A Bibliometric Review of Instructional Leadership Research: Science Mapping the Literature from 1974 to 2020

Una revisión bibliométrica de la investigación sobre liderazgo educativo: Mapeo científico de la literatura de 1974 a 2020

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Abstract

This study used bibliometric science mapping to explore the research development status and intellectual structure of instructional leadership and to identify research fronts and hotspots in instructional leadership studies. Relevant citation data screened from Web of Science revealed 1172 records spanning from 1974 to 2020, which were analyzed using HistCite™, VOSviewer and Sci2 Tool. Descriptive statistics revealed four development stages along with significant articles in each stage. Document bibliographic coupling and content analyses indicated eight major research clusters with their respective research focus. Burst detection and keywords co-occurrence analyses identified research fronts including shared leadership, teaching strategies, systematic review, principal preparation,

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and school climate. Comparison of analysis results obtained using different tools showed discrepancies, thus highlighting the need for different analytical tools to be adopted as they complement each other in offering multiple and complementary perspectives for an across-the-board overview. Finally, implications and limitations of this study are presented.

Keywords: instructional leadership, schools' leadership, principal, science mapping, bibliometric analysis

Resumen

Este estudio utilizó el mapeo científico bibliométrico para explorar el estado de desarrollo de la investigación y la estructura intelectual del liderazgo educativo y para identificar frentes de investigación y puntos críticos en los estudios de liderazgo educativo. Los datos de citas relevantes seleccionados de Web of Science revelaron 1172 registros que abarcan desde 1974 hasta 2020, que se analizaron con HistCite™, VOSviewer y Sci2 Tool. Las estadísticas descriptivas revelaron cuatro etapas de desarrollo junto con artículos significativos en cada etapa. El acoplamiento bibliográfico de documentos y los análisis de contenido indicaron ocho grupos principales de investigación con sus respectivos focos de investigación. Los análisis de detección de ráfagas y co-ocurrencia de palabras clave identificaron frentes de investigación que incluyen liderazgo compartido, estrategias de enseñanza, revisión sistemática, preparación del director y clima escolar. La comparación de los resultados de los análisis obtenidos con diferentes herramientas mostró discrepancias, lo que destaca la necesidad de adoptar diferentes herramientas analíticas, ya que se complementan entre sí al ofrecer perspectivas múltiples y complementarias para una visión global. Finalmente, se presentan las implicaciones y limitaciones de este estudio.

Palabras clave: liderazgo educativo, liderazgo escolar, director, mapeo científico, análisis bibliométrico

Introduction

Instructional leadership (IL) has been defined as actions directly related to teaching and learning that aim to improve teaching tools and methods by initiating reflection and influencing teacher goals, values, and practices (Leithwood & Duke, 2009). Both teacher- and student-centered, IL targets at delivery of quality instruction (Juma et al., 2021). As instructional leaders, principals influence classroom teaching through formulating

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school goals, setting and communicating achievement expectations, organizing classrooms, allocating resources, assessing teacher performance, evaluating student learning progress, and creating a positive and orderly school environment for learning (Heck et al., 1990). In essence, IL is the leadership behavior of the principal in influencing the learning process; therefore, its focus is on the actions taken by the principal to improve instructional quality.

Empirical research on IL includes the pioneering work of Edmonds (1979) and recent studies of Skaalvik (2020), which investigated the significant influence of IL on teacher professional development, motivation, and job satisfaction. Reitzug et al. (2008) proposed four dominant conceptions, namely relational, linear, organic, and prophetic IL, and discussed their implications for research and practice. Cale et al. (2015) critically explored IL in the context of special education in small to medium town schools. They identified a set of factors including communication, teacher evaluation and supervision, staff development, instructional programming, and instructional design that were crucial to the implementation of IL. Day et al. (2016) examined both direct and indirect impacts of principals applying both transformational and IL on student outcomes.

On the basis of content analysis results, Rigby (2013) proposed three logics of IL, namely prevailing logic, entrepreneurial logic, and social justice logic. The IL framework proposed by Hallinger and Murphy (1985) comprises three dimensions: defining the mission of the school, managing instructional programs, and promoting the school learning climate. In addition to these, Weber (1996) identified two more dimensions of IL, which include observing and enhancing teaching quality, and evaluating programmed teaching.

Focusing on school leadership relations between principals and teachers, Marks and Printy (2003) evaluated the potential of their active collaboration around instructional matters and found substantial effect IL on school performance, measured by the quality of its pedagogy and the achievement of its students. Wahlstrom and Louis (2008) further explored the role of the professional community of teachers, which aimed at reducing teachers' dependence on principals as instructional leaders. Their study found that only when the professional community was weak did teachers turn to principals for direct instructional support. In addition to academic research, there are books that specifically investigate and promote IL (Hallinger et al., 2015; Townsend, 2019; Weber, 1996).

This study conducted a systematic literature review on IL with data obtained from the Web of Science (WoS) database. To identify leading research in the field of IL, descriptive analysis, document bibliographic coupling analysis, content analysis, keyword co-occurrence analysis and burst detection analysis were performed. Thus, the analysis results obtained would present a perspective different from conventional literature reviews, because the study with a systematic literature review are quite comprehensive as well as less biased and more transparent that allow large data sets to be represented meaningfully (Meza, 2021). Moreover, the knowledge constructs of IL are linked and visualized with network analysis in the form of clusters and networks. Furthermore, related literature included in the analysis covered almost half a century, from 1974-2020, which would shed light on the evolution of IL research over time. The research questions examined are as follows:

- What is the volume and growth trajectory of the IL journal literature?
- Which authors and documents have the greatest influence on IL?
- What are the most popular topics investigated by the IL scholars?
- How have research themes evolved over time and what are the current research fronts?

