Research Trends on Lesson Study Based on Google Scholar and Scopus Database: a Bibliometric Analysis

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Submission Track:	ABSTRACT
	This study investigates lesson study research trends through bibliometric analysis on widely distributed Google Scholar (GS) and Scopus databases. We reviewed 997 papers from GS and 200 documents from the Scopus database searched using Harzing's Publish on May 6 2023. A descriptive study approach was used to investigate the data. The result of this study is that the number of lesson study documents has increased over the last decade (2012-2022). The most productive author based on GS is R Huang from the United States, and the full author based on Scopus is E. Saito from Australia. While the prominent authors based on the highest citations are Fernandez & Yoshida, based on GS, and Dudley, with the highest citations based on Scopus. The "International Journal for Lesson and Learning Studies" in the last decade is the most source of lesson study documents. Based on VosViewer visualization, Rosa is the author who has the most co-authorship papers and total link strength. The VosViewer displays four clusters related to lesson study: community, context, observation, and participation. Our strong recommendations regarding this study are lesson study research related to literacy, numeracy, and mathematical abilities. The results can assist relevant researchers in understanding trends in lesson study research and recommend guidelines for other studies. ***Keywords:*** *Bibliometric analysis, Lesson study, Research trend*

INTRODUCTION

The United Nations (UN) established the Sustainable Development Goals (SDGs) as the global development agenda through 2030. Indonesia is a UN member that is working to implement the SDGs. The SDGs comprise 17 objectives and 169 quantifiable accomplishments established by the UN. Indonesia focuses on public health and welfare, gender equality, industry and infrastructure, marine ecosystems and Indonesia's partnerships with other countries (Nugroho and Wijayanti 2022). However, in Indonesia, quality education is fair and equitable,

and there are opportunities for lifelong learning for all ages; several provinces still have not implemented the SDGs strategy to raise the standard of education in Indonesia. In its implementation, it still encounters various obstacles, such as difficulty accessing schools, differences in customs, quality of quality competencies and the quality of teaching staff in remote areas is not encouraging at all (Safitri, Yunianti, and Rostika 2022).

Therefore, a method or system is needed to improve teacher quality. Teachers must innovate learning, such as strategies, techniques, media, or new learning resources, will open their classes, and invite several other teachers as colleagues to convey their ideas. Some of these teachers then developed good learning preparations to implement the teacher's ideas. Furthermore, the teacher carries out learning based on the lesson plan that has been developed while other teachers observe the learning process. Immediately after class ended, the group of teachers discussed the learning practices that had been carried out, and they observed. The discussion is intended to find more and fewer sides as a basis for developing subsequent learning (Mahmudi 2014). Learning innovation through planning, implementation and viewing, and reflection is known as lesson study (Lewis 2006, 2015; Lewis et al. 2013).

Lesson study (LS) is a model for developing the teaching profession and education staff, which has rapidly evolved in Indonesia. The presence of lesson study takes part to encourage teachers to increase their professionalism through activities at the KKG/MGMP level, known as a teacher working group-based lesson study or subject teacher-based lesson study, as well as activities at the school level, known as school-based lesson study (Fadloli 2014). Lesson study (LS) is a collaborative process of a group of teachers (see Figure 1) to jointly: (1) identify learning problems felt by the instructor (one or a group of teachers), (2) plan learning steps (to solve identified problems), (3) extend out learning performed by one of the teachers chosen, while other instructors observe the process of learning, and (4) judge the learning process that has been performed out, (5) based on assessment outcomes, enhance learning planning (6) Re-implement learning, (7) Re-evaluate implemented learning, and (8) Share experiences and conclusions from assessment results with other instructors (Melati, Junanto, and Lestari 2014).
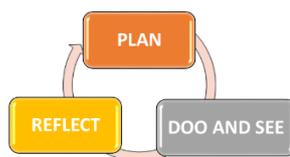

Figure 1. Framework of Lesson Study

Lesson study is significant because it allows lesson-study collaboration. CLS can obtain optimal results (Puchner and Taylor 2006; Takahashi and McDougal 2016), learning quality can be controlled (Breda et al. 2021; Færøyvik Karlsen 2022; Sulistiyani, Wijaya, and Ardyan 2020), improving mathematics learning and problems solving (Lewis 2016; Marwiang et al. 2017), Enhancing mathematics teachers' quality (Bozkurt and Yetkin-Özdemir 2018; Lomibao 2016). There is a lot of research related to lesson study, but there is only one bibliometric study related to lesson study from 1999 to 2021 in China based on the CNKI database (Liao and Wu 2022). No comprehensive study related to lesson study research globally uses Google Scholar metadata while comparing it with Scopus metadata. Therefore it is important to unify multiple libraries from multiple metadata sources. for example, this study uses metadata from Scopus and Google Scholar to provide an overall portrait of lesson study research in the last ten years.

