

Global trend of research and development in education in the pandemic era: A systematic literature review

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Abstract: Research and Development (R&D) has urgency in education, especially during a pandemic because it describes solutions and innovations. The purpose of this systematic literature review (SLR) was to analyze the global trend of research and development in education in the pandemic era. We used the word “research and development education” in the disbursement menu in the SCOPUS database, and after applying the inclusion and exclusion criteria using the PRISMA technique, we found 15 suitable articles. There is an increasing trend of research on R&D in the last three years, where the peak of publication occurs in 2021 and decreases in 2022. More articles are published by authors from Europe. Articles are dominated by international collaborations. The R&D article is related to sustainable development and is closely related to educational innovation, especially at the university level. Based on the co-citation data presented by VOSviewer, there is a relationship between R&D and COVID-19. It can be concluded that R&D in education gets special place and attention from researchers in the world.

Keywords: COVID-19; education; international collaboration; research and development

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1. Introduction

Research and Development (R&D) is currently one type of research that is widely carried out in the world of education, especially in Indonesia. R&D is one type of research that can connect or break the gap between basic research and applied research (Rahardjanto & Husamah, 2022). R&D is a creative and systematic work carried out to increase knowledge and to design new products from available knowledge (Moris, 2018). R&D is important to realize a more innovative school (Hatch, 2021), because it encourages teachers and school administrators to change their mindset to be more creative (Beachy, 2017; OECD, 2004).

R&D is a process used to develop and validate educational products. The steps of this process are usually referred to as the R&D cycle, which consists of: studying the research findings related to the product to be developed, developing the product based on these findings, the test area in the setting where it will be used eventually, and revising it to correct any deficiencies identified. found in the stage of submitting testing. In a more

stringent program of R&D. This cycle is repeated until the test datasets show that the product meets the defined behavioral objectives (Gall et al., 2007).

During the COVID-19 pandemic, the world of education has been affected a lot (El Said, 2021; Hargreaves, 2021; Hayat et al., 2021; Muthuprasad et al., 2021; Pokhrel & Chhetri, 2021; Zalut et al., 2021). COVID-19 also affects the creativity of teachers and school administrators (Anderson et al., 2021; Constantia et al., 2021; Karakose et al., 2021). So it can be said, the COVID-19 pandemic also has an impact on the activities carried out in the world of education (Constantia et al., 2021; Hoofman & Secord, 2020; Koç & Koç, 2021; Spunei et al., 2022), included in the aspect of R&D (Salomaa & Caputo, 2021).

So far, there is only one article that reviews R&D trends and that is only done by analyzing articles published in SINTA 2 indexed journals (accredited level 2). This article provides an overview of how R&D can help the world of education in Indonesia, especially at the high school and university levels in Indonesia (Rahardjanto & Husamah, 2022).

Therefore, this systematic literature review aims to analyze the global trend of research and development in education in the pandemic era. Efforts to find out the trend of research and development in education in the pandemic era are important because this will be a baseline or map of information that shows where the current position of R&D is.

2. Material and Methods

2.1 Study Type

This study is a Systematic Literature Review (SLR), which is a technique for identifying, evaluating, and analyzing various existing and relevant information in the literature/references to answer research questions and analyze them in depth. (Snyder, 2019; Xiao & Watson, 2019). SLR helps in providing a summary of current knowledge or topics related to the research question (Kurniati et al., 2022). This approach has also been used by several previous authors in Indonesia (Husamah et al., 2022a, 2022b).

2.2 Research Question (RQ)

Determination of the research question is used to define the scope to develop a clear focus for the study. This research question is made based on the needs of the chosen topic, namely: how is the trend of publications related to action competence in journals indexed by Scopus? We limit this trend by focusing on: article distribution by year, trend keywords, linkage to the pandemic, country of origin of the corresponding authors, and collaboration in publications.

