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Research Trends of E-Module Problem Based Learning Model to Improve Creative Thinking Skills of Learners (2016-2025): Literature Review

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Abstract: One of the important skills for Indonesian people in the digital era is the ability to think creatively. Creative thinking is an aspect of life skills that must be improved to face the information age and increasingly intense competition. One of the high-level thinking abilities that can be utilised to solve problems in the learning process is student creativity. In problem solving, the application of creative thinking can generate various ideas that are useful for finding solutions. To support active learning, it is very important to have appropriate teaching materials, so that students can understand the material better and achieve learning objectives, one of which is through the use of problem-based learning e-modules. This study aims to identify, analyse the tendency of e-modules of problem-based learning models to improve students' creative thinking skills. This research method is descriptive and analytical. The data used in this study were obtained from documents indexed by google scholar from 2016-2025 using publish or perish and dimension.ai. The data identified and analysed are the type of publication, the source of publication, and the title of the research on the PBL e-module model to improve students' creative thinking skills that are widely cited. The data analysis method uses bibliometric analysis assisted by VOS viewer software. The results showed an increase in the number of publications from 2016 to 2023, with the peak of publications occurring in 2023. However, there are fluctuations that show the challenges in this study. In addition, there are many types of publications in the form of articles, procceding, chapters, edited books, preprints and monographs. However, the most common type of publication is article, signalling the strong contribution of research in this area.

Keywords: e-module; Problem based learning; Creative thinking

Introduction

The utilisation of technology in education is characterised by innovation in the development of computer-based learning media. This media makes it easier for students to access information relevant to their learning process. This statement is also in line with Febliza's research (2025) that Generation Z, which consists of individuals born between 1995 and 2010, refers to the fact that they have been exposed to and raised in an environment heavily influenced by digital technology, so that technology becomes an integral part of their daily lives. It is no wonder that the utilisation of the internet among students is needed to find information about assignments and materials. As a form of adaptation response to the digital era, educators are tasked with providing strategies to identify the skills that learners must acquire to face the digital era as it is today (Puteri et al., 2023).

One of the important skills for Indonesians in the digital era is creative thinking (Panjaitan, 2023). Creative thinking is an aspect of life skills that must be improved to face the information age and increasingly intense competition (Perdana, 2020). In the digital era that we are now living in, where information and technology are developing rapidly, one of the main goals that must be

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achieved in the education system is to form individuals who are able to think creatively, and also have skills in solving various complex problems (Aytekin, 2024). According to Widia et al (2020) Creative thinking is how to involve ways of thinking that use imagination and logic as well as the ability to connect ideas that may seem unrelated. Creative thinking skills are a thinking process that allows students to use their imagination to generate new ideas, hypotheses, or experiments. This skill focuses on how students can solve problems from various perspectives (Kadir et al., 2022). Creative thinking skills can be developed by providing opportunities for individuals to think and express ideas that arise according to their interests and needs (Kartina, et al., 2021). Creative thinking can generate new ideas and innovative solutions and view problems differently (Nurjanah et al., 2024). Creative thinking skills need to be developed at every level of education in Indonesia. With good creative thinking skills, it is expected to increase students' motivation in learning, thus having a positive impact on their learning outcomes (Hasanah et al., 2023). One of the higher-level thinking skills that can be used to solve problems in the learning process is students' creative thinking skills, in problem solving, the application of creative thinking will produce various ideas that are useful in finding solutions (Ningrum & Marsinun, 2022).

