Studies in Bibliometrics of Education and Technology
Homepage: https://scie-journal.net/index.php/SiBET
Email:

p-ISSN:XXXXX; e-ISSN: XXXXX
SiBET, Vol. 1, No. 2, April 2026
Page 53-66
©2026 SiBET

Mapping the Intellectual Structure of Physics Anxiety Research: A Bibliometric Analysis of Influencing Factors

***Joenathan Eka Prasetya[1], Adrian Bagas Damarsha[2], Mita Sofita[1], Hanandita Veda Saphira[3]**
[1]Department of Physics Education, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya, Indonesia
[2]Master Program of Science Education, Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya, Indonesia
[3]Master Program of Digital Technologies for Learning, Faculty of the Arts, Social Sciences and Humanities, University of Wollongong, Australia

Article Info

Article history:

Received: 25 February 2026
Revised: 15 Macrh 2026
Accepted: 23 March 2026
Available Online: 30 April 2026

Keywords:

Bibliometric Studies
Emotional Condition
Learning Motivation
Physics Anxiety
Physics Education

ABSTRACT

Physics anxiety is a significant issue in physics education that contributes to declining student academic achievement. This condition arises from the perception that physics is a complex and difficult subject, which triggers negative emotional responses during the learning process. Therefore, this study aims to explore research trends in physics anxiety and identify the factors influencing this phenomenon. A bibliometric approach based on the PRISMA method was employed, 73 documents retrieved from the Scopus database using the keywords "physics education" and "anxiety". The extracted data were analyzed using VOSviewer and Biblioshiny software to identify publication trends and map relationships among relevant concepts. The results show that research trends on physics anxiety have increased gradually over the past two decades. Furthermore, three major factors influencing physics anxiety were identified: intrinsic factors, extrinsic factors, and social factors. Based on these findings, it is recommended that educators minimize the impact of these factors through adaptive, interactive, and student-centered learning designs to prevent the decline of student achievement in physics learning.

Check for updates OPEN ACCESS CC BY NC ND

INTRODUCTION

Science education has become a priority for the advancement of a nation, particularly in the field of physics. This statement is supported by Damarsha et al. (2023), who argued that physics encompasses concepts closely related to modern technology, making it essential to prioritize in education. Furthermore, it is important to implement physics learning that integrates technology without neglecting fundamental concepts (Sofita et al., 2024; Damarsha et al., 2025). Through this approach, students are expected to apply their understanding of physics in relation to modern technological developments.

In reality, many students still experience difficulties in learning physics. This is evidenced by the prevalence of misconceptions in physics among students (Mufit et al., 2020). According to Resbiantoro and Setiani (2022), these misconceptions may arise from the psychological conditions experienced by students during physics learning. Such conditions can be caused by the perception that physics is too difficult, leading students to feel fear or anxiety toward the subject.

Perceptions of difficulty and prior negative experiences can lead to fear and apathy toward learning physics (Gonzales et al., 2017). Achor et al. (2023) noted that such phenomena indicate anxiety in physics learning. Survey data further confirm that many students experience physics anxiety due to the perception that physics is difficult to understand (Taibu & Ferrari-Bridgers, 2020; Bray & Williams, 2020). Consequently, educational efforts are needed to reduce student anxiety and promote quality education. According to Berutu & Mutiawati (2023), quality education is characterized by the absence of learning anxiety among students.

Further research on anxiety in physics learning is necessary to better understand its underlying causes. The objective is to identify trends in research on physics anxiety at an international level. Mapping research is essential to uncover gaps between anxiety and physics education (Molin et al., 2021). Through such mapping, it becomes possible to emphasize the importance of translating research findings on anxiety into educational practice (Bartling et al., 2022). Therefore, studies that provide

analytical mapping of anxiety, particularly in physics education, are needed.

This study presents a bibliometric analysis combined with a systematic literature review as a research mapping approach. Bibliometric analysis is used to examine the research landscape and identify gaps in previous studies (Wang et al., 2025; Pessin et al., 2022). In addition, this study provides a mapping of research on physics anxiety. The purpose is to establish a structured flow of information related to physics anxiety in physics education, thereby highlighting trends and developments in this research areas.

1. **RQ1:** How research trends in keywords and publication according to "Physics Education" and "Anxiety" keywords finding in Scopus?
2. **RQ2:** What factors affecting anxiety in physics education significantly?