2.3 Search article and inclusion criteria

We use the word "research and development in education" in the disbursement menu in the SCOPUS database. The data obtained is stored in *CSV and *RIS formats which are then synchronized into the Reference Manager (Mendeley). VOS-viewer software is used to visualize the data so that it is clearer and more communicative. As for our search history in SCOPUS, namely "TITLE (research AND development AND education) AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020)) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SUBJAREA, "SOCI"))". With that said we found 1316 articles. The inclusion and exclusion model used is the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) which refers to (Gallagher et al 2016). The following points are inclusion criteria used, namely (1) articles published from January 2020 to November 2022 (the COVID-19 pandemic period); (2) Articles published in English; (3) articles including research/original articles; (4) only final articles; and (5) articles only related to the field of social science. The order of inclusion and exclusion that we do is as presented in Figure 1.

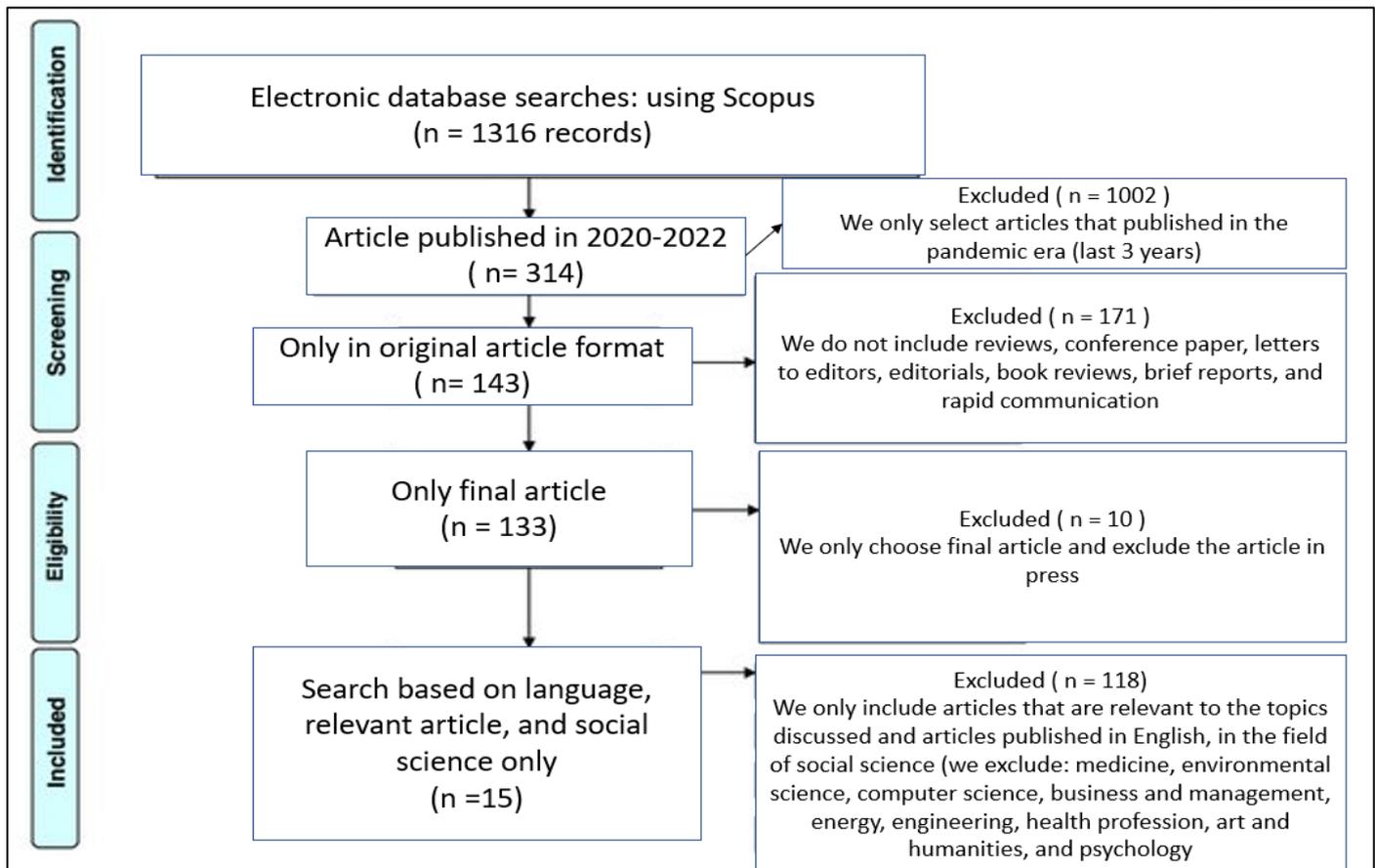


Figure 1. Systematic review flow diagram. Caption: the PRISMA flow diagram for the systematic literature review detailing the database searches, the number of abstracts screened and the full texts retrieved.

Based on [Figure 1](#), it can be seen that in the initial search we found as many as 1316 articles. Then we take only articles published in 2020-2022. Articles that meet the criteria are 314 articles, which means there are 1002 excluded articles. Next, we use the original/research article only criteria. There were 143 articles that met the criteria, which means 171 articles were excluded. Next, we use the inclusion criteria for the final article. Those who met the criteria were 133 articles, 10 articles were excluded. We only use articles in English and the appropriate field of science, namely social science. We also only use relevant articles. On this basis, we only included 15 articles, which means that 118 articles were excluded.

