Physics e-module: A review and bibliometric analysis

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Abstract. The Covid-19 pandemic has brought significant changes in education and the tendency of face-to-face learning to be online. Therefore, several studies have developed e-modules to support learning, one of which is physics learning. This research is the result of a review based on a bibliometric analysis of the physics e-module. The data was obtained based on articles published in journals and proceedings on Google Scholar in 2020-2021, namely when the Covid-19 pandemic happened. These were selected via Publish or Perish (PoP) software. The data has been sorted until found 74 articles from 142 articles. The data were processed in depth using VOSviewer software. The results showed how the network, overlay, and density were between pieces. It also showed other information regarding the distribution of the authors and their affiliations. Based on this analysis, it was suggested that there is a need to strengthen collaboration between writers and research focused on students' abilities and skills.

1. Introduction

During the COVID-19 pandemic, many schools are conducting distance learning or online. The problem that occurred during the Covid-19 pandemic in the world of education in Indonesia was the lack of student interest in carrying out the learning process [1]. In the current pandemic conditions, information technology to support the learning process is massively used [2].

Physics is one of the branches of Natural Sciences which has a vital role in everyday life [3]. Physics learning in the future is expected to be more meaningful and adapted to the development of science and technology [4,5]. Effects in the era of globalization itself are characterized by the production and use of information technology quickly and modernly to realize the learning process [6].

Technological developments in the educational aspect have given rise to a new paradigm: students are not only recipients of knowledge information. Still, they can act as constructors in managing the knowledge they acquire [2]. Developments in learning can be seen from several things, including curriculum, learning models, learning methods, teaching materials used and so on [1].

As for the smooth teaching and learning process, teachers can use appropriate and appropriate teaching materials. One of them is through the development of teaching materials and utilizing the right learning media [7–10]. Educators are expected to design, develop, and use media and teaching materials as a form of effort to increase students' motivation, interest, and attention [1,11,12]. Therefore, the development of learning media is needed to make it more attractive to students. One media that can be developed is a learning module in the form of an electronic module (e-module)[13,14].

The use of e-modules can foster creativity and be active in learning [3]. E-Modul is a digital module that will assist students in understanding a concept [15,16]. Learning using e-modules aims to learn
independently and measure their abilities through learning outcomes so that learning is more effective in achieving learning objectives [12,17,18]. The electronic modules used in education must be designed by the teacher very interestingly, such as the teacher displaying several pictures and videos in the module so that students do not feel bored in the learning process and the learning objectives can be achieved easily [19]. Electronic modules as teaching materials that utilize technology can change a boring learning atmosphere into fun [11]. Interactive e-module teaching materials in electronic form can help students develop their knowledge in learning material and improve independent learning, both in class and distance learning [20]. This study aims to analyze and describe trends in the research and development of electronic modules in physics learning.

2. Metode
The research method used in the bibliometric analysis adopts the five-step method [21], as shown in Figure 1.

2.1 Find keywords
The literature search uses the keyword "e-module" based on Google Scholar in 2020-2021 (during the Covid 19 Pandemic).

2.2 Get search results
Based on the search results using the keyword, obtained 142 articles. The results of this search are stored in a Research Information Systems (RIS) format on a PoP.

2.3 Search result sorting
The articles obtained are 142 and then sorted because some are not in the scope of learning physics. In addition, it is re-sorted that only analyzes which journal articles and proceedings articles. Thus there are a total of 74 pieces. The results of this sorting are again saved in RIS format. The RIS-formatted data is then imported into the Mendeley Desktop software for further data analysis.

2.4 Collecting data information
On the Mendeley Desktop, the RIS-formatted data is reviewed by checking the metadata one by one. If there is incomplete metadata, then editing is done so that the metadata is in accordance with the published article. Edits are also saved in RIS format.

2.5 Analyze data
The RIS format data edited by Mendeley Desktop underwent a further analysis process using VOSviewer software.

3. Results and Discussion
The output of the PoP Viewer and VOSviewer will display any keywords used by the author. For example, here are the data for the Top 10 articles about e physics modules, which can be seen in Table 1.