Method

This systematic review of research used bibliometric analysis to gain insights into the key documents and topics on IL research. Bibliometric complements traditional reviews and meta-analyses that look objectively at a particular area of control sign, for example a specific time frame or a limited sample of journals, to assess the productivity and frequency of scientific work, and word frequency (Pritchard, 1969). In recent years, bibliometric analysis has been a popular method increasingly used in the scientific community. Results of bibliometric analyses in this research can be of use to scholars in understanding current status and identifying future research opportunities in the field of IL. Methods used in this study for exploring the knowledge domains of IL research include descriptive analysis, document bibliographic coupling analysis, content analysis, keyword co-occurrence analysis and burst detection analysis.

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Bibliographic coupling occurs when two documents both cite one or more documents likewise. The more citations to other documents they share, the higher their coupling strength. Capable of identifying 'hot' research topics, bibliographic coupling relies on appropriate thresholds set for number of related documents and the strength of bibliographic links (Glänzel & Czerwon, 1996). Content analysis aims for the subjective interpretation of the text data through the systematic classification process of coding and identifying themes or patterns (Hsieh & Shannon, 2005).

Keyword co-occurrence analysis explores links between keywords to understand the knowledge components and knowledge mapping of a scientific field (Radhakrishnan et al., 2017). Visual representation of co-occurrence networks shows nodes of keywords representing the cumulative knowledge of a domain, and links denoting co-occurrence of word pairs. Link weights are calculated according to the number of times a pair of words appear together in documents. Burst detection analysis, proposed by Kleinberg (2003), identifies time periods in which a target event is uncharacteristically frequent, or "bursty". To identify the research fronts of IL, this study analyzed the average year of publication for keywords, supplemented by keyword burst detection analysis, using Kleinberg's algorithm, to identify topics showing significant change of research interest. Such analysis brings to light both topics that have received attention over a short period but then lost favor, as well as current research fronts in the burst period including the present.

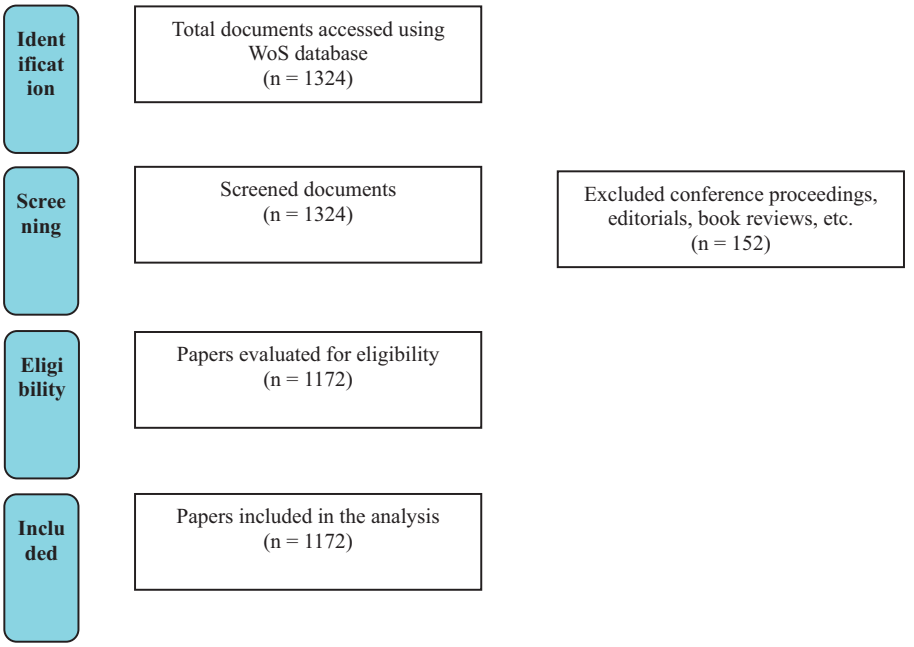
Data source, procedure, and analytic software

Data analyzed in this study were extracted from the Social Sciences Citation Index (SSCI), Science Citation Index Expanded (SCI-Expanded), and Arts & Humanities Citation Index (A&HCI) databases in the WoS Core Collection, which is a common source for bibliometric research. WoS includes the most reliable, high-impact scientific studies (Zyoud et al., 2017), and leading scientific citation search and analytical information platform supporting diverse scientific tasks across multiple knowledge domains as well as a dataset for large-scale data-intensive studies (Li et al., 2018). Moreover, about 99.11% of the journals indexed in the WoS database are also indexed in the Scopus database (Singh et al., 2021). This

study also used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Figure I) which provide a transparent and standardized scheme to visualize the identification and selection of study results in the bibliometric review and meta-analysis process (Moher et al., 2009). Related literature was identified from the WoS database using "instructional leadership" for search in terms of "Topic". The categories chosen were Education and Educational Research, with a time span of 1974 to 2020, and a total of 1324 studies were screened. After excluding conference proceedings, editorial materials, and book reviews and chapters, the search performed in April 2021 yielded a total of 1172 documents (Figure I).