3. Results

3.1 Trends by year

The trend of articles by year of publication can be presented in Table 1.

Table 1. Article trends by year of publication

No	Year	Amount	Article
1	2020	6	(Broadhead, 2020; Gabrielsson et al., 2020; Lee, 2020; O’Sullivan et al., 2020; Sawitri et al., 2020; Wilhite et al., 2020)
2	2021	7	(Artyukhov et al., 2021; Degani et al., 2021; Guo et al., 2021; Jordan et al., 2021; Meiji et al., 2021; Mnguni, 2021; Yang et al., 2021)
3	2022	2	(Mikkonen et al., 2022; Okoye et al., 2022)

Table 1 shows that the most published articles were in 2021 when the peak of the COVID-19 pandemic occurred.

3.2 Trends by country-of-origin corresponding author

The trend of articles based on the country of origin of the corresponding author can be presented in Table 2.

Table 2. Trends in articles by country of origin of the corresponding author

No	Country	Continental	Amount	Percentage base on country	Percentage base on continental
1	Poland	Europe	1	6.7%	40%
2	Finland	Europe	1	6.7%	
3	Israel	Europe	1	6.7%	
4	Sweden	Europe	1	6.7%	
5	Germany	Europe	1	6.7%	
6	United Kingdom	Europe	1	6.7%	
7	Indonesia	Asia	1	6.7%	33.3%
8	Malaysia	Asia	1	6.7%	
9	China	Asia	2	13.3%	
10	Korea	Asia	1	6.7%	
11	USA	America	2	13.3%	20%
12	Mexico	America	1	6.7%	
13	South Africa	Africa	1	6.7%	6.7%

Based on Table 2, it can be seen that more articles are published by authors from Europe (as many as 40%). Authors from Asia are also quite interested in R&D during the pandemic (as many as 33.3%). Meanwhile, articles originating from Africa were only found 1 (6.7%) during these 3 years. This is very reasonable considering that education in Europe and Asia has been heavily affected by the COVID-19 pandemic.

3.3 Trending by collaboration status

The trend of articles based on collaboration status, as presented in Figure 2. Meanwhile, if viewed based on the collaboration status of authors (based on the number of authors) as presented in Figure 3.