RESEARCH METHOD

This study employed a bibliometric research design to systematically analyze trends and patterns in the literature on physics anxiety. Bibliographic data were retrieved from the Scopus database, which was selected for its extensive journal coverage, standardized indexing system, and widespread use in bibliometric research (AlRyalat et al., 2019; Prahani et al., 2024). Data obtained from Scopus offer credibility and enable intensive discussion of global research trends (Rusmaya & Utami, 2025).

The data collection and screening procedures followed the PRISMA framework proposed by Page et al. (2022), ensuring transparency and reproducibility in the identification, filtering, and selection of relevant publications. The overall methodological procedure is illustrated in Figure 1.

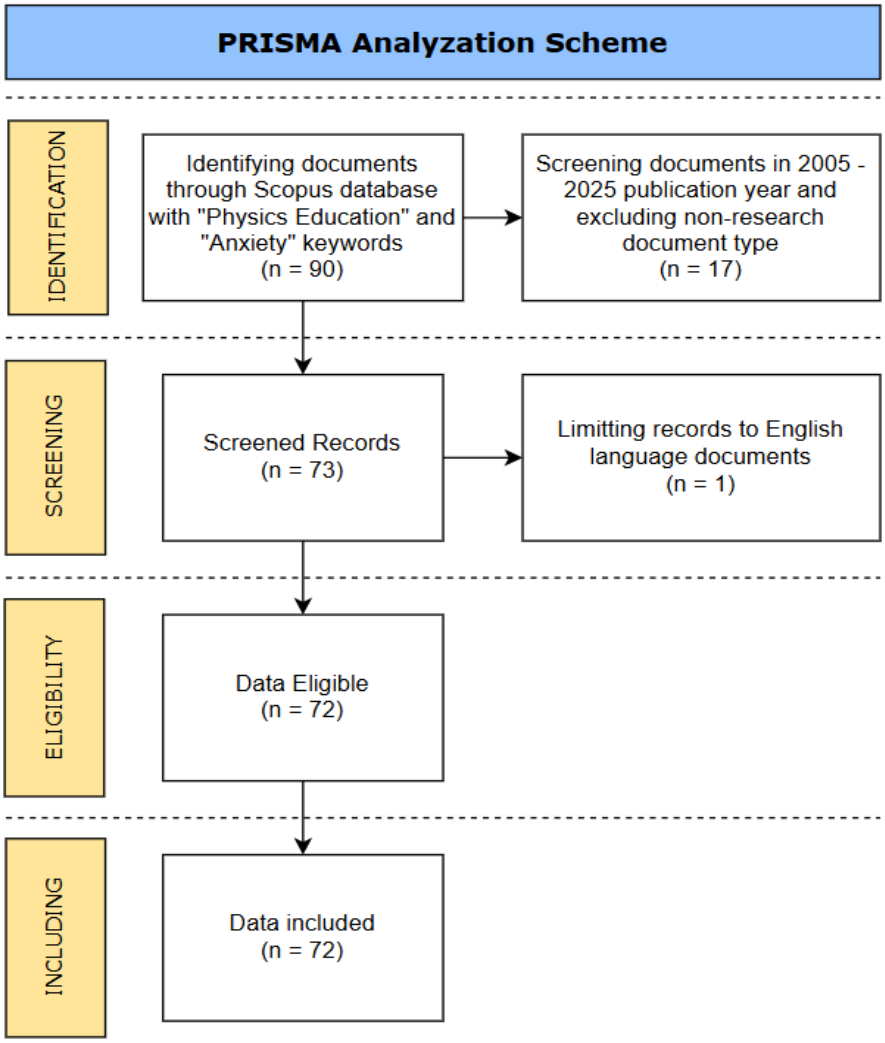


Figure 1. PRISMA Research Design Workflow

Eligibility Criteria

The bibliometric design used in this study required a document filtration process. Filtration was carried out to maintain the alignment of research topics with the results found in the Scopus database (Prahani et al., 2024). This filtration process was performed using the advanced search strings in Table 1.

