding the classroom environment, research focuses on investigating how teacher beliefs shape and influence the dynamics within the classroom. This encompasses studying teacher beliefs and practices related to classroom management, instructional atmosphere, interaction styles, and student engagement. For instance, Gremmen et al. (2016) explored considerations for classroom seating arrangements and the role of teacher characteristics and beliefs.

Research on teacher beliefs in the area of belief ontology primarily focuses on four key aspects: “knowledge”, “attitude”, “perception” and “self-efficacy”. In terms of knowledge, studies examine teacher beliefs regarding teaching content and subject knowledge. This includes understanding teacher beliefs about the depth, breadth, and organization of subject knowledge, as well as their belief about how to impart and assess knowledge. For instance, Spruce and Bol (2015) investigated the beliefs, knowledge, and classroom practices of ten elementary and middle school teachers related to self-regulated learning. At the attitude level, researchers explored teachers’ attitudes toward teaching and students. This encompasses teachers’ attitudes toward their profession, their emotional disposition toward students, and their attitudes toward student learning, growth, and development. For example, Kast et al. (2021) examined Austrian teachers’ attitudes and self-efficacy beliefs regarding at-risk students during home learning due to COVID-19. Regarding perception, studies investigate teachers’ perceptions of the educational environment and student characteristics. This includes teachers’ perceptions of students’ abilities, learning styles, interests, and needs, as well

as their perceptions of the educational environment, such as school culture and family backgrounds. For instance, Dewey and Pineda (2020) explored language teachers’ perceptions towards language and English as a Lingua Franca. In terms of self-efficacy, research examines teachers’ confidence and self-evaluation regarding their teaching abilities and professional development. This encompasses teachers’ self-efficacy beliefs about their teaching skills, classroom management abilities, and instructional strategies, and their self-efficacy beliefs regarding professional growth and educational reform. For example, Kiel et al. (2020) investigated different groups of teachers in German inclusive primary and secondary schools regarding their self-efficacy in implementing inclusive education.

Research on teacher beliefs regarding teaching practices primarily focuses on two areas: education and pre-service teachers. In the field of education, the research examines the influence and impact of teacher beliefs on the educational domain. This includes exploring teacher beliefs about educational goals, teaching methods, assessment practices, and educational policies. For example, Gao et al. (2022) conducted a study on educational planning, teacher beliefs, and teacher practices during the pandemic, specifically focusing on science and technology-based universities in China. Research regarding “pre-service teachers” investigates the formation and development of beliefs among pre-service teachers. This includes studying pre-service teachers’ beliefs about their teaching roles, professional identities, pedagogical knowledge, and skills. Han et al. (2017) explored the effect of student teaching experience and teacher beliefs on pre-service teachers’ self-efficacy and intention to use technology in teaching. By examining teacher beliefs in the context of teaching practices, these studies contribute to a deeper understanding of the influence of teacher beliefs on educational practices and the professional development of pre-service teachers. Such research findings can inform educational planning, curriculum design, and teacher training programs to enhance teaching effectiveness and improve educational outcomes.

Research frontiers in the teacher beliefs field: burst keyword analysis

A research frontier refers to a dynamic and evolving cluster of concepts and underlying research issues. To identify emerging research frontier concepts in the field, we applied Kleinberg’s burst detection algorithm using the burst keyword analysis method. This method involves analyzing keywords that have experienced rapid changes or significant increases within a short period, highlighting sudden shifts in keyword usage. A burst is characterized by its burst strength and bursting time. Keywords with high strength are

indicative of research frontiers. By examining keywords with high strength values, we can roughly determine the research frontiers in teacher beliefs research over time. After the analysis of *CiteSpace*, we obtained the top 20 keywords with high strength in the teacher beliefs field, as shown in Fig. 8. In Fig. 8, it can be observed that all the strength values were above 4, with the highest strength value reaching 12.96.

From 1991 to 2010, epistemological belief emerged as the keyword with the highest strength in teacher beliefs research. Epistemological beliefs pertain to individuals' beliefs and assumptions regarding the nature of knowledge, learning, and the process of knowledge acquisition. These beliefs shape individuals' perceptions of knowledge, determine its validity, and govern their understanding of how knowledge is acquired, evaluated, and applied. The relationship between epistemological belief and teacher beliefs is characterized by a close interconnection and mutual influence. Epistemological beliefs represent a specific aspect within the broader framework of teacher beliefs, specifically focusing on teachers' beliefs and assumptions about the nature of knowledge, learning, and the process of knowledge acquisition. Conversely, teacher beliefs encompass a wider range of convictions held by teachers, including their beliefs about students, teaching practices, classroom management, and educational goals.