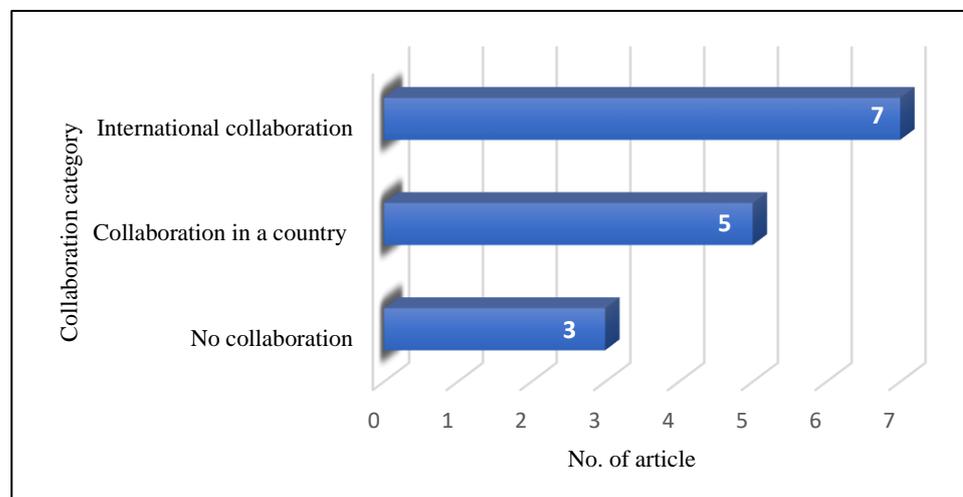


Figure 2. Article trends by collaboration status

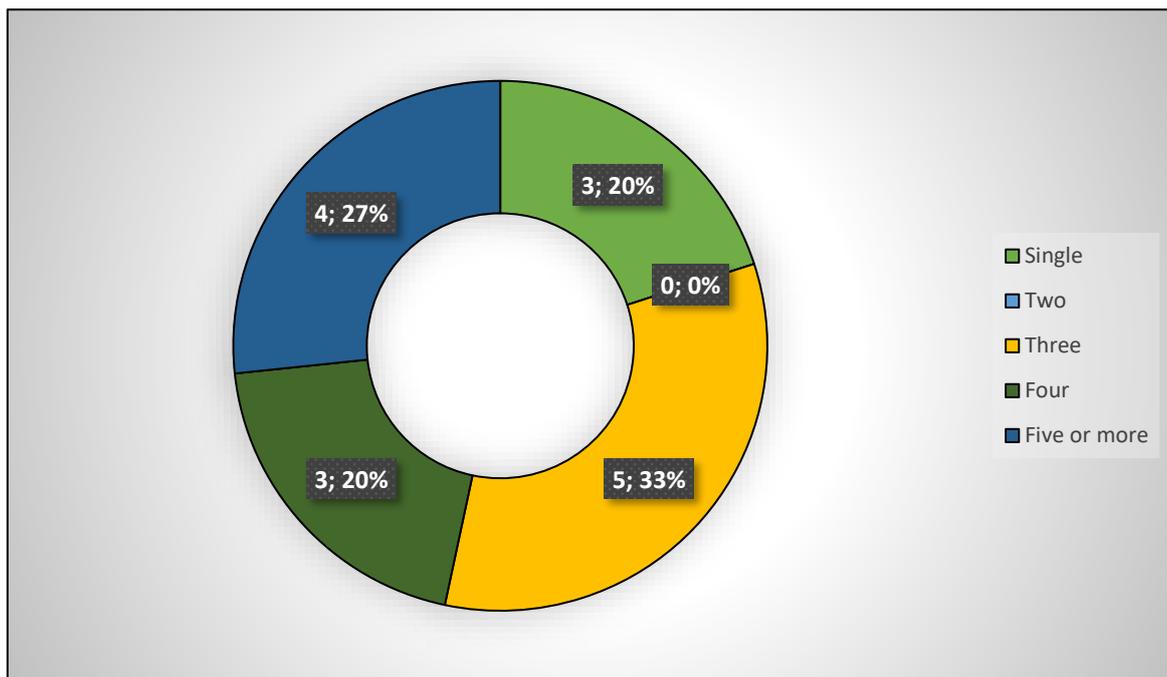


Figure 3. Trends in articles by number of authors

Based on [Figure 2](#), it can be seen that articles on R&D are dominated by international collaboration (7 articles). The number of articles with collaboration in a country status is also quite a lot (5 articles). There are only 3 articles published without collaboration. This shows that research and publications related to R&D themes are more attractive if they are carried out in a collaborative manner, even with the status of international collaboration. [Figure 3](#) further