Table 1. Physics anxiety advanced query in Scopus database

Advanced Query	Documents Found
(Title-Abs-Key (physics education) AND TITLE-ABS-KEY (anxiety)) And Pubyear > 2004 And Pubyear < 2026 AND (LIMIT-TO (Language , "English")) And (Exclude (Doctype , "Bk") Or Exclude (Doctype , "Ch") Or Exclude (Doctype , "No") Or Exclude (Doctype , "Ed") Or Exclude (Doctype , "Le") Or Exclude (Doctype , "Cr"))	73

Data Collection

Bibliographic data were collected from the Scopus database and processed according to the procedure outlined in Figure 1. The data collection process followed the PRISMA framework proposed by Page et al. (2022), encompassing stages of identification, screening, and eligibility assessment. This process resulted in a final dataset of 73 documents that met the predefined inclusion criteria.

During the data selection process, no additional keyword-based restrictions were applied beyond the initial search query. This approach was adopted to preserve the inclusiveness of the dataset and to capture a broader range of studies addressing factors related to physics anxiety within the literature.

Data Analyze

The collected bibliometric data (Figure 1 & Table 1) were analyzed using VOSviewer and Biblioshiny to examine structural and performance patterns within the dataset (Thangavel & Chandra, 2023; Oyewola & Dada, 2021; Singh et al., 2025). VOSviewer was employed to perform keyword co-occurrence analysis, enabling the visualization of relationships among research themes through network and density map ping. These visualizations facilitated the identification of dominant topics and emerging trends in studies related to physics anxiety (Prahani et al., 2024; Suprapto et al., 2021).

In addition, Biblioshiny was utilized to analyze bibliometric performance indicators, including publication trends over time and journal productivity (Alhusni et al., 2026). This complementary use of tools allowed for both relational mapping of research themes and quantitative assessment of publication patterns within the field. Together, these analyses provide a comprehensive understanding of the intellectual structure and development trajectory of research on physics anxiety.

RESULTS AND DISCUSSION

Physics Anxiety Research Productivity Trends

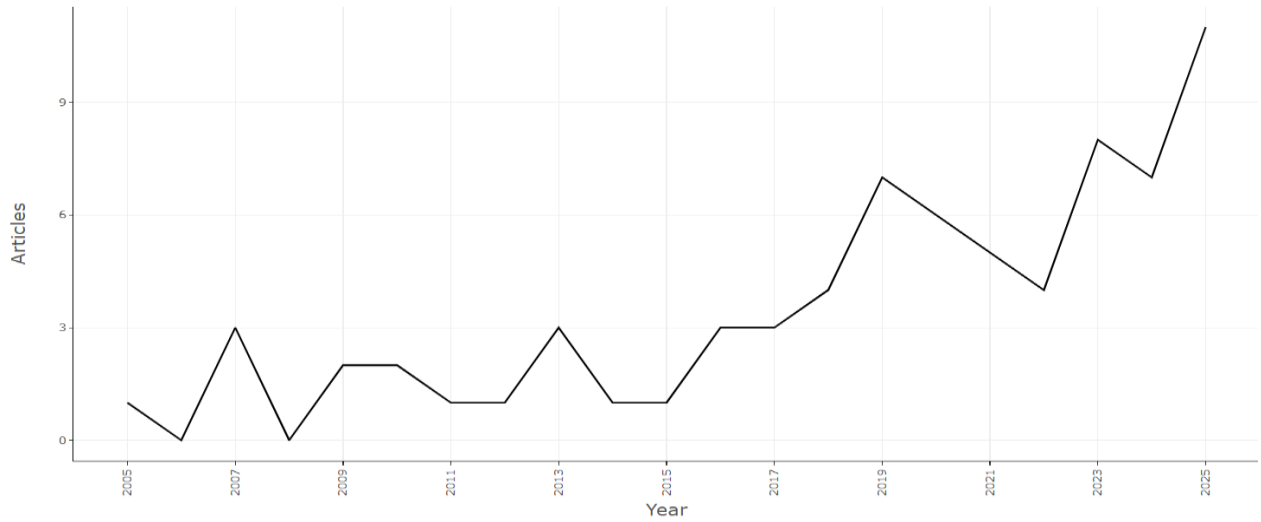


Figure 2. Productivity Trend Graph in Two Decades (2005-2025)

Figure 2 illustrates fluctuating trends in research productivity on physics anxiety over the past two decades. This pattern reached a pivot point in 2017, marked by a clear shift in publication trends. By 2025, more than nine documents related to this topic were published, indicating a growing research trend. This projection suggests that the topic of "physics anxiety" will gradually increase in importance, reflecting growing concern about anxiety in physics learning.