To support active learning, it is very important to have appropriate teaching materials, so that students can understand the material better and achieve learning objectives, one of which is through the use of modules (Vianis et al., 2022). Modules can be optimised with technology and presented in interactive electronic media so that they can improve students' creative thinking skills (Wiranti et al., 2022; Basaroh et al., 2023). One strategy to develop students' creative thinking skills is to apply e-modules oriented to the Problem Based Learning model actively in the learning process in the classroom (Hanifah & Hidayah, 2024). *problem-based learning* model has a positive effect on the development of students' creative thinking skills in science learning, this is due to the application of problem-based learning that focuses on students, where the teacher acts as a facilitator and encourages independent involvement of students (Sulastri et al., 2022; Murdiasih & Wulandari, 2022; Ishlahul & Haryanti, 2023). The Problem Based Learning model is very relevant to be applied in the context of 21st century learning, as it encourages learners to actively participate in the learning process (Fonna & Nufus, 2024; Nafizatunni'am et al., 2024). Universities need to encourage teachers to implement the *problem-based learning* model approach, so with this *problem-based learning* model is suitable for application in the development of e-modules (Almulla, 2020; Feziyasti et al., 2024). Therefore, this study aims to identify research trends regarding e-modules that use the Problem Based Learning model to improve students' creative thinking skills. It is expected that the results of this study can be a reference in the development of further research related to e-modules using the Problem Based Learning model to improve students' creative thinking skills.

Method

This research method is descriptive and analytical, aiming to understand and explain research trends related to e-modules that apply the Problem Based Learning model in improving students' creative thinking skills. Researchers collected data from the Dimensions database for the last 10 years, from 2016 to 2025, relating to problem-based learning e-modules to improve students' creative thinking skills. The software used to analyse and visualise is the Vosviewer application. A search on Google Scholar was conducted with keywords relevant to research trends regarding e-modules of Problem Based Learning models to improve creative thinking skills. In this study, 1,000 documents indexed in Google Scholar during the period 2016 to 2025 were analysed.

Result and Discussion

This study aims to describe research trends regarding e-modules that use the Problem Based Learning model to improve creative thinking skills. Documents relevant to this research trend were taken from the period 2016 to 2025. The following is presented in Figure 1 which illustrates the research trends on e-modules using the Problem Based Learning model in an effort to improve students' creative thinking skills.

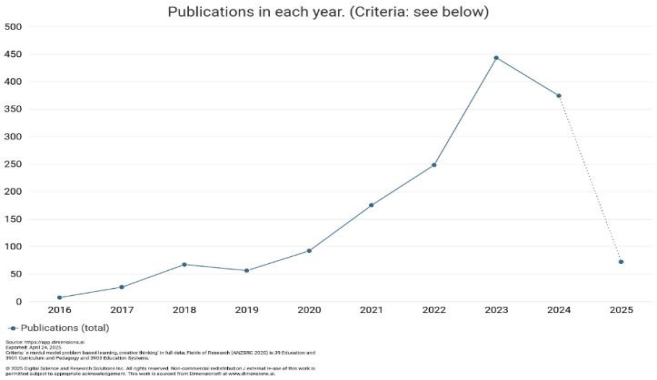

Figure 1. Research Trend of e-module problem-based learning model to improve creative thinking skills

Based on the publication trend graph from 2016 to 2025 regarding the Problem Based Learning e-module model that aims to improve students' creative thinking skills in

the education system, there is a significant increase in the number of publications. Starting from around 7 publications in 2016, this number increased drastically until it peaked in 2023 with 443 publications. However, from 2024 onwards, there is a sharp decline, with only 374 publications in 2024 and 72 publications in 2025. The increasing and decreasing trends reflect changes in research focus and provide challenges for publications in this area. Overall, this graph shows that research interest in e-modules related to the Problem Based Learning model in the context of creative thinking skills is experiencing positive growth, but also faces fluctuations that need to be further analysed. This research trend provides a deeper understanding of the effectiveness of the Problem Based Learning e-module model in improving learners' creative thinking skills. In addition, this study also presents e-module research with the Problem Based Learning model that aims to improve creative thinking skills, according to the publication category which can be seen in Table 1.