Data collected were processed for knowledge mapping using three bibliometric analysis and information visualization tools, namely HistCite™, VOSviewer and Sci2 Tool. The HistCite™ software analyzed inputs

FIGURE I. Flow diagram of study selection process



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in the form of bibliometric records on co-citations of scientific articles (Barreiro, 2015). The VOSviewer software analyzes complex networks with its own group analysis function according to the strength of the connection between one project and another (van Eck & Waltman, 2020). On one hand, VOSviewer processed the data collected on the basis of co-occurrence; on the other hand, it generated network maps for result visualization. Sci2 Tool is a modular toolset specifically designed for the study of science (Sci2 Team, 2009), and can load data sets in different formats to conduct fundamental analysis such as burst detection analysis, co-occurrence, and coupling analysis.

Results and discussion

Yearly quantitative distribution of literature

Results of descriptive analysis shown in Figure II illustrate changes in the number of publications on IL between 1974 and 2020. Over this almost half a century, four stages of development can be identified. From 1974 to 2000, it was the Foundation stage, during which there were few publications and the number of publications each year showed no significant difference, on average six per year. Then came the Consolidation stage between 2001 and 2008 with the number almost doubled, albeit less than 20 per year. The average number of publications increased significantly to 50 per year in the Growth stage that followed, spanning from 2009 to 2013. From 2014 till present was the Maturity stage with an ever-increasing number of publications per year, two-fold that of the Growth stage. Figure II illustrates the number of publications on IL as a percentage. As can be seen, the number of publications in both Foundation and Consolidation stages are relatively few and insignificant, but increase sharply in both Growth and Maturity stages.

Significant publications in different development stages identified by Histcite^{tm}

As Table I shows, Local Citation Score (LCS) is indicative of the citation frequency of a publication in the collection. The higher the LCS, the more

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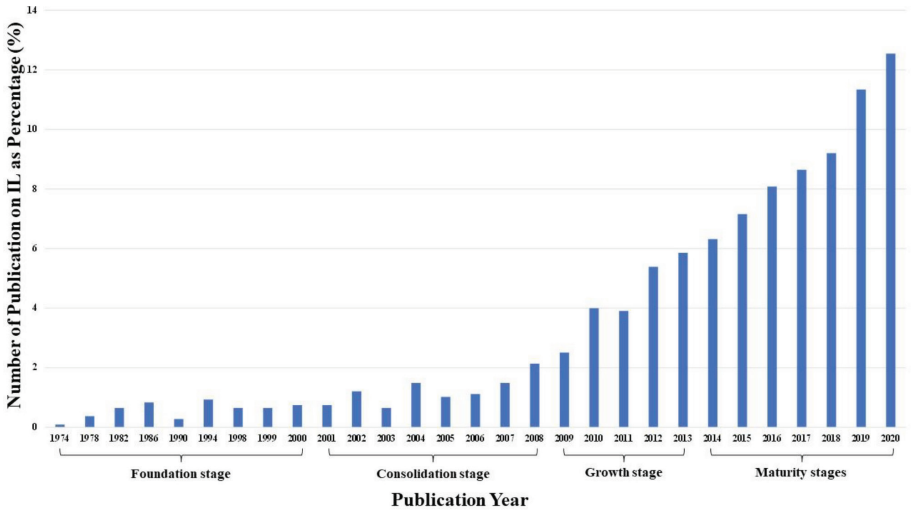
FIGURE II. Number of publications on IL as percentage between 1974 and 2020



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frequent it is cited and the more significant it is in the research domain. Take Robinson et al. (2008) for example, it has the highest LCS of 131 among those listed in Table I, meaning that it is most cited in research publications on IL. Along with Robinson et al. (2008), publications of the Consolidation stage have much higher LCS than those in other stages, indicating their significant influence in promoting further development in the field of IL. Papers with comparatively low LCS, including Grissom et al. (2013) and those of the Maturity stage, are more recent publications of the past decade and it would take time for them to accumulate citations, and their impact on subsequent development of IL research is yet to be seen.

As Table I shows, during the Foundation stage, definitions and concepts of IL were still vague. The main papers published during this period (Blase & Blase, 1999; Hallinger & Murphy, 1985; Heck et al., 1990) focused on investigating, exploring, and defining the concept of IL, formulating dimensions and behaviors of IL, and exploring instructional management.

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TABLE I. Significant publications on IL in different development stages identified by HistCite™

Period	Rank	Author(s)/Year	LCS
Foundation stage	1	Hallinger and Murphy (1985)	93
	2	Blase and Blase (1999)	54
(1974-2000)	3	Heck et al. (1990)	44
Consolidation stage	1	Robinson et al. (2008)	131
	2	Marks and Printy (2003)	116
(2001-2008)	3	Spillane et al. (2004)	40
Growth stage	1	Supovitz et al. (2010)	66
	2	Neumerski (2012)	46
(2009-2013)	3	Grissom et al. (2013)	26
Maturity stage	1	Shatzer et al. (2014)	24
	2	Day et al. (2016)	24
(2014-present)	3	Goddard et al. (2015)	21

Note: The article marked in gray also appears in Table III
Source: Compiled by author

The chief emphasis in this period was on refining the principles and concepts of IL. Comparison was made between IL and other leadership models in terms of effectiveness in improving school outcomes. The meta-analysis of Robinson et al. (2008) found IL three to four times more effective than transformational leadership in enhancing student academic and non-academic outcomes. Their findings were consistent with those reported by Marks and Printy (2003) that IL contributed more to improving school performance than transformational leadership.