This study uses two sources of metadata, namely from Scopus and GS. To avoid discussion bias, we only focus on six research questions. Thus, this study emphasizes research trends in lesson study during 2012-2022 with six investigation questions below:

i) What is the output of lesson study (LS) publications in the last ten years?

ii) Who was the first place of the author of LS Worldwide?

iii) What is LS's publication pattern based on the source's title?

iv) How does the author interact with lesson study trends?

v) How to visualize the results of lesson study research trends?

vi) What recommendations are for future lesson study?

METHOD

This study uses a literature study by bibliometric analysis of the paper, providing a valuable reference experience on time ahead research (Kulakli and Osmanaj 2020; Thanuskodi 2010). The style bibliometrics was first coined by (Alan Pritchard 1969), "hoping that it will be used explicitly in all studies seeking to measure the communication writing process and will rapidly gain acceptance in the information science field"(Parra-González et al. 2020). Researchers optimized the Scopus Elsevier database, the world's most significant academic bibliography. In academic study, getting a new, more comprehensive perspective from the study that has been done on relevant and up-to-date content is essential. Bibliometric analysis (Chinnaraj and A 2021; Espina, Marbán, and Maroto 2022; Murugan and Kavitha 2021; Wu et al. 2022) profiles will guide research activities worldwide. "lesson study" looks for titles, words, keywords, and abstracts. The search strategy titles use Scopus and GS search on Harzing's

Publish or Perish (PoP) (See Figure 2). The CSV and RIS metadata used in this study can be accessed in the PoP application using the strategy in the Figure 2.
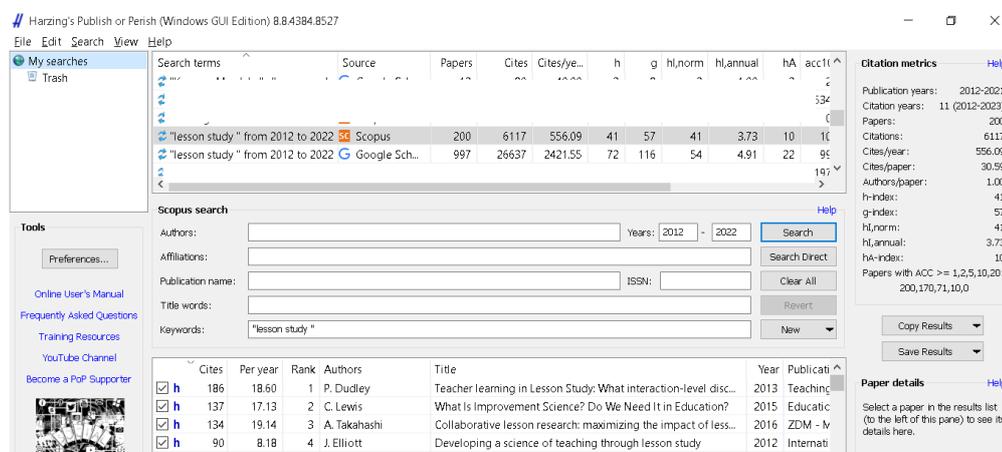

Figure 2. Search strategy Scopus and GS on PoP Software

The data was collected on May 6 2023. Nine hundred ninety-seven documents on Google Scholar (GS) and 200 on Scopus were searched from 2012 to 2022. Moreover, the data analysis technique used is descriptive. Microsoft Excel was used to examine the data. Exploration was carried out to investigate research trends, including the research output, paper source, spreading of countries and organizations, spreading of the production in subject categories, the first place of authors, top citations, and research trends. VoSViewer application was used to find research trends in lesson study (van Eck and Waltman 2022).