Table 1. Type of publication of e-module trends of problem-based learning models to improve creative thinking skills

Publication Type	Number of Publications
Article	1.346
Proceedings	111
Chapter	79
Edited book	35
Preprint	5
Monograph	4

The table above presents data on the research trend of e-module model Problem Based Learning in improving creative thinking skills based on the type of publication. From the table, it can be seen that the type of publication that contains the most research results of the problem-based learning e-module model in improving creative thinking skills is articles, with a total of 1,346 publications. Furthermore, proceedings recorded 111 publications, showing contributions from scientific conferences. Chapters in books recorded 79 publications, while edited books had 35 publications. There were also preprints with a total of 5 publications, indicating that preliminary research was published before the review process. Finally, monographs showed the lowest number of publications, at 4. This data illustrates the significant distribution of publication types in research on the application of the Problem Based Learning model for the development of creative thinking skills.

Furthermore, researchers present fifteen (15) titles of sources that are trending in research on e-modules with Problem Based Learning models that aim to improve creative thinking skills, and are often referred to by other researchers related to the topic which can be seen in Table 2.

Table 2. Trends in 15 journal source titles of e-module problem-based learning models to improve students' creative thinking skills 2016-2025

Journal Name	Publications	Excerpt	Average Citation
Journal of Science Education Research	120	268	2.23
Advances in Social Science, Education and	91	99	1.09
AIP Conference Proceedings	54	46	0.85
Scientific Journal of Primary School	29	119	4.10
KnE Social Sciences	22	4	0.18
Journal of Education Research and Evaluation	22	42	1.91
JPI (Journal of Indonesian Education)	19	52	2.74
International Journal of Academy Research in progressive Education and Development	17	45	2.65
AKSIOMA Journal of Mathematics Education Study Programme	17	21	1.24
Journal of Education and Teaching	16	19	1.19
Al-Jabar Journal of Mathematics Education	14	80	5.71
Journal of Elements	14	36	2.57
International Journal of Elementary Education	13	38	2.92
Physics Learning and Education	13	3	0.23
Journal of Exact Education (JEP)	12	97	8.08

Table 2 shows the number of publications from each journal and the varying number of citations reflects the level of recognition and relevance of each source title among researchers, where journals with higher citation counts signify significant contributions to the field. It can be seen that the source that publishes the most research trends in e-modules of problem-based learning models to improve students' creative thinking skills is the Journal of Science Education Research, which has 120

publications with 268 citations and an average citation of 2.23. The Journal of Science Education Research publishes scientific articles that include research results in the fields of science, technology, and science teaching (Doyan et al., 2024). The Journal of Science Education Research is open access, which means that published articles can be read, downloaded, and distributed free of charge.

Based on the number of publications regarding the problem-based learning e-module model to improve students' creative thinking skills, researchers also identified article titles that are often referred to by researchers, namely "Development of STEM-Integrated Physics E-Modules to Improve Students' 21st Century Skills", namely 27 references (Hafizah & Asrizal 2022). Furthermore, the research entitled "Development of Integrated Science Literacy E-Modules and Demonstration Videos Using Problem Based Learning Models for High School Students on Acid and Base Materials", namely 9 references (Yani et al., 2020). In improving creative thinking skills, science literacy is needed to help solve problems (Febrianti, 2024). Yuliana et al.'s research (2021) entitled "Development of Interactive Learning Media Based on Problem Based Learning Model to Improve Students' Physics Creative Thinking Ability" was also widely referenced by other researchers as many as 44. Furthermore, the research entitled "Citations about e-modules for problem-based learning models to improve creative thinking skills" was referred to 62 times (Handi et al., 2019). Utari et al., (2023) in their research entitled "Development of E-Modules for Physics Learning Model Problem Based Learning Based on Flipbook to Improve Students' Creative Thinking Skills" was referenced 10 times. Citations about the problem-based learning e-module model to improve creative thinking skills can be seen in Table 3.