Significant development during the Growth stage saw empirical studies conducted on assessing the contribution of IL to teaching performance and learning achievement (Supovitz et al., 2010). In addition, Neumerski (2012) further reviewed IL of principals, teachers and coaches as well as their interaction with followers when they work toward the improvement of teaching and learning. Complementing comparison of different leader types, the study of Grissom et al. (2013) with a unique data source of in-person, full-day observations collected over three years offered longitudinal evidence on the effective use of instructional time of school principals.

Moreover, in the early 2000s during both Consolidation and Growth stages, scholars began to re-conceptualize IL more broadly, as evidenced by the emergence of "shared instructional leadership" (Marks & Printy, 2003), "teacher leadership" (York-Barr & Duke, 2004), and "leadership for learning" (Murphy et al., 2007). These leadership models reframed IL as a distributed process that not only focuses on student learning, but also enhances teacher capacity and teacher commitment as well as designs school organizations to achieve their main goals.

From the Maturity stage till the present, the research focus of IL has shifted towards massive integration and comparative study on impact of instructional and transformational leadership on student achievement (Day et al., 2016; Shatzer et al., 2014). Aiming for a more comprehensive exploration, Goddard et al. (2015) conducted both theoretical and empirical analyses of how IL, teacher collaboration, and collective efficacy beliefs support student learning.

Document bibliographic coupling analysis

In bibliographic coupling analysis, all extracted data were used not only to avoid citation bias but also to identify research fronts. Using VOSviewer to filter the 1172-node bibliographic coupling network yielded eight clusters, with 518 documents in Cluster 1, 208 in Cluster 2, 167 in Cluster 3, 152 in Cluster 4, 85 in Cluster 5, 36 in Cluster 6, 3 in Cluster 7, and 3 in Cluster 8. Figure III shows the document bibliographic coupling network, in which the node size represents the total link strength of the article. According to van Eck and Waltman (2020), a bibliographic coupling link is a link between two items that both cite the same document. The total link strength of a document is the sum of the strengths of its links with other documents.

Table II shows the number of documents in each cluster at the Foundation, Consolidation, Growth, and Maturity stages. As can be seen, in the Foundation stage, Cluster 1 had the highest number of documents (51.31%), significantly higher than the other clusters, followed by Clusters 4 (35.08%), and 3 (6.81%). In the Consolidation stage, Cluster 1 had the highest number of documents (37.60%), though less than that in the Foundation stage, followed also by Clusters 4 (25.60%) and 3

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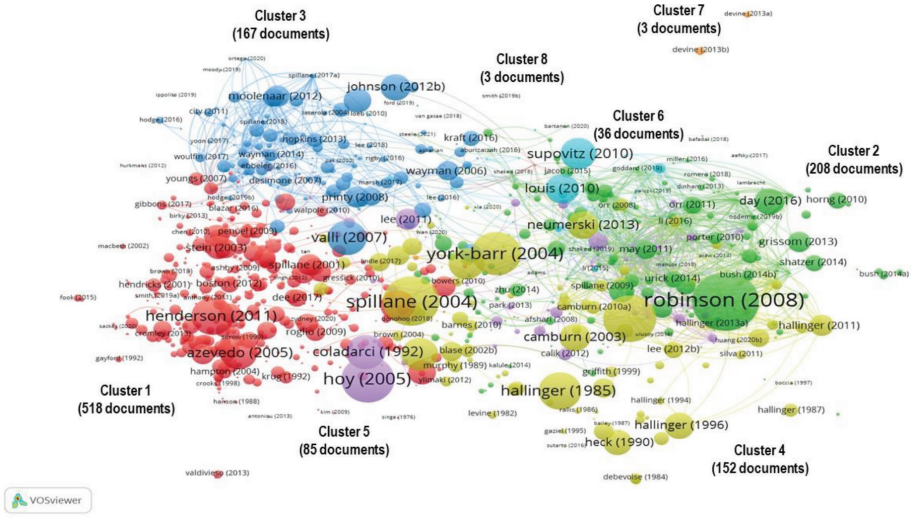
FIGURE III. Document bibliographic coupling network on IL identified by VOSviewer



Source: Compiled by author

(18.40%) with fewer publications compared with the preceding stage. In the Growth stage, Cluster 1 still had the highest number of documents (48.92%), though less than that in the Foundation stage, followed by Clusters 2 (16.02%) and 4 (11.69%), which in contrast showed increase in publications compared with the preceding stage. Finally, in the Maturity stage, the number of documents among the clusters showed bigger differences and the top three were Clusters 1 (41.60%), 2 (24.80%), and 3 (16.96%). The changing trend over the years revealed similar research focuses, evidenced by the same significant cluster (Cluster 1) in both Foundation, Consolidation, and Growth stages, but more diverse research interests in more recent years of the Maturity stage.

This study conducted content analysis of the top three publications with the largest total link strength in each cluster and identified a common theme within each cluster, as shown in Table III and discussed below.