RESULT & DISCUSSION

Result

Figure 2 below shows the number of studies related to lesson study based on Scopus and google scholar (GS) databases from 2012 to 2022.
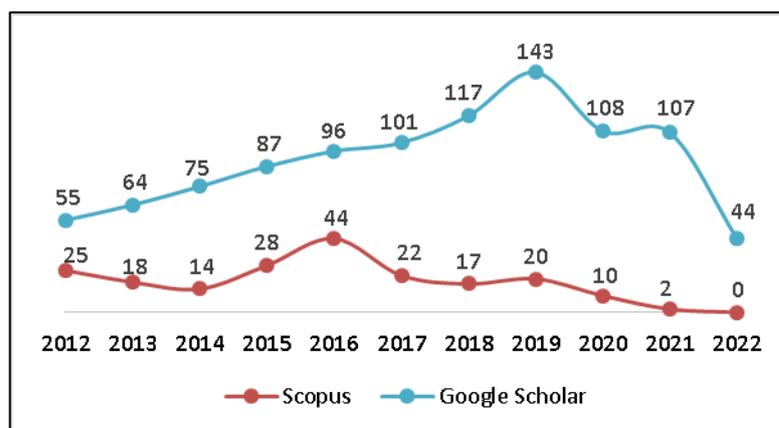

Figure 3. The trend of lesson study research

A total of 997 documents on Google Scholar (GS) can be seen in Figure 3 (blue line). Documents in GS have increased every year in the 2012-2019 period. However, in the last three (2020-2022), it has experienced a downward trend. At the same time, 200 documents on Scopus experienced a downward trend. However, there was a peak increase in 2016 with 44 papers. Furthermore, Table 1 will provide an overview of the top 5 authors of the GS and Scopus versions in the last decade (2012-2022).

Table 1. Top 5 authors most cited based on Scopus database

No	Author	Title	Source	Cites
1	Dudley (Dudley 2013)	"Teacher learning in Lesson Study: What interaction-level discourse analysis revealed about how teachers utilized imagination, tacit knowledge of teaching and fresh evidence of pupils learning to develop practice knowledge and enhance their pupils' learning."	"Teaching and Teacher Education"	186
2	Lewis (Lewis 2015)	"What Is Improvement Science? Do We Need It in Education?"	"Educational Researcher"	137
3	Takahashi & McDougal (Takahashi and McDougal 2016)	"Collaborative lesson research: maximizing the impact of lesson study."	"ZDM - Mathematics Education"	134
4	Elliott (Elliott 2012)	"Developing a science of teaching through lesson study."	"International Journal for Lesson and Learning Studies"	90
5	Ming Cheung & Yee Wong (Ming Cheung and Yee Wong 2014)	"Does Lesson Study work? : A systematic review on the effects of Lesson Study and Learning Study on teachers and students."	"International Journal for Lesson and Learning Studies"	89

In general, the total of documents cited or used as references throughout the year can be seen in Table 1, namely the authors Dudley (186), Lewis (137), Takahashi & McDougal (134), Elliott (90), and Ming Cheung & Yee Wong (89). The five authors in Table 1 are the top five most cited in 2012-2022.

Table 2. Top 5 authors most cited based on GS database

No	Author	Title	Source	Cites
1	Fernandez & Yoshida (Fernandez and Yoshida 2012)	"Lesson study: A Japanese approach to improving mathematics teaching and learning."	"Routledge Taylor & Francis Group"	1262
2	Dudley (Dudley 2013)	"Teacher learning in Lesson Study: What interaction-level discourse analysis revealed about how teachers utilized imagination, tacit knowledge of teaching and fresh evidence of pupils learning to develop practice knowledge and enhance their pupils' learning."	"Teaching and teacher education"	424
3	Chong & Kong (Chong and Kong 2012)	"Teacher collaborative learning and teacher self-efficacy: The case of lesson study."	"The Journal of experimental education"	341
4	Takahashi & McDougal (Takahashi and McDougal 2016)	"Collaborative lesson research: Maximizing the impact of lesson study."	"ZDM Mathematics Education"	339

No	Author	Title	Source	Cites
5	Dudley (Dudley 2014)	"Lesson study: A handbook."	"Routledge Taylor & Francis Group"	307

Table 2 above provides information regarding the top 5 authors most cited based on the GS database in the last ten years. We can see that Fernandez et al. is the most cited article, with 1262 mentioned in google scholar. Furthermore, Table 3 provides information regarding the top five productive authors related to lesson study in the last ten years.