supports the data in [Figure 2](#), that most articles were written by more than one person (80%) and only 20% were written and published by a single author.

3.4 Trending articles based on keywords

Article trends based on the keywords used by the authors are presented in [Figure 4](#).

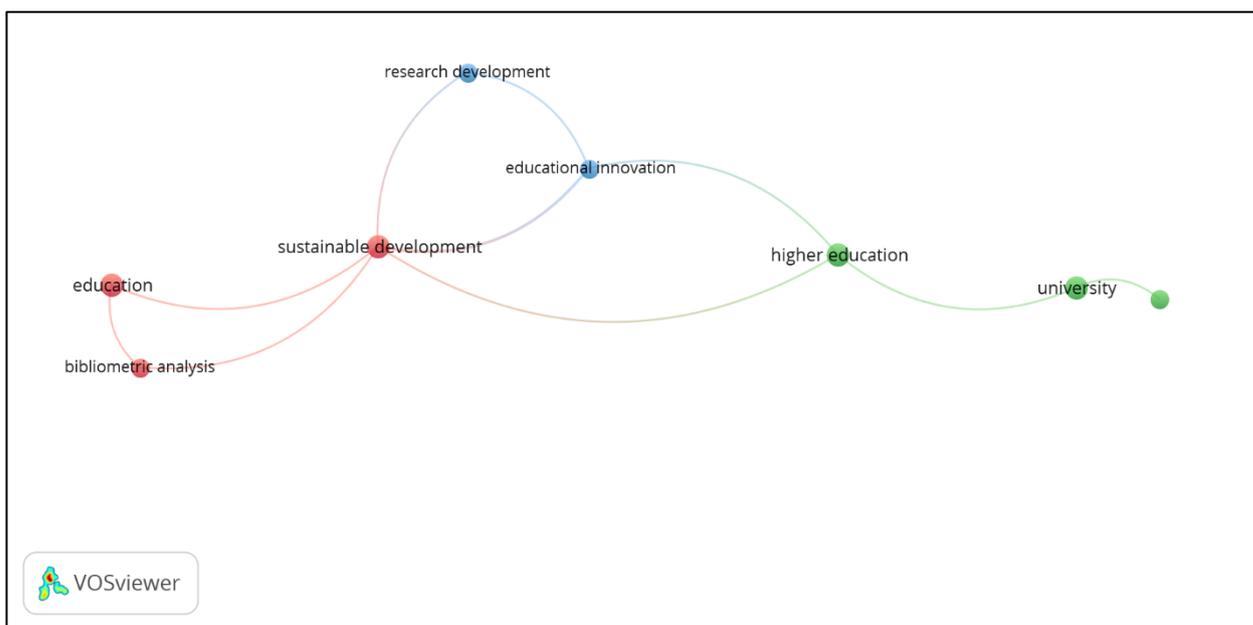


Figure 4. Article trends based on keywords

Figure 4 shows that R&D is related to sustainable development and closely related to educational innovation, especially at the university level.

3.5 The relationship with the COVID-19 pandemic

The relationship of the article with the COVID-19 pandemic as presented in Figure 5.