| Rank | Writer's name          | Year | Title                                                                 | Journal                        |
|------|------------------------|------|----------------------------------------------------------------------|--------------------------------|
| 1    | Fadieny, N, Fauzi, A   | 2021 | Validitas E-Modul Fisika Terintegrasi Materi Bencana Petir Berbasis Experiential Learning [22] | Jurnal Penelitian Pembelajaran Fisika |
| 2    | Susilawati, S, Pramusinta, P, & Saptaningrum, E | 2020 | Penguasaan konsep siswa melalui sumber belajar e-modul gerak lurus dengan software flipbook maker [15] | UPEJ Unnes Physics Education Journal |
| No | Authors                                      | Year | Title                                                                 | Journal                                      |
|----|---------------------------------------------|------|-----------------------------------------------------------------------|----------------------------------------------|
| 3  | Agustia, FS, & Fauzi, A                     | 2020 | Efektivitas E-Modul Fisika SMA Terintegrasi Materi Kebakaran Berbasis Model Problem Based Learning [23] | Jurnal Penelitian Pembelajaran Fisika        |
| 4  | Ramadayanty, M, Sutarno, S, & Risdianto, E. | 2021 | Pengembangan E-Modul Fisika Berbasis Multiple Representation Untuk Melatihkan Keterampilan Pemecahan Masalah Siswa [24] | Jurnal Kumparan Fisika                      |
| 5  | Haspen, CDT, Syafriani, S, & Ramli, R       | 2021 | Validitas E-Modul Fisika SMA Berbasis Inkuiri Terbimbing Terintegrasi Etnosains untuk Meningkatkan Kemampuan Berpikir Kreatif Peserta Didik [25] | Jurnal Eksakta Pendidikan                   |
| 6  | Nisa, WL, Ismet, I, & Andriani, N          | 2020 | Development of e-modules based on multi-representations in solid-state physics introductory subject [26] | Berkala Ilmiah Pendidikan Fisika            |
| 7  | Ramadhan, MA, Handoyo, SS, & Alfarisi, MM  | 2020 | Pengembangan E-Modul Fisika Dasar untuk Mahasiswa Calon Guru SMK Teknik Konstruksi dan Properti [17] | Jurnal Pendidikan Fisika dan Teknologi      |
| 8  | Kurnia, R                                  | 2020 | Validitas E-Modul Fisika Terintegrasi Bencana Gunung Meletus Berbasis Model Inquiry Based Learning untuk Meningkatkan Sikap Kesiapsiagaan Peserta Didik [27] | Jurnal Penelitian Pembelajaran Fisika       |
| 9  | Latifah, N, Ashari, A, & Kurniawan, ES     | 2020 | Pengembangan e-Modul Fisika Untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik [28] | Jurnal Inovasi Pendidikan Fisika           |
| 10 | Ningsih, AT, Ruhiat, Y, & Saefullah, A     | 2020 | EMOSETS: Pengembangan E-Modul Berbasis Science, Environment, Technology, and Society (SETS) Materi Fluida Dinamis [29] | Prosiding Sendikfi                         |

VOSviewer will display a network visualization between keywords used by the author. Figure 2 shows the visualization of the overlay.

In Figure 2, it can be seen that there are five clusters marked with five different colours, namely purple, green, blue, red, and yellow. In the red cluster, there are 10 items, namely abilities; assessment; critical thinking skills; electronic modules; experts; material experts; media experts; need; problems; and skills. In the green cluster there are 9 items, namely: development; ethnoconstructivism; evaluation; forms; implementation; modules; motivation; perception; r&d. In the blue cluster, there are 8 items, namely inquiry; instruments; learning models; model; products; teaching materials; use; validity. In the yellow-coloured cluster, there are 7 items, namely: approach; developed e-module; lacks; medium; science, stem; technology. The last cluster is purple with 7 items, namely: analysis; e-module; e-modules; learning; physics; physics education; integrated Islam.
Each cluster contained in Figure 3 will analyse how to spread the article's focus at any time. This way, you can see what the latest trends are. Figure 4 shows a visualization of the density of the keywords used by the author. Density will be indicated by the intensity of the colour in the image. The lighter the colour, the more often the keyword is used by the author.

Figure 2 Network Visualization on Google Scholar Database

Figure 3 Overlay Visualization on Google Scholar Database

Figure 4 Density Visualization in Google Scholar Database
In this section, the author focuses on observing specifically the keyword “critical thinking skills”. In this case, it can be seen that some research and development have focused on e- physics modules to strengthen students' critical thinking skills [20,28,30–33]. There is also a physics module developed, which is part of the teaching material [33]. Other studies also show how e-modules to strengthen students' critical thinking skills are packaged in STEM learning [30,34,35].

Next, we will focus on STEM keywords. STEM-oriented physics modules have been widely developed [1,14,36]. Existing research does not only focus on development [1,35,37]. However, some examine how it is used in learning, such as through project-based learning [35], problem-based learning [34], and self-directed learning [38]. Also, how to approach the target of student skills which is the primary goal of this development, includes critical thinking skills [30,34,35].
Figure 7 Overlay Visualization on Google Scholar Database with Keyword Critical Thinking Skill

Figure 7 shows how the visualization of overlay is focused on the keyword “critical thinking skills” from the image. The picture shows that the e-module research that focuses on critical thinking skills will be carried out around 2020.5. And the most recent is how to package e-modules in stems to strengthen students' necessary thinking skills.