Table 3. Top 5 productive authors base on Scopus

No	Author	Cites	Total
1	E. Saito	Australia	7
2	W. Cajkler	United Kingdom	7
3	C. Lewis	United States	6
4	R. Huang	United States	5
5	P. Dudley	United Kingdom	4

Table 3 illustrates that the top 5 authors who contributed most to writing lesson study articles based on the Scopus database were E. Saito (Australia) and W. Cajkler (United Kingdom), with seven documents each. In addition, Lewis from the United States wrote six documents, Huang from the United States 5 documents, and Dudley from the United Kingdom wrote four papers. While the most productive authors, according to the GS database, Table 4 shows the results.

Table 4. Top five productive authors base on GS

No	Author	Cites	Total
1	R Huang	United States	10
2	B Norwich	United Kingdom	9
3	P Dudley	United Kingdom	9
4	E Saito	Australia	8
5	A Ní Shúillebháin	Ireland	7
6	C Lewis	United States	7
7	S de Vries	Netherlands	7
8	W Cajkler	United Kingdom	7

Table 4 shows the eight most prolific writers in the last ten years, namely R Huang from the United States (10 documents), B Norwich from the United Kingdom (9 papers), P Dudley from the United Kingdom (9 documents), E Saito from Australia (8 papers), and the rest contributed seven copies each as shown in table 4. Table 5 below presents the top five source articles based on GS.

Table 5. Top five source articles based on GS

No	Author	Cites	Total
1	"International Journal for Lesson and Learning Studies"	101	1
2	"Journal of Physics: Conference Series"	20	2
3	"Teaching and teacher education"	19	3
4	"Journal for Lesson and Learning Studies"	18	4
5	"Professional development in education"	16	5
6	"ZDM–Mathematics Education"	16	6

According to the data in Table 5, it can be seen that the "International Journal for Lesson and Learning Studies" is the most dominant source contributing to publishing lesson study-related papers in the 2012-2022 period based on the GS database. At the same time, the Top five source articles based on Scopus are "International Journal for Lesson and Learning Studies" with 44 papers, "ZDM Mathematics Education" with 19 papers, "Teaching and Teacher Education" with 16 papers, "Professional Development in Education" 10 papers, and " Journal of Mathematics Teacher Education" which published eight documents in the last ten years. So, based on the GS and Scopus databases, the "International Journal for Lesson and Learning Studies" is the most dominant source for publishing lesson study documents.

Discussion

The output of lesson study (LS) publications in the last ten years base on google scholar tends to increase (see Figure 1). Therefore based on the Scopus database, the number of publications grows to de-increasing. Most research results related to LS in the last decade have been published in publishers indexed by Google Scholar. However, the number of research results published in the Scopus database has decreased.

Based on Table 1, the number one author with the most citations based on the Scopus database is Dudley (Dudley 2013), with 186 citations. At the same time, the first place with the most citations based on Google Scholar is Fernandez & Yoshida (Fernandez and Yoshida 2012), with 1262 citations. The number one author who is the most productive in writing papers related to LS based on the Scopus database is E. Saito from Australia, with seven documents. While the number one author who is the most prolific in writing papers related to LS based on the GS database is R Huang from the US, with ten documents. Meanwhile, based on the GS database, the "International Journal for Lesson and Learning Studies" is the most dominant source contributing to publishing lesson study-related papers in the 2012-2022 period. Meanwhile, the

"International Journal for Lesson and Learning Studies" is the most contributing source for publishing papers related to LS based on the Scopus database, with 44 articles.