TABLE II. Number of documents in each cluster at the four development stages, 1974-2020

Stage	Year	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8
Foundation stage (1974-2000)	1974-1978	19							
	1979-1983	24			6				
	1984-1988	24			24				
	1989-1993	8			13	9			
	1994-2000	23		13	24	4			
Percentage		51.31	0	6.81	35.08	6.80	0	0	0
Consolidation stage (2001-2008)	2001-2004	20	4	7	21				
	2005-2008	27	12	16	11	7			
Percentage		37.60	12.80	18.40	25.60	5.60	0	0	0
Growth stage (2009-2013)	2009-2011	52	16	12	17	9	6		
	2012-2013	61	21	13	10	7	4	2	1
Percentage		48.92	16.02	10.82	11.69	6.93	4.33	0.87	0.42
Maturity stage (2014-present)	2014-2016	81	66	31	13	10	6	1	
	2017-2020	179	89	75	13	39	20		2
Percentage		41.60	24.80	16.96	4.16	7.84	4.16	0.16	0.32

Source: Compiled by author

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TABLE III. Significant publications in each cluster of document bibliographic coupling network on IL identified by VOSviewer

Cluster	Rank	Author(s)/Year	Total Link Strength
Cluster 1 IL and professional learning communities for learning success	1	Zheng et al. (2019)	1004
	2	Schecter (2008)	656
	3	Riehl (2000)	614
Cluster 2 Impacts of shared IL practice in schools	1	Paletta et al. (2017)	1906
	2	Urick (2016)	1824
	3	Bellibas et al. (2016)	1563
Cluster 3 Leadership for teaching and learning	1	Mangin and Dunsmore (2015)	1554
	2	Spillane et al. (2004)	1143
	3	Daly et al. (2013)	1122
Cluster 4 Review studies in the context of IL	1	Neumerski (2012)	1677
	2	Qian et al. (2017)	1575
	3	Hallinger (2019)	1547
Cluster 5 Influence of IL on teachers	1	Bellibas and Liu (2018)	1535
	2	Ma and Marion (2020)	1484
	3	Urick et al. (2018)	1344
Cluster 6 Influence of IL on school performance	1	Hallinger and Hosseingholizadeh (2020)	1727
	2	Sebastian et al. (2019)	1285
	3	Louis et al. (2010)	1095
Cluster 7 Instructional coaching for teachers	1	Goldring et al. (2014)	466
	2	Devine (2013)	155
	3	Devine et al. (2013)	7
Cluster 8 Influence of IL on students' achievement	1	Boston et al. (2017)	1228
	2	Smith and Smith (2018)	894
	3	Fairman and Mackenzie (2012)	422

Note: The article marked in gray also appears in Table I
Source: Compiled by author

Cluster 1 IL and professional learning communities for learning success

The common emphasis of publications in Cluster 1 is the important impacts of IL on professional learning communities for learning success. The most significant article in this cluster, namely Zheng et al. (2019) exploring the mediating effect of professional learning communities on relationship between IL and teacher self-efficacy in the context of Mainland China. Schecter (2008) highlighted the importance of the preparatory program of principals in Israel that affects their ability to foster teachers' collective learning. The study of Riehl (2000) is distinct from the rest in its inclusive educational settings. Needless to say, the leading role in a regular school differs from that in an inclusive school with students of diverse special needs.

Cluster 2 Impacts of shared IL practice in schools

Research in Cluster 2 focused on how principals practice shared IL in schools and investigated their impact on teacher performance. Paletta et al. (2017) found that schools with higher leadership scores have greater job satisfaction and higher self-efficacy among teachers, and a better educational climate. Urick (2016) concluded that principals should have similar influence over resources, safety and facilities regardless of degree of shared IL because these tasks address foundational school needs. Bellibas et al. (2016) noted from the perspective of capacity building that system leaders have in recent years increased their investment in the preparation and professional development of school leaders.

Cluster 3 Leadership for teaching and learning

Cluster 3 represents the thoughts of scholars on the relationship of leadership with teaching and learning. Mangin and Dunsmore (2015) revealed that IL with the framing of instructional coaching as a lever for teacher instructional reform influences the enactment of coaching. Spillane et al. (2004) noted that teachers working in an IL culture perform better in teaching, instructional practice, and learning improvement, which are the most proximal causes of student achievement. Daly et al. (2013) presented a study measuring leader's network position by incoming, outgoing,

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and close ties; personality traits; and leader self-efficacy after controlling for demographics.

Cluster 4 Review studies in the context of IL

Studies in Cluster 4 focused on reviewing theory and leadership research in schools' organizations. Neumerski (2012) utilized a distributed lens to examine the principal, teacher leader, and coach IL literatures. Qian et al. (2017) elaborated on three dimensions with the greatest context-specific meanings for Chinese principals, namely defining purpose and direction; nurturing positive and collaborative relationships with and among teachers; and fostering professional development to enhance teacher capacity. Hallinger (2019) reviewed theory and research on educational leadership and management. The patterns thus obtained revealed that the research front in the emerging-region literature in educational leadership and management lies in papers that examine principal and shared leadership in relation to student achievement and curriculum reform.