Based on this bibliometrics, the latest research related to physics modules is about STEM e-modules that improve students' critical thinking skills. This is good for further development. So it is recommended to innovate e STEM modules so that they have a good update value. Therefore, it is suggested to develop ethno-STEM in the physics module, which aims to improve students' critical thinking skills.

4. Conclusion

Based on the results of bibliometric analysis, it can be concluded that articles with the keyword e-module in the period 2020-2021 can train various aspects of student skills, such as critical thinking skills. In further research, e-modules can be developed by combining them with ethno-STEM to improve students' critical thinking skills.

References

[1] Syahiddah D S, A P P D and Supriadi B 2021 J. Literasi Pendidik. Fis. 2 1–8
[2] Rani L and Maarif S 2021 J. Medives J. Math. Educ. IKIP Veteran Semarang 5 377–89
[3] Sidik F D M and Kartika I 2020 J. Penelit. Pembelajaran Fis. 11 185–201
[4] Prihatiningtyas S and Sholihah F N 2020 J. Pendidik. Fis. 8 223–34
[5] Dewantara D, Misbah M, Mahtari S, Azhari A, Sasmita F D, Melisa, Rusmawati I, Kusuma L W, Ridho M H and Lutfi M 2021 J. Phys. Conf. Ser. 1760
[6] Isnia H W A, Wahyuningtyas D T and Yulianti Y 2020 Pros. Semin. Nas. PGSD UNIKAMA 4 311–9
[7] Aryanti E D and Arief M 2021 J. Ekon. Bisnis dan Pendidik. 1 24–33
[8] Hartini S, Misbah M, Dewantara D, Oktovian R A and Aisyah N 2017 J. Pendidik. IPA Indoones. 6 313–7
[9] Kairmo G A, Ratu T, Hermansyah, Yahya F and Fitriyanto S 2021 J. Sci. Instr. Technol. 1 29–33
[10] Malina I, Yuliani H and Syar N I 2021 U Silampari J. Pendidik. Ilmu Fis. 3 70–80
[11] Piyana S O 2020 J. JPSD (Jurnal Pendidik. Sekol. Dasar) 7 21–8
[12] Kurniawan A R, Budiono H, Hariandi A, Marlina M, Kurniawati E F, Meidiauwati R and Piyana S O 2020 Profesi Pendidik. Dasar 1 93–104
[13] Zaka A M and Supraptono S 2020 Automot. Sci. Educ. J. 9 12–9
[14] Aulia D M, Parno P and Kusairi S 2021 J. Ris. Pendidik. Fis. 6 7–12
[15] Susilawati S, Pramusinta P and Saptaningrum E 2020 UPEJ Unnes Phys. Educ. J. 9 36–43
[16] Dewi M S A and Lestari N A P 2020 J. Imtiah Pendidik. dan Pembelajaran 4 433–41
[17] Ramadhan M A, Handoyo S S and Alfarisi M M 2020 J. Pendidik. Tek. Sipil 2 117–23
[18] Kurniawati E F 2020 *J. Penelit. Ilmu Pendidik.* **13** 10–21
[19] Asrial A, Syahrial S, Maison M, Kurniawan D A and Piyana S O 2020 *JPI (Jurnal Pendidik. Indones.)* **9** 30
[20] Sintawati N P and Margunayasa I G 2021 *Int. J. Elem. Educ.* **5**
[21] Haryandi S, Suyidno S, Misbah M, Dewantara D, Mahtari S and Ibrahim M A 2021 *Momentum Phys. Educ. J.* **5** 10–20
[22] Fadieny N and Fauzi A 2021 *J. Penelit. Pembelajaran Fis.* **7**
[23] Agustia F S and Fauzi A 2020 *J. Penelit. Dan Pembelajaran Fis.* **6** 1–8
[24] Ramadayanty M, Sutarno S and Risdianto E 2021 *J. Kumparan Fis.* **4** 17–24
[25] Haspen C D T, Syafriani S and Ramli R 2021 *J. Eksakta Pendidik.* **5** 95–101
[26] Nisa L W, Ismet and N A 2020 *Berk. Ilm. Pendidik.* **8** 73–80
[27] Latifah N, Ashari A and Kurniawan E S 2020 *J. Inov. Pendidik. Sains* **1**
[28] Suryaningtyas A, Kimianti F and Prasetyo Z K 2020 *International Conference on Educational Research and Innovation (ICERI 2019)* **401** 65–70