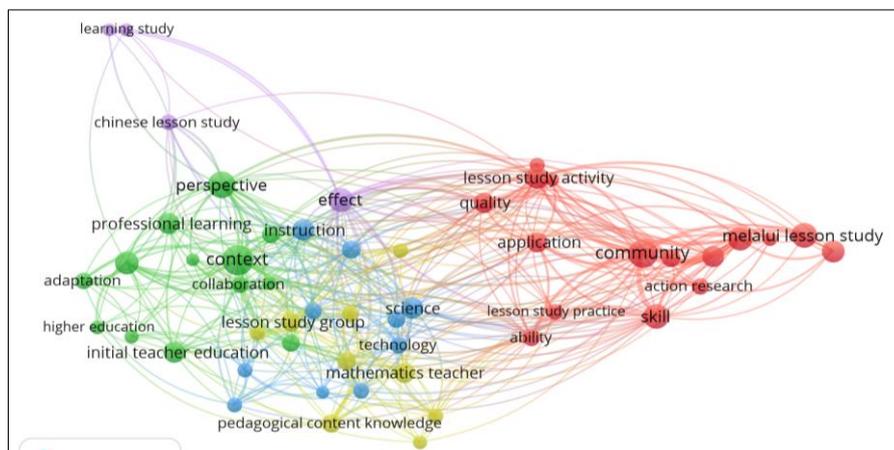***Visualization of research output on lesson study by using VoSViewer***

Figure 4. Whole picture of the lesson study database on GS and Scopus

If we zoom out on Figure 4, it will be apparent that there have been five lesson study research clusters. However, only four significant groups discussed community, context, observation, and participation. For more detail, see Figure 5 to Figure 8 below.
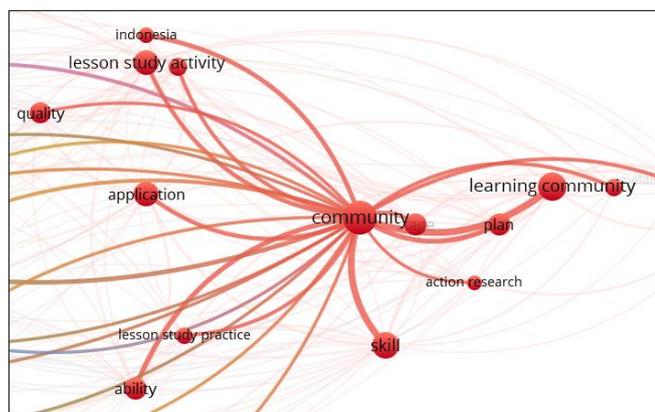

Figure 5. Cluster one (red colour)

Cluster 1 (see Figure 5) is red and related to the plan, learning community, community, lesson study, quality, application, lesson study practice, and ability. Several related lesson study studies plan that create authentic learning opportunities in general education classrooms for kids with intellectual impairments (Anderson 2022) through lesson study, make a creative inquiry-based lesson plan (Canalita et al. 2019), Model for Developing Interdisciplinary Activity Plans Using the Lesson Study Method (Gülhan 2022), and a lesson study to increase mathematics pre-service teachers' ability in preparing lesson plans based on ethnomathematics (Sintawati,

Fitrianawati, and Marsigit 2019). Examples of lesson study research related to the learning community namely Lesson Study for Learning Community (LSLC) to enhance Student's Creative Thinking Capabilities (Fauziah et al. 2019), LSLC to Support Creative Teachers (Fauziyah et al. 2021), LSLC to high-order thinking capability in mathematics contextual teaching and learning (Hobri, Septiawati, and Prihandoko 2018), LSLC Improving the quality of learning (Winaryati et al. 2022), Kindergarten Project-Based Learning (PBL) LSLC (Sumarni, Putri, and Andika 2021), and LSLC is a method for instructors and educators to collaborate (Setyawan, Permana, and Latifa 2019). Examples of LS research related to action research, namely LS-based action research for the rebuilding of teachers' practical knowledge in Spanyol (Soto Gómez et al. 2019) to determine the circle area formula (Sunata 2019) and reconstruction of teachers' practical thinking (Pérez, Soto, and Serván 2010). Selan itu, LS application in Turkey (Yuzbasioglu and Babadogan 2016), and the Use of LS in Improving English Teaching Quality (Laoli, Dakhi, and Zagoto 2022). Furthermore, an example of lesson study research related to lesson study practice is LS practice di Indonesia (Saito et al. 2006; Suratno 2012), Lesson Study in field practice in Norway (Munthe, Bjuland, and Helgevold 2016), and Significant topics in the development of LS theory and practice (Elliott 2016). The last topic is related to red clusters related to abilities or skills. Here are some examples of LS' research related to abilities and skills, Improving Science Teacher Candidates' Instructional Skills Using LS (Supeno et al. 2022), Improving Teachers' Ability in Writing a Scientific Paper (Juniardi, Irmawanty, and Aghnia Aulia 2021), Developing problem-solving skills in mathematics (Bradshaw and Hazell 2017), and Supporting tudent's Creative Thinking Ability in Biology Content (Fatmawati, Ariandani, and Sasmita 2021).
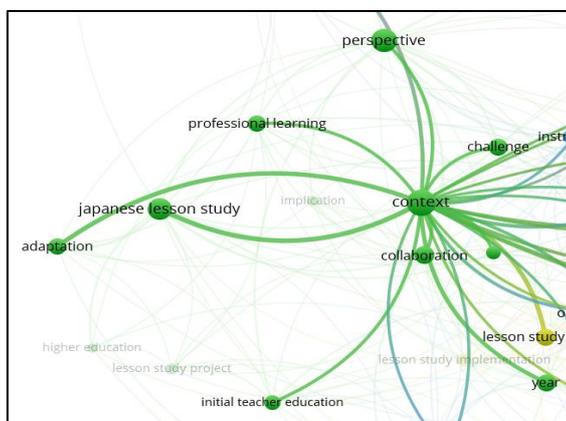