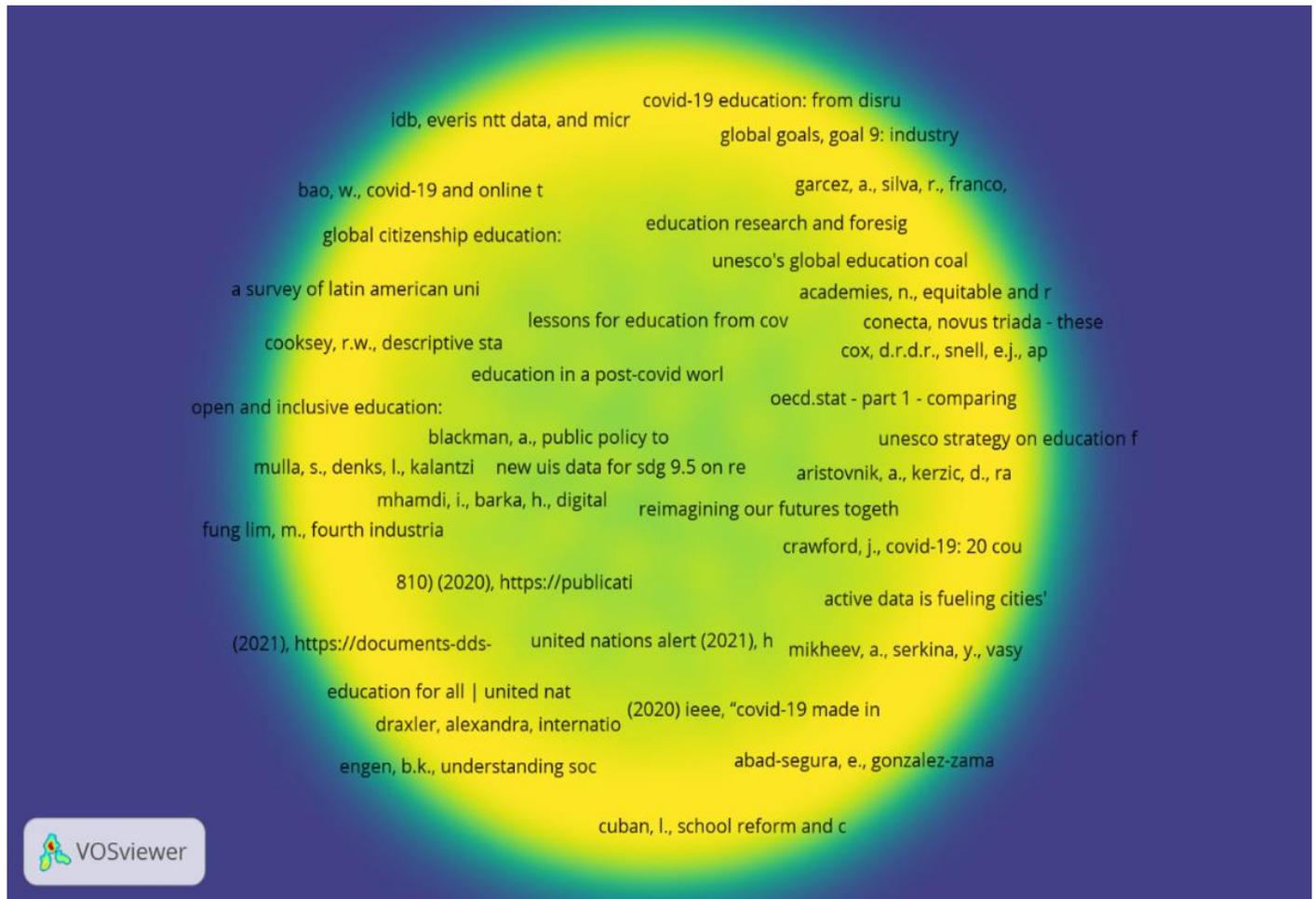


Figure 5. The relationship of the article to the COVID-19 pandemic

Based on the co-citation data presented by VOSviewer, there is a relationship between R&D and COVID-19. The word COVID-19 or pandemic appears five times, which shows a relationship between the COVID-19 pandemic and R&D in the world of education.