Cluster 5 Influence of IL on teachers

Data gathering and analysis in the studies of Cluster 5 are mainly through quantitative approaches using questionnaires. These studies contributed to a growing body of research evidencing a positive effect IL on teachers, such as teacher trust, teacher collegiality, teacher efficacy, and teacher instruction. Bellibas and Liu (2018) found that principals' emphasis on instructional practice and sharing leadership can play a significant role in promoting the trust, collegiality and respect among staff. Ma and Marion (2020) indicated that IL, in terms of developing a positive learning climate, directly and positively affects teacher efficacy. Urick et al. (2018) found a direct effect of IL on math instruction in the classroom and teacher participation in math professional development.

Cluster 6 Influence of IL on school performance

Studies in Cluster 6 contributed to a growing body of research evidencing a positive effect IL on school performance, such as organizational

management, focused instruction, and collegial and collaborative environment in school for teachers. Hallinger and Hosseingholizadeh (2020) highlighted that ensuring a collegial and collaborative environment for teachers is commonly articulated by successful principals as an important aspect of IL. Findings of Sebastian et al. (2019) concluded that principals view themselves as either strong or weak on IL and organizational management skills simultaneously. Louis et al. (2010) reported that teachers' professional community and the quality of classroom instruction is a mediator on the effect of IL on student achievement.

Cluster 7 Instructional coaching for teachers

This cluster contains only three articles, published mostly during the Growth stage. Goldring et al. (2014) found that principals often experience cognitive dissonance in face of contrasting feedback from different data sources (e.g., their self-ratings to those of their teachers). Devine (2013) explored how principals' recognition of immigrant children as well as investment in supporting their learning are shaped by the logics of practice across different fields, as well as by their own authentic habitus evolving in a period of rapid social change. Devine et al. (2013) noted that instructional coaching can support schools in implementing new teaching practices in a sustained way.

Cluster 8 Influence of IL on students' achievement

This cluster also contains only three articles, published mostly during the Maturity stage. Boston et al. (2017) investigated how to support principals as instructional leaders in mathematics. Smith and Smith (2018) reported that the most impactful investment toward student achievement is helping leaders learn. The solid, sustainable, and laser-sharp focus on IL helps leaders hone, model and lead new learning through deliberate practice by engaging in rich, rigorous, and reflective open-to-learning conversations (Smith & Smith, 2018). Fairman and Mackenzie (2012) found that the work of teacher leaders results in teacher learning as well as improves students' achievement.

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Examining the distribution of significant publications in the above eight clusters at the four development stages in Table II revealed the time period when the intellectual structure of studies on IL was formed. As can be seen, the majority of studies published in the Foundation stage were of Cluster 1 with contents focusing on how IL influences professional learning communities, assessing the instructional management behavior of principals, and the effect IL on school achievement. Research development further evolved from the Foundation to Consolidation stage with emphasis shifting to in-depth investigation on how IL improves teaching, and on dimensions of IL. Research in the Growth stage focused on how IL influences teaching and learning, as well as effective instructional time use for instructional leaders. Finally, in the Maturity stage, research interests become more diverse with IL explored from different perspectives, including comparing the effects of transformational and IL on student achievement. Among the wide-ranging research topics, analysis of the roles of IL, teacher collaboration, instructional strategies, and collective efficacy beliefs have received the most scholarly attention in recent years.

This study made a comparison between significant publications identified using HistCite™ tool (Table I) and VOSviewer (Table III). Of note is that the two tools yielded markedly different results. Only one significant article with high LCS, namely Neumerski (2012), was among the top 24 in the eight clusters, indicating huge discrepancy in articles identified using LCS and total link strength. The study of Neumerski (2012) was published in the Growth stage and grouped under Cluster 4, ranked sixth in LCS (Table I) and fourth in total link strength (Table III). The comparison shows that reviewing the number of times papers are cited (LCS) alone cannot objectively determine the focus of research at the development stage. In addition, the increasing number of citations from older papers over time have more "average" citations than newer papers. In contrast, bibliographic coupling is a similarity measure that uses citation analysis to establish similarity relationships between papers, which are combined into different clusters. In other words, papers grouped in the same cluster have similar content. Therefore, cross-referencing both indicators, LCS and total link strength of publications in clusters provides a more comprehensive perspective on the research focus at different stages of development and the intellectual structure of the IL knowledge base.

Keyword co-occurrence analysis

Figure IV presents the network diagram obtained from co-occurrence analysis of the 3188 keywords in the 1172 documents screened. The results revealed 18 clusters of frontier topics in IL studies. The large number of clusters generated would imply that analysis by clusters does not have much meaning or significance. Instead, this study analyzed the keywords in terms of its number or frequency of occurrences with the threshold of appearing in a minimum of 54 publications. Table IV lists the 20 keywords that met such criterion. As can be seen and as expected, "instructional leadership" is the most frequently used keyword, appearing in 243 publications, followed by "leadership" in 174, "teachers" in 110, and "achievement" in 106 publications.