Figure 6. Cluster two (green colour)

Cluster 2 (green colour) lesson study research related to adaptation, Japanese lesson study, professional learning, perspective, challenge, content, collaboration, and initial teacher education (see Figure 6). Examples of LS research related to adaptation, namely the adaptation of LS in a Danish context (Skott and Møller 2020) and Critical elements in adaption and implementation (Groves et al. 2016). Examples of research conducted by Bütün (Bütün 2019) and Widjaja (Widjaja, Groves, and Ersozlu 2020) state the Challenges and Advantages of LS. Berikutnya contoh penelitian terkait lesson study collaboration (Karabuga 2021; Richit, da Ponte, and Tomasi 2021). Examples of LS research related to context, namely Reflective Actions of mathematics instructors in the Context of LS (Bozkurt and Yetkin-Özdemir 2018; Posthuma 2012) and students' mathematical ability in high scope and LS context (Thinwiangthong et al. 2021). Next, related LS research initial teacher education, namely for mathematics teachers (da Ponte 2017), Mentors and student-teachers (Cajkler and Wood 2016), and the relationship between reflexivity and reflective practice (Lamb and Aldous 2016). Next, an example of Japanese lesson study research, which is related numeracy coach's view (Doig et al. 2016), Inservice Professional Development and Preservice Clinical Experiences are combined (Groth et al. 2020) help improve the geometry and spatial thinking teaching and learning (Moss et al. 2015), and to upper-level undergraduate statistics course (Roback et al. 2006). Furthermore, LS research is related to the cultural perspective (Chen 2017; Hummes 2019) and the management perspective of LS (Hervas 2019). Next, an example of Professional Learning (PL) research is connected to PL Communities in Malaysian Low-Performing Schools (Ansawi and Pang 2017), LS for supporting school instructors' professional learning (Schipper, Willemse, and Goei 2022), and Students' perspectives on collaborative professional learning in LS (Karlsen and Ohna 2021).
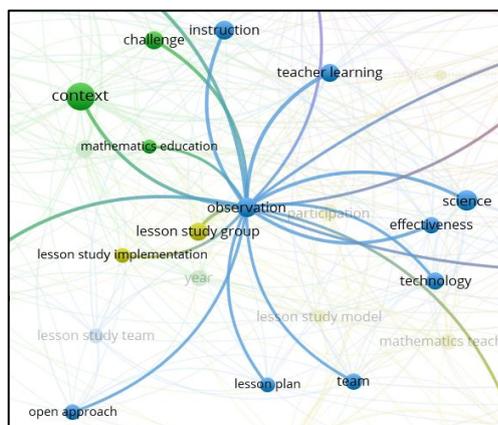

Figure 7. Cluster three (blue colour)