Table 3. Top quotes about problem-based learning e-modules to improve creative thinking skills

Excerpt	Year	Author	Title
27	2022	Naurah Nazifah, Asrizal Asrizal	Development Of STEM Integrated Physics E-Modules to Improve 21st Century Skills of Students
9	2022	Yani Puspita Yani, Hardeli Hardeli, Budhi Oktavia, Desy Kurniawati	The Development of An Integrated E-Module of Scientific Literacy and Video Demonstration Using A Problem-Based Learning Model for High School Students on Acids and Bases
44	2021	Yuliana Husniati Ridwan, Muhammad Zuhdi, Kosim Kosim, Hairunnisyah Sahidu	Development of Interactive Learning Media Based on Problem Based Learning Model to Improve Students' Creative Thinking Ability in Physics
62	2019	Handi Herdiawan, Indah Langitasari, Solfarina	Application of PBL to Improve Students' Creative Thinking Skills on the Concept of Colloids
10	2023	Wiwin Melia Utari, I Wayan Gunada, Muh. Makhrus, Kosim	Development of E-Modules for Physics Learning Model Problem Based Learning Based on Flipbook to Improve Creative Thinking Skills of Participants Educate

The data from this study is in line with the increasing trend of research on Problem Based Learning e-modules that aim to improve learners' creative thinking skills between 2016 and 2025. This indicates that during that period, research related to this topic was consistently referenced by other researchers.

Furthermore, there is a visualisation of data analysis from VOSviewer on 1000 journals linked to Google Scholar by looking at subject connections related to scientific studies between various studies. The results of the analysis of word relationships in articles related to the e-module model of Problem Based Learning and the improvement of creative thinking skills are shown in Figure 2.

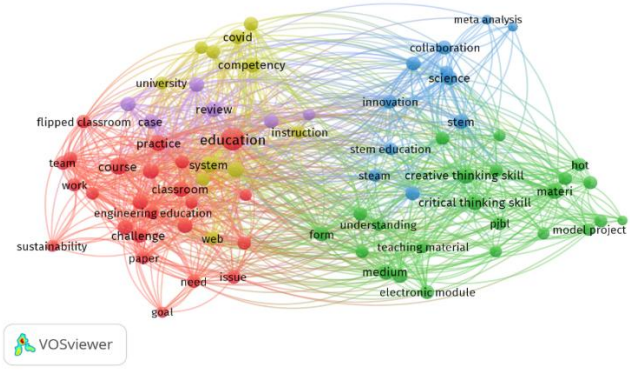

Figure 2. Network visualisation of problem-based learning e-modules to improve creative thinking skills

Figure 2 shows the results of mapping word relationships in research trends related to e-modules of problem-based learning models to improve creative

thinking skills. In Figure 2 there are 75 keyword items that are often used in research on e-modules of problem-based learning models from 2016 to 2025. In addition, Figure 2 also contains 5 clusters, where the first cluster is red which consists of 24 items, with keywords such as case study, challenge, classroom, course, design thinking, etc. The second cluster is green which consists of 24 items. The second cluster is coloured green which consists of 23 items with the keywords creative thinking ability, creative thinking skill, e module, etc. The third cluster is coloured blue which consists of 11 items with keywords such as 21st century skills, collaboration, communication, innovation and so on. The fourth cluster is coloured yellow which consists of 11 items with keywords blended learning, computer, covid, e learning etc. The fifth cluster in purple consists of 6 items with keywords case, computational thinking, game, literature, review, systematic review.

Below is also presented Figure 3 with keywords regarding e-modules of problem-based learning model to improve creative thinking skills based on *overlay* visualisation.