The value of Avg. Pub. Year, calculated using VOSviewer according to the weighted average concept, serves as a scalar proxy indicating how 'new' or 'mature' a particular keyword is in IL research. As shown in Table IV, keywords with frequent occurrences appear in documents of earlier publication years and vice versa. Hence, the top four frequent-occurring keywords "instructional leadership", "leadership", "teachers",

FIGURE IV. Network visualization of keywords co-occurrence analysis by VOSviewer

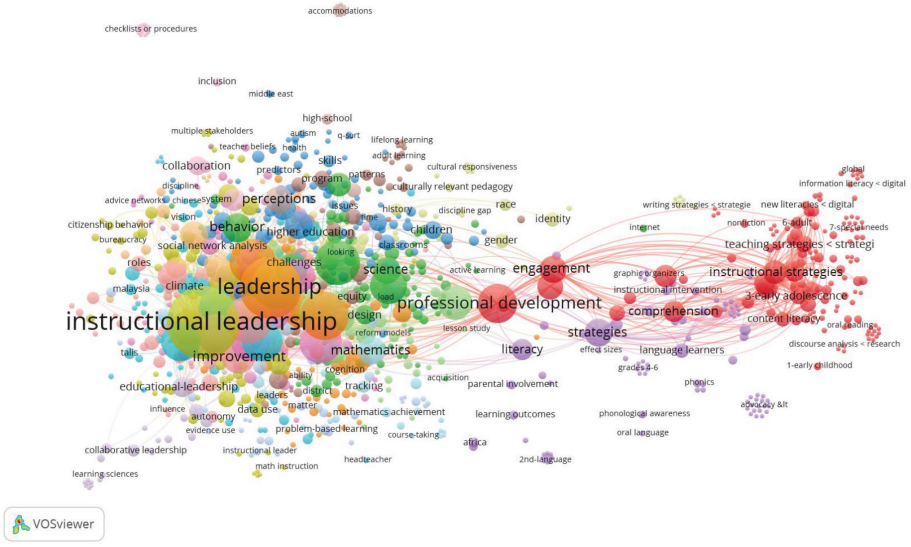

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TABLE IV. Significant keywords from co-occurrence analysis

Keyword	Occurrences	Avg. Pub. Year
instructional leadership	243	2015.19
leadership	174	2014.35
teachers	110	2014.40
achievement	106	2014.53
performance	99	2014.56
education	91	2014.59
policy	85	2014.94
principals	77	2014.83
principal leadership	73	2016.26
professional development	73	2015.22
reform	70	2013.66
shared leadership	66	2016.43
higher education	65	2014.78
students	62	2016.78
school	58	2014.43
distributed leadership	57	2016.29
instruction	56	2015.32
job satisfaction	56	2015.65
improvement	54	2015.73
management	54	2014.50

Note: *Occurrences* refers to the number of publications the keyword appears in; *Avg. Pub. Year* the average publication year for articles that include the keyword
Source: Compiled by author

and "achievement" are more mature topics appearing in publications of 2014 and 2015 while keywords with low occurrences including "principal leadership", "shared leadership", "students", "distributed leadership", and "student-achievement" represent emergent research fronts mentioned in more recent publications of 2016.

Burst detection analysis

This study conducted a burst detection analysis using the Sci2 Tool to distinguish between topics of sustained research interest over time and topics that are popular merely for a few years. The burst detection

analysis identifies keywords with high-concentration and high-density characteristics in the document according to the density of changes in keyword frequency. In this way, the sudden growth of a research field can be detected in terms of the frequency with which the term subject is used. In addition, changes in research trends can be determined according to the burst weight, start and end year of each burst keyword. In this study, the top 30 keywords with the largest burst weights in IL literature were included in the analysis, the results are shown in Table V.

In the Foundation stage, there are six burst keywords. "Leadership" had the highest burst weight, followed by "school reform" and "urban schools". They highlighted that IL practices have an effect on the school reform movement to improve student performance, especially students from poor families studying in urban schools (Polite et al., 1997). "Problem-based learning" remained in vogue for the longest duration of 19 years from 1995 to 2013 while "professional community", though important, represented a younger focus of research and had the shortest burst of seven years from 1998 to 2004. Moreover, these burst results echoed the emergence of IL as a leadership style and model for effecting problem-based learning, professional community, and school performance (Figuerola et al., 2020; Irby, 1996).

In the Consolidation stage, there are eight burst keywords. As expected, "instructional leadership" had the highest burst weight, followed by "instructional improvement" and "professional development". These burst results echoed that IL is a key influence on the teacher's instructional improvement and professional development (Reitzug et al., 2008). Burst keywords including "principal leadership", "curriculum development", and "leadership qualities", highlight the focus of the main research trend at this stage while other leadership styles, such as "curriculum leadership" and "teacher leadership", have also become hot issues in IL studies on implementing curriculum reform (Hsiao et al., 2008).

In the Growth stage, there are eight burst keywords. "Higher education" had the highest burst weight, followed by "teaching styles" and "transformational leadership". The high burst weight of "higher education" reflected the sharp increase in research on IL practice and development in universities, while that of "teaching styles" and "transformational leadership" indicated such a goal as a focal point in this stage. Despite of their significance, they appear only for a short period of time. Moreover, these burst results highlight that IL has influence on instructional coaching and school improvement (Ruebling et al., 2004). Keywords "inclusive

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TABLE V. Significant keywords with highest burst weights clustered by development stage

Stage	Keywords	Weight	Start	End	1974-2020
Foundation stage (1974-2000)	leadership	2.33	1997	2000	
	school reform	2.25	1999	2010	
	urban schools	1.34	1998	2000	
	problem-based learning	1.20	1995	2013	
	professional community	1.18	1998	2004	
	school performance	0.96	2000	2009	
Consolidation stage (2001-2008)	instructional leadership	4.09	2003	2007	
	instructional improvement	2.76	2003	2012	
	professional development	1.74	2005	2009	
	principal leadership	1.63	2007	2008	
	curriculum development	1.55	2007	2011	
	leadership qualities	1.28	2007	2009	
	curriculum leadership	1.15	2008	2014	
	teacher leadership	1.10	2007	2010	
Growth stage (2009-2013)	higher education	1.68	2010	2014	
	teaching styles	1.25	2013	2013	
	transformational leadership	1.25	2013	2013	
	instructional coaching	1.21	2013	2016	
	school improvement	1.16	2012	2013	
	inclusive education	1.09	2009	2012	
	distributed leadership	1.02	2009	2010	
	educational administration	0.92	2011	2013	