Cluster 3 (blue) is lesson study research related to observation, instruction, teacher learning, science, effectiveness, technology, team, lesson plan, and open source(see Figure 7). Some examples of LS research related to observation namely observation phases in the lesson study methodology (Breda et al. 2021), Observations in the Class and Perceptions of Lesson Effectiveness (Myers 2012), and Combining student and teacher learning observations (Warwick et al. 2016). Here are some related studies on the impact of the Lesson Study Approach on the beliefs of preservice science teachers (Yakar and Turgut 2017), Professional development for teachers (Willems and Van den Bossche 2019), Differentiated Instruction Among Mathematics Head Panels (Ping et al. 2020), and teacher behaviour and student motivation (Borghouts et al. 2023). Berikutnya, Lewis, et al. state that LS improves mathematics instruction (Lewis 2016), and LS enables pre-service biology instructors to create more effective lesson plans (Diem and Thathong 2019). Next, The open approach and lesson study improve students' mathematical communication (Wiriyaudomsatean and Thinwiangthong 2019), mathematical connections (Jaijan and Suttiamporn 2013), and Sustainable development of Students' Mathematical Learning Process(Thinwiangthong, Inprasitha, and Loipha 2012). Furthermore, LS research related to Professional Learning, namely professional learning and practice development collaborative vehicle (Cajkler et al. 2015; Holden 2022), and mathematics teacher professional learning (Mhakure 2019). Some examples of LS research in science are science lessons in elementary school (Dotger 2015; Handayani et al. 2019) and science teachers (Handayani et al. 2019; Vlachou 2018). Berikutnya, LS research related to teacher learning, namely promoting teacher learning Using a creativity framework (González and Deal 2019) and Using the lesson study strategy, math teachers may promote active learning (Obara and Bikai 2019). Next is the LS team's research, namely Pre-Service Teachers as a Part of LS Team (Boonsena, Inprasitha, and Sudjamnong 2019), and Observing reasoning in LS teams during basic teacher education (Bakker, de Glopper, and de Vries 2022). The technology keyword is one part of the blue cluster. Some examples of LS research related to technology, namely professional development through technology-facilitated (Soto et al. 2019), and a integrated method to lesson study to assist solitary instructors in teaching using technology (Joubert, Callaghan, and Engelbrecht 2020).
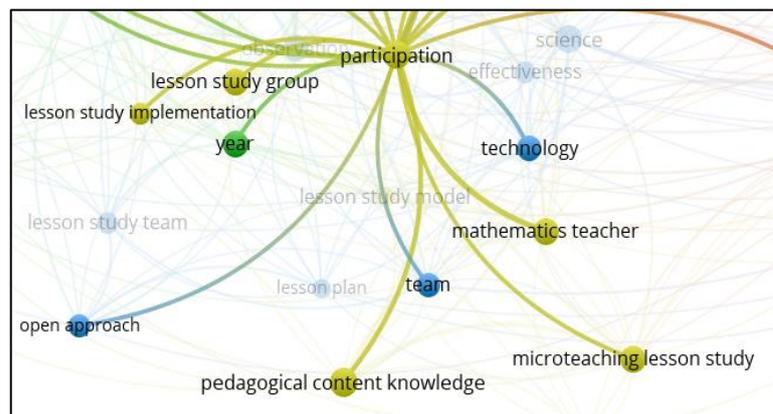
Figure 8. Cluster four (yellow colour)

Cluster 4 (yellow colour) lesson study research related to participation, lesson study groups, lesson study implementation, pedagogical content knowledge (PCK), microteaching lesson study, and mathematics teacher (see Figure 8). Some examples of LS research related to participation are via engagement, the personality traits and capacities of Japanese teachers (Sakai et al. 2022) and Leveraging prospective teachers' knowledge (González, Villafañe-Cepeda, and Hernández-Rodríguez 2023). Some examples of research related to lesson study groups, namely the group investigation model establishing lesson study can influence science knowing competency (Widiasari and Sumantri 2020), and Group Counseling as a Tool for Increasing Creativity in LS (Ketut Kusuma Umbarini Sari, Ketut Gading, and Ketut Dharsana 2020). The following is an example of LS implementation research, namely improving the quality of learning in physics learning (Widyaningsih and Yusuf 2020) and a tool for enhancing student learning and instructor professional development (Özdemir 2019). Next is related LS research PCK, that is, PCK of pre-service teachers (Danday 2019; Murtafiah and Lukitasari 2019; Zhou, Xu, and Martinovic 2017), and Microteaching LS to Encourage EFL Student Teachers' Life-Long Learning (Suryani et al. 2018). Next, LS research related to Microteaching LS, namely Microteaching LS's Capability to Promote Teaching Practice and Pedagogical Development (Asman 2016), and TPACK Development in Statistics Teaching for Preservice Mathematics Teachers (Kurt and Çakıroğlu 2018).