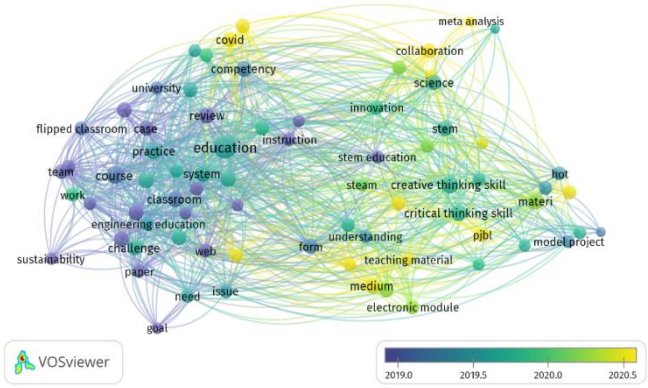

Figure 3. Visualisation of e-module overlay of problem-based learning model to improve students' creative thinking skills

Figure 3 shows the trend of keywords related to research on e-modules of problem-based learning models to improve creative thinking skills indexed by Google Scholar from 2016 to 2025. The trend of research on e-modules of problem-based learning models to improve creative thinking skills from the oldest is marked in purple then when the colour gets younger, it marks the research as the latest research. It can be seen in Figure 3 that the keywords sustainability, classroom, web, engineering education, etc. are found in 2019. While in 2020 the keywords that often appear are electronic module, covid, creative thinking skills, collaboration, etc.

Research on e-modules of Problem Based Learning models to improve creative thinking skills has become one of the rapidly growing research fields in recent years. Next, the keywords of e-modules for problem-based learning models to improve creative thinking skills are also presented based on the density visualisation in Figure 4.

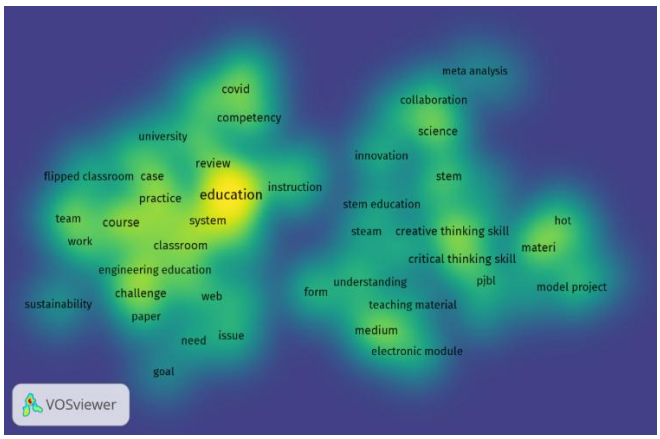

Figure 4. density visualisation on e-module research of problem-based learning model to improve creative thinking skills.

Figure 4 shows the density visualisation. The density visualisation shows that the lighter the colour of a research topic, the more people do research on that topic. In the density visualisation, the brightly coloured topics are education, system, practice classroom. However, the dimmer the colour means that the topic is rarely researched. Topics that are fainter in colour such as innovation, goals, sustainability, meta analysis indicate that the topic can be used as a reference for further research.

Overall, research on Problem Based Learning e-modules that aim to improve creative thinking skills has become one of the areas that have experienced significant development in recent years. This increase is due to the importance of creative thinking skills that need to be strengthened in the 21st century era, which is characterised by the rapid advancement of digital technology. In this context, creative thinking skills become highly relevant to prepare individuals to face challenges and opportunities in an increasingly complex world.

Conclusion

Based on the analysis of research trends regarding e-modules of Problem Based Learning (PBL) models to improve creative thinking skills, it can be concluded that research in this field has experienced a significant increase in recent years. The application of technology in education, especially in the form of e-modules, has proven effective in facilitating the development of students' creative thinking skills. This is important in the digital era that demands the ability to think critically and innovatively. The data shows an increase in the number

of publications from 2016 to 2023, with the peak of publications occurring in 2023. However, there are fluctuations that show the challenges in this study. In addition, the most common publication type is articles, signalling a strong contribution from research in this area. Creative thinking skills need to be continuously developed at all levels of education in Indonesia, and the PBL model is a relevant approach to achieve this goal. This research is expected to be a reference for further research in the development of PBL-orientated e-modules to improve students' creative thinking skills.

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