As noted by Miedijensky et al. (2021), research on learners' psychological and pedagogical conditions continues to grow due to generational changes in student populations. Consequently, further investigations into students' psychological states, particularly in physics learning, remain highly relevant. In this context, studies focusing on the enhancement of active learning in physics have become increasingly important. This urgency is further intensified by the growing use of AI in physics learning environments. Sofita et al. (2024), for instance, demonstrated that AI-generated responses often show highly similar and nearly entirely correct answers. Such conditions may influence the psychological well-being of both students and educators.

Furthermore, educational concerns are increasingly associated with ongoing technological developments. Lund et al. (2024) linked anxiety to the advancement of AI, noting that some individuals feel threatened by the possibility of being replaced by AI systems. This uncertainty about the future may contribute to heightened anxiety in students' learning processes. However, a study by Saphira et al. (2024) reported contrasting findings, suggesting that AI and technology can be effectively integrated into learning processes to support learning flow and enhance students' motivation. These contrasting perspectives warrant further comprehensive investigation, particularly to examine the usefulness of AI in physics learning and the anxiety experienced by students during the learning process.

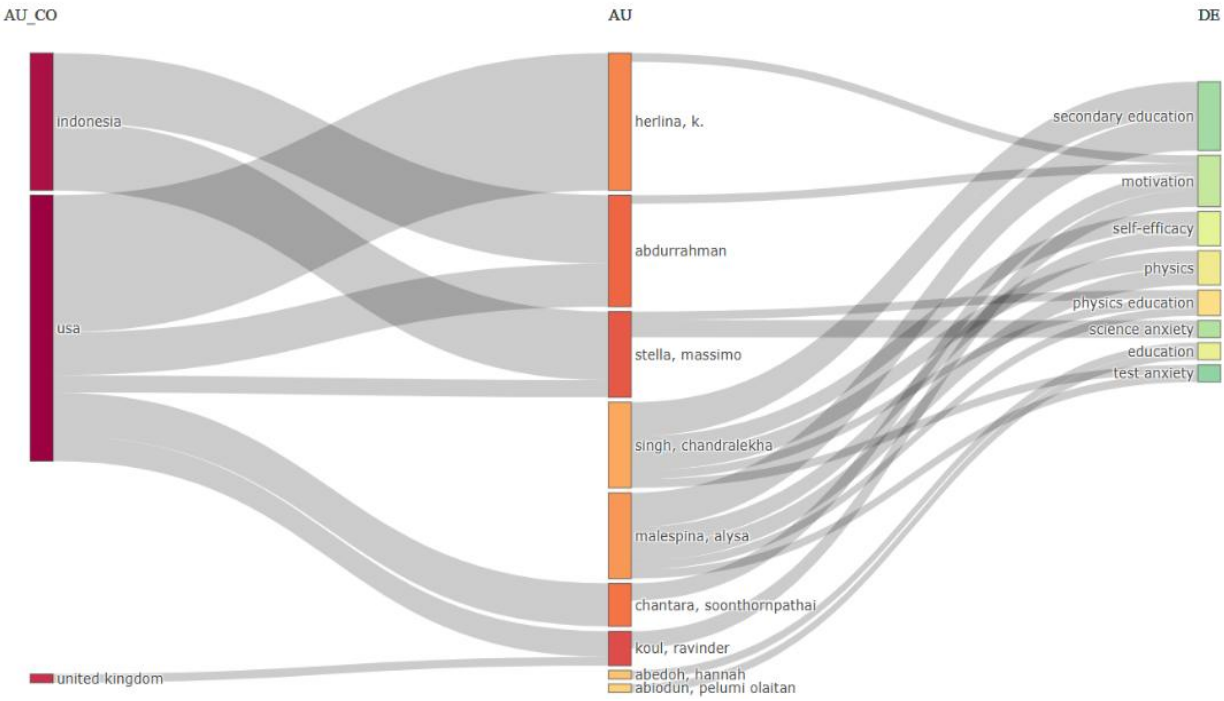


Figure 3. Three-field Plot According to Keyword Preferences

Figure 3 presents a three-field plot illustrating the relationships among three bibliometric indexes: country, author, and keywords (Prahani et al., 2024). On the left side, Indonesia emerges as the dominant country in terms of publication volume on this topic. In the middle section, Herlina, K. appears as the most prominent author, with a direct linkage originating from the United States. This indicates that both Indonesia and the United States are associated with authors actively publishing in this research area.