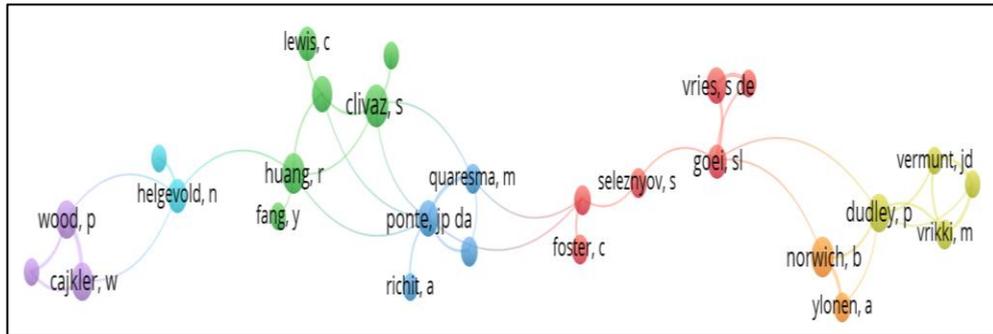*Visualization of the Co-authorship interact with lesson study trends*

Figure 9. Co-authorship and coupling authors of the LS database on GS and Scopus

Figure 9 demonstrates that seven groups of authors or co-coupling authors have the most vital total link strength based on VosViewer. The first group is Cajkler et al.; the second group is Heigevold et al., the third group is Huang et al., the fourth group is Ponte et al., the fifth group is Vries et al., the sixth group is Norwich et al. The seventh group is Dudley et al., based on VosViewer Visualization; these seven authors have the most co-authorship and citations (see Tables 1 to 4).
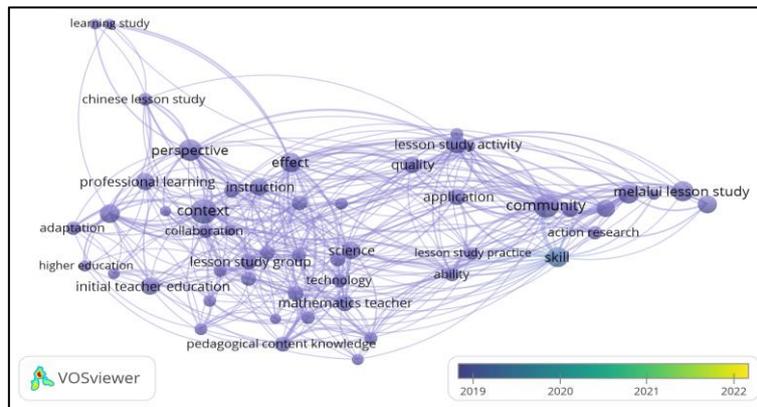
Recommendations for Future Lesson Study

Figure 10. Research novelty in researching lesson study

Based on the overlay in Figure 10, It is clear that the keywords that are not coloured yellow still have a fresh novelty from studying, meaning that lesson study research is still relatively new and opens up new possibilities for linking new topics not yet in Figure 10. However, the results of this research may give the eagle eye little assistance in enlightening the body of knowledge specifically correlated to the research on lesson study.

CONCLUSION

Based on the results of research trend analysis and discussion, it can be concluded that the number of lesson study documents has increased over the last decade (2012-2022). The most productive author based on GS is R Huang from the United States, and the full author based on Scopus is E. Saito from Australia. At the same time, the primary authors based on the highest citations are Fernandez & Yoshida, based on GS, and Dudley, with the highest citations based on Scopus. The "International Journal for Lesson and Learning Studies" in the last decade is the most source of lesson study documents. Based on VosViewer visualization, Rosa is the author who has the most co-authorship papers and total link strength. The VosViewer displays four clusters related to lesson study: community, context, observation, and participation. Our strong recommendations regarding this study are lesson study research related to literacy, numeracy, and mathematical abilities. The results can assist relevant researchers in understanding trends in lesson study research and recommend guidelines for other studies.

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