(*continued*)

TABLE V. Significant keywords with highest burst weights clustered by development stage *(continued)*

Stage	Keywords	Weight	Start	End	1974-2020
Maturity stage (2014-present)	job satisfaction	1.90	2015	2017	
	social network analysis	1.80	2018	2019	
	shared leadership	1.58	2019	2020	
	teaching strategies	1.58	2018	2020	
	systematic review	1.44	2019	2020	
	principal preparation	1.34	2019	2020	
	school climate	1.22	2019	2020	
	educational reform	1.19	2016	2017	

Source: Compiled by author

education" also reflected the sharp increase in research on IL practice and development in inclusive schools (Ruairc et al., 2012). In this stage, "distributed leadership" and "transformational leadership" received greater attention and were compared with IL in terms of effectiveness in improving school performance (Halverson & Clifford, 2013). Other notable research fronts including "educational administration" reflected the stress in recent literature on excellence in schools and the positive effect principals can have on quality instruction; thus IL has received renewed emphasis in writings on school administration (Lee & Hallinger, 2012).

The Maturity stage of IL studies had two keywords with high burst weights, namely "job satisfaction" and "social network analysis". The highest burst weight of "job satisfaction" revealed the emphasis that IL is an antecedent for job satisfaction (Skaalvik, 2020). These burst results also highlighted the usage of "social network analysis" to understand the influence of principals' social networks and how principals navigate instructional development initiatives (Rigby, 2016). Of note is that keywords such as "shared leadership", "teaching strategies", "systematic review", "principal preparation", and "school climate" have all experienced strong and recent bursts that persist till present.

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While both keywords co-occurrence and burst detection analyses can be employed to explore the research fronts, they yielded different results. Take the keyword "shared leadership" for example. Co-occurrence analysis showed its Avg. Pub. Year being 2016.43 (Table IV), implying that it is a relatively new research topic most likely to be featured in recent literature. However, burst detection analysis revealed its burst starting but also ending in 2020 (Table V). Another keyword "teachers" is also an emergent research area with Avg. Pub. Year being 2014.40 (Table IV) but it is not identified by burst detection analysis (Table V). Other up-and-coming research fronts including "teaching strategies", "systematic review", "principal preparation", and "school climate" had strong and recent bursts in the Maturity stage persisting till present (Table V). Despite being hot, they appear in few publications and are not listed among the significant keywords from co-occurrence analysis (Table IV).

Conclusions, implications, limitations, and suggestions for future research

This study applied science mapping methods using HistCite™, VOSviewer and Sci2 Tool to identify, visualize and describe the knowledge base of IL research. Four development stages, namely Foundation, Consolidation, Growth and Maturity stages were identified along with the most influential studies in each stage. Document bibliographic coupling and content analysis conducted revealed not only the knowledge base but also the intellectual structure of IL studies in each development stage. Keywords co-occurrence and burst detection analyses showed "shared leadership" as the recent focus in the field. As suggested by burst detection analysis, keywords including "teaching strategies", "systematic review", "principal preparation", and "school climate" indicated also emergent fronts. Analysis results obtained using different tools were compared. The discrepancies in analysis results highlight the need for diverse analytical tools to be adopted as they complement each other in offering multiple and complementary perspectives for an across-the-board overview of IL research in the past five decades.

The implications of this study are as follows. First, IL research is still growing. Over the last 50 years, IL has continued to develop and has been reorganized, especially conceptually, demonstrating the continued

relevance of IL, both in theory and in principal leadership practice. Second, findings of this study highlight IL trends in comparing against and integration with other leadership models. In other words, there has been continuous efforts devoted to developing ideal educational leadership within the scope of schools for principals and school organizations to apply according to the respective school context. Third, the knowledge base of IL has evolved for almost five decades and remains to be an intellectual pillar for research on principal leadership. The schools of thought underlying the conceptual foundation of IL today reflect a common theme centered on how principals as instructional leaders promote student learning, teacher teaching performance, and school improvement.

This study also has limitations. First, findings in this review are obtained from an analysis of WoS-indexed bibliographic data; thus, review in this paper is only limited to assessing the evolution of the corpus of WoS-indexed publications. Second, bibliometric analyses tend to emphasize only the dominant trends of the literature. Non-dominant features that may have significant potential may have been overlooked. Overcoming this deficiency would give a more comprehensive literature review on IL.

Possible directions for further research include the following. First, the adopted interdisciplinary approach to the analysis of IL research which allowed identification of new research trends, can be extended by including investigation of other bibliometric databases (such as Scopus, ERIC, and EBSCO). Second, expanding the analysis to include, e.g., co-citation and co-authorship relationships, or full-text analysis of papers, would also allow comparison of the results obtained to date. Third, analyses made using other methods or bibliometric programs (such as CiteSpace, Pajek, and SciMAT) may yield interesting results.

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