The third column of Figure 3 displays keywords that are highly relevant and frequently co-occur with the authors listed in the middle section. The three most prominent keywords are "secondary school," "motivation," and "self-efficacy." Research on anxiety in physics learning is consistently linked to students' learning motivation and self-efficacy, both of which serve as determinants of academic achievement (Molin et al., 2021; Malespina & Singh, 2024). Accordingly, the correlation between students' intrinsic self-

perceptions and their experiences in physics learning demonstrates a significant effect on anxiety levels.

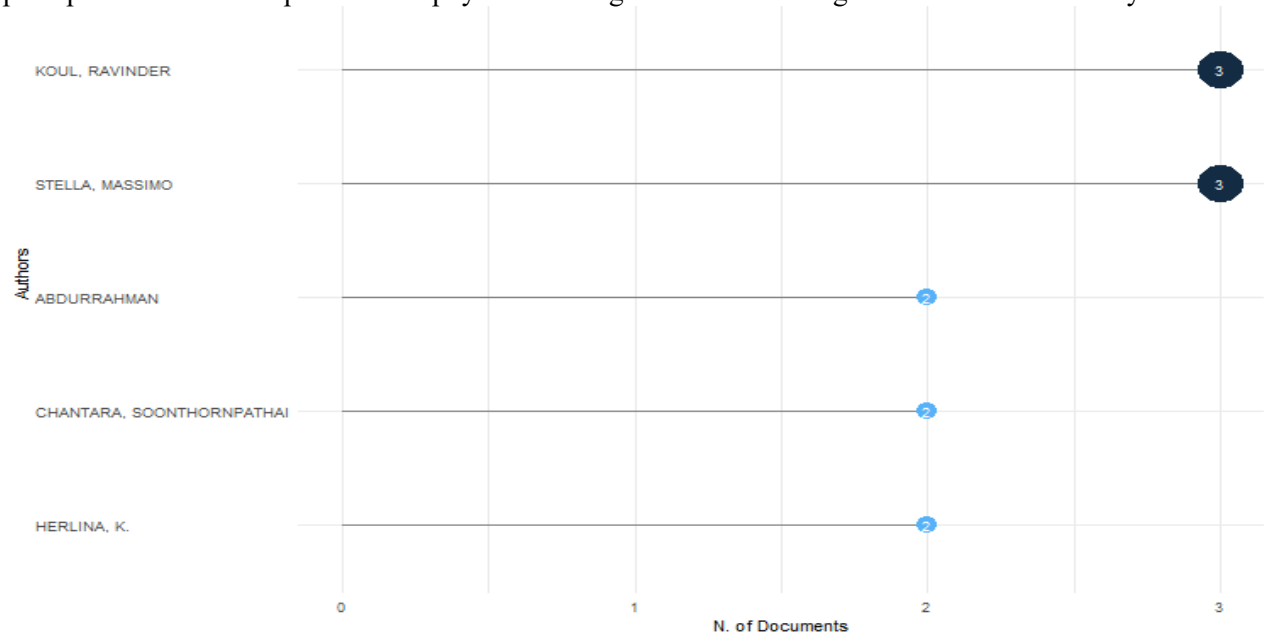


Figure 4. The Most Productive Authors

Based on Figure 4, the top authors contributing to the research on physics anxiety are K, Ravinder; S, Massimo; and Abdurahman. K, Ravinder has published 3 research papers related to physics anxiety. S, Massimo contributed 3 documents, while Abdurahman contributed 2 documents. These top authors have published more than 2 research papers, thus making significant contributions to this research. In this context, these top authors have made significant contributions and have major implications for the implementation of physics anxiety research.