From 2011 to 2017, the keyword with the highest strength in teacher beliefs research was “implementation”. The term “implementation” refers to the process of putting

a plan, decision, or policy into action or practice. In teacher beliefs research, “implementation” frequently appears as a keyword because researchers are interested in understanding how teacher beliefs are actualized and executed in real teaching contexts. Teacher beliefs encompass teachers' views, perspectives, and convictions about education and teaching, including their beliefs about students, teaching methods, classroom management, and educational goals. These beliefs significantly influence teachers' instructional decisions and behaviors. However, simply possessing these beliefs does not guarantee their effective implementation in teaching. Therefore, after reaching a certain level of understanding about teacher belief ontology, researchers started exploring the process and outcomes of implementing teacher beliefs in actual teaching settings. In summary, the keyword “implementation” holds significance in teacher beliefs research during the period from 2011 to 2017. Researchers are interested in exploring how teacher beliefs are implemented and executed in real teaching contexts, recognizing the importance of translating these beliefs into effective instructional practices.

From 2018 to 2019, the keyword with the highest strength in teacher beliefs research was inclusive education. Inclusive education refers to an educational approach that aims to provide equal opportunities and support for all students, including those with diverse learning needs or disabilities. The frequent occurrence of inclusive education in teacher beliefs research is due to its close association with teacher beliefs. Inclusive education aligns with the principles of

Top 20 Keywords with the Strongest Citation Bursts

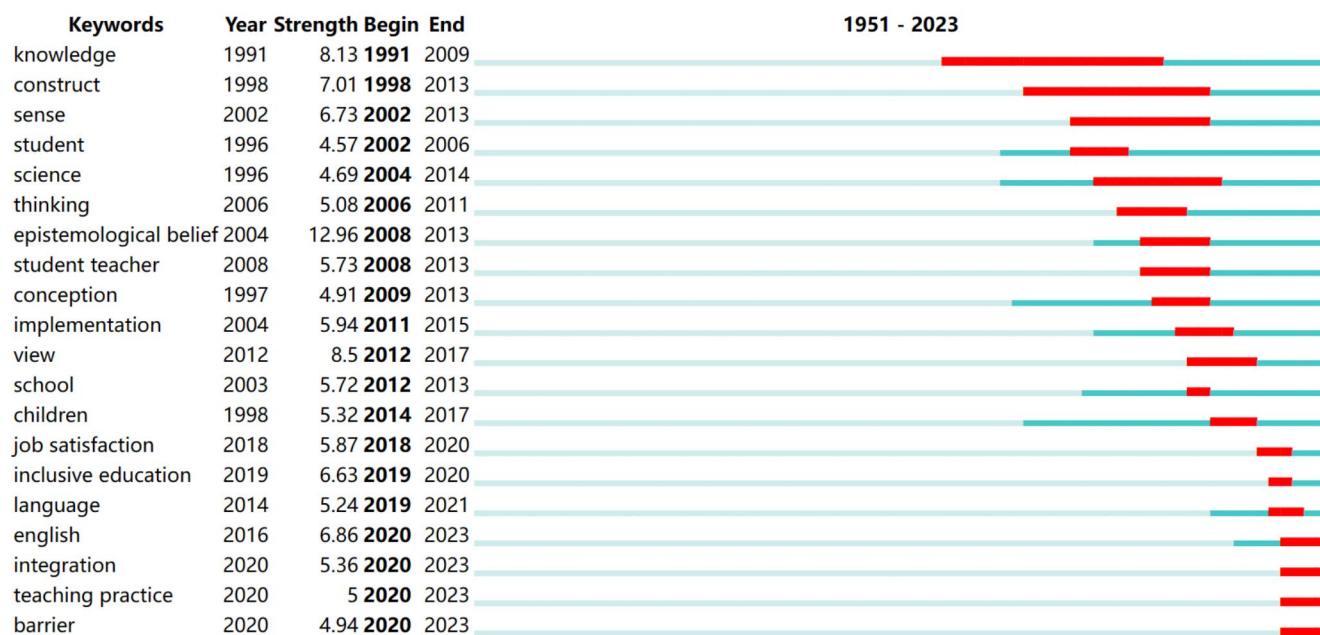


Fig. 8 Top 20 keywords with the strongest citation bursts in teacher beliefs research

equity, access, and support for all students, regardless of their learning needs or disability status. As researchers achieved certain advancements in exploring teacher beliefs and their relationship with teaching practices, they expanded their scope of research to investigate the beliefs and practices of teachers at different educational levels. Against this backdrop, “inclusive education” emerged as a research frontier during this period. Scholars recognized the significance of studying how teacher beliefs align with the principles and practices of inclusive education. By examining the intersection of teacher beliefs and inclusive education, researchers aim to enhance teachers’ understanding and awareness of inclusive education, promote their adoption of inclusive teaching strategies, and create supportive learning environments for all students. This line of research contributes to the professional development of teachers and fosters an inclusive and equitable education system.