4. Discussion

4.1 Trends by year

Along with the decline in COVID-19 cases, articles related to R&D also decreased, where only 2 articles were found. This shows that researchers have an adaptive response to the COVID-19 pandemic trend. Meanwhile, as the COVID-19 trend declines and the public become more sensitive to this pandemic, publications are also increasingly being abandoned.

4.2 Trends by country-of-origin corresponding author

This condition requires scientists in the region to work hand in hand and catch up with time in finding innovative solutions so that education can adapt to the COVID-19 pandemic (Dhawan, 2020; Ng, 2021; Zancajo et al., 2022). In addition, countries in Europe tend to always be at the forefront of innovation in the field of education.

4.3 Trending by collaboration status

This trend is in line with the findings of previous authors that based on data in Scopus or WoS we will conclude that it is rare to find articles written independently/single author. (Husamah et al., 2022a). Reputable and quality articles should be published collaboratively. Collaboration encourages cross-disciplinary contributions and discussions (Eberle et al., 2021). Collaboration in publications will lead to higher levels of readability, understanding and confidence (Freeling et al., 2021). Collaboration drives group creativity beyond individual creativity and increases the impact of publications (Uzzi et al., 2013). Therefore, collaborative publication encourages the emergence of group creativity to maximize science that is novelty and innovative because it has gone through a process of individual reflection and brainstorming during the script development process (Oliver et al., 2018).

Interdisciplinary research also turns out to be more attractive to donor agencies to fund research and publications than research in a limited field of science (Bellotti et al., 2016). The collaboration of many authors has its own challenges, so it requires carefulness, for example regarding the contribution of each author, fair credit, diversity of work styles, and clarity of communication (Frassl et al., 2018). Some other challenges, for example, come from the different approaches and theoretical and methodological abilities of each author (Peffer & Renken, 2016).

4.4 Trending articles based on keywords

R&D is related to innovation and creativity to support sustainable development and the burden is mostly given to universities. Universities play in the transformation of individuals, institutions and societies towards more sustainable futures. Universities provide value to the economy, society and environment through education, research, innovation, community engagement, leadership and influence (Price et al., 2021). Special attention is paid to the university's role of human resources to support research and encourage innovation in various fields (Sukiennik et al., 2021). Universities play a key role in ensuring a transformative innovation in terms of local sustainable development (Filho et al., 2022). The transformation carried out by the university becomes a means to support the achievement of the SDGs (Bina & Pereira, 2020).

4.5 The relationship with the COVID-19 pandemic

The world of education needs innovative research to be able to provide solutions to be able to adapt to the COVID-19 pandemic (Dayagbil et al., 2021; Iivari et al., 2020; Singh et al., 2021; Zhao & Watterston, 2021). The birth of a solution in the form of online learning or hybrid / blended learning is an innovation from research carried out by scientists in responding to the challenges of the COVID-19 pandemic (Adel & Dayan, 2021; Bashir et al., 2021; El Said, 2021; Muthuprasad et al., 2021; Singh et al., 2021; Verde & Valero, 2021).

5. Conclusions

Research and development (R&D) in the field of education receives special place and attention from researchers in the world during the COVID-19 pandemic, although the trend continues to decline in line with the increasing amount of cases/number of patients with COVID-19. Research and publications related to R&D themes are more attractive if

they are carried out in a collaborative manner, even with the status of international collaboration. Articles should not be written by a single author, but should be written in groups so that the quality of the articles is better.

This SLR is only limited to article trends, not to content analysis of each article found. Therefore, other authors can continue this study by examining in detail the contents and findings of the 15 articles that we used in this SLR. This will provide more complete information to the readers.

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Conflicts of Interest: We declare that there are no conflicts of interest.

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