From 2020 to the present, the keyword with the highest strength in teacher beliefs research is English. This indicates that scholars have recently started focusing on the beliefs of English as foreign language teachers. The reasons behind this trend are as follows: Firstly, English, as an international language, plays a crucial role in international communication, business cooperation, academic research, and cultural exchange. Secondly, as a foreign language, English is taught in diverse educational contexts across different countries and regions. Studying English teachers’ beliefs can help us understand the variations in beliefs that exist due to different cultural and educational backgrounds. This understanding can provide valuable insights for cross-cultural teaching and teacher training. Therefore, the prominence of the keyword English in recent teacher beliefs research reflects the recognition of the significance of English language teaching and the need to explore the beliefs of English teachers in various educational settings.

Based on the research frontiers in different periods, the development of teacher beliefs research can be roughly divided into four stages. These stages include the ontological research of teacher beliefs, the research on the practical aspects of teacher beliefs, the research on teacher beliefs in different educational systems, and the research on teacher beliefs in the context of English. In the first stage, the ontological research of teacher beliefs focuses on the basic structure and components of teacher beliefs. This stage of research helps us gain a deep understanding of the essence and formation process of teacher beliefs. In the second stage, the research on the practical aspects of teacher beliefs examines how teacher beliefs are manifested and implemented in teaching practice. This stage of research helps us understand the role and mechanisms through which teacher beliefs influence actual teaching. In the third stage, the research on teacher beliefs in different educational systems explores the

characteristics and variations of teacher beliefs in diverse educational contexts. This stage of research contributes to our understanding of the diversity of teacher beliefs and the influence of educational backgrounds on their formation. In the fourth stage, the research on teacher beliefs in the context of English specifically focuses on the beliefs and practices of English teachers. This stage of research provides insights into the characteristics of English teacher beliefs and their significant impact on English language instruction. The exploration of these stages offers valuable insights into the nature, implementation, contextual variations, and influence of teacher beliefs, particularly about English language teaching.

Future directions

In the future, research on teacher beliefs can be expanded in various dimensions. This expansion can make a significant contribution to the depth and breadth of our understanding of this crucial aspect in the education field. This study mainly discusses two promising avenues for expansion: an in-depth exploration of teacher beliefs development and teacher beliefs about technology integration.

Firstly, one avenue for future research involves conducting comprehensive reviews regarding the development of teacher beliefs from various perspectives. On the one hand, future research can conduct an in-depth analysis of the theoretical frameworks that have been used to study teacher beliefs over time. This involves identifying and summarizing the key theoretical models and perspectives that have guided research in this area. On the other hand, researchers can also undertake a comparative analysis of different theoretical models to assess their effectiveness in explaining the development of teacher beliefs. Such analysis can reveal the strengths and limitations of each model and offer further insights into which theoretical approaches are the most applicable to specific contexts or stages of a teacher’s career.

Secondly, future studies could delve into teacher beliefs about technology integration. As the digital age advances, there emerges a need for research into teacher beliefs regarding technology integration, notably in the context of emerging tools like large language models. This focus is crucial, as teachers’ perceptions and understandings can significantly mediate the effective incorporation of such advanced technologies in pedagogical contexts. Investigating these beliefs provides pivotal insights into potential facilitators and barriers to successful technology integration, guiding both curriculum development and teacher training initiatives.

Conclusion

This bibliometric study analyzed 1,731 publications on teacher beliefs from the WOS database between 1951 and 2023. The analysis reveals an increasing trend in research output, with expectations for continued growth. Within this body of work, key themes have emerged, specifically in professional development, teaching practices, self-efficacy, theoretical orientation, and student performance. However, this research also highlights a significant gap in collaborative efforts among scholars and institutions. Moreover, the current research hotspots center on the external environment, belief ontology, and teaching practices. Importantly, emerging frontiers in the field are now orienting towards the understanding of epistemological beliefs, application methods, inclusive education, and English language teaching.

However, this study recognizes specific limitations. Its broad scope may inadvertently overlook nuanced, discipline-specific beliefs. Sole reliance on the Web of Science databases might exclude pertinent insights from other sources. Moreover, the strict focus on specific keywords could bypass valuable literature not encompassing these terms. Despite these constraints, this effort seeks to present a thorough overview of the multifaceted realm of teacher beliefs research in the academic context.

Funding This research was supported by the Chinese National Social Science Foundation, with the project “Chinese College Foreign Language Teachers’ Beliefs and Practices of Value-Based Instruction” (grant#23XYY005)

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