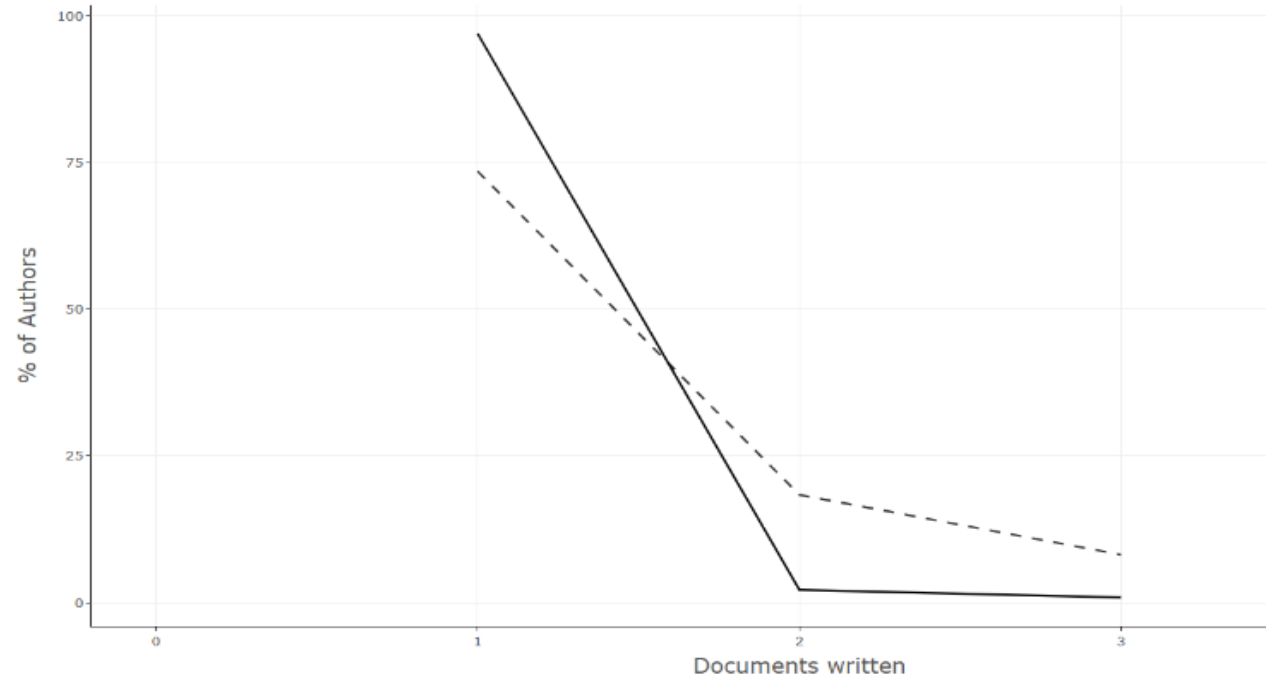


Figure 5. Lotka law

Furthermore, Figure 5 displays a Lotka graph explaining publication statistics on the topic addressed in this study, namely physics anxiety. The graph on the horizontal axis (documents written) has a maximum of 3, indicating that authors on this topic have published only three times on the same topic. Percentage-wise, 96.9% of authors have published only once on this topic. This indicates a publication sluggishness in

the continuous exploration of physics anxiety within the research trend.

Table 2. Most cited and high FWCI sorted document relating to physics education and anxiety

No	Author (Year)	Title	TC	FWCI
1	Gungor et al. (2007)	The relationship of freshmen's physics achievement and their related affective characteristics	73	2.19
2	Gupta et al. (2018)	Exploring the entanglement of personal epistemologies and emotions in students' thinking	39	1.46
3	Dou & Zwolak (2019)	Practitioner's guide to social network analysis: Examining physics anxiety in an active-learning setting	33	1.39
4	Panjaitan et al. (2025)	The role of emotional regulation in shaping students' perception of physics problem-solving tasks	30	21.51
5	Maison et al. (2019)	Learning environment, students' beliefs, and self-regulation in learning physics: Structural equation modelling	29	2.37

Table 2 presents the top authors ranked by total citation count, along with the Four-Weighted Citation Index (FWCI), which serves as an indicator of document relevance within multidisciplinary research (Torres-Rivera et al., 2025). According to Table 2, the study by Gungor et al. (2007) received the highest number of citations, whereas the study by Panjaitan et al. (2025) achieved the highest FWCI score. This discrepancy can be attributed to the latter's greater relevance and novelty relative to its publication year, in addition to its citation count (Scelles & Da Silva, 2022).

Table 2 also lists several keywords associated with indicators of physics anxiety. Panjaitan et al. (2025) and Gupta et al. (2018) emphasize students' emotional dimensions. Gungor et al. (2007) focused on the reciprocal relationship between student achievement and affective domains. Meanwhile, Maison et al. (2025) and Dou & Zwolak (2019) explored extrinsic factors that contribute to the development of physics anxiety. These studies align with Bronfenbrenner's ecological model, which posits that students' cognitive development is shaped by multiple environmental layers interacting with individual characteristics (Veiga et al., 2023; Tudge et al., 2022). Nevertheless, physics anxiety may also arise from factors that are otherwise considered beneficial to students' cognitive development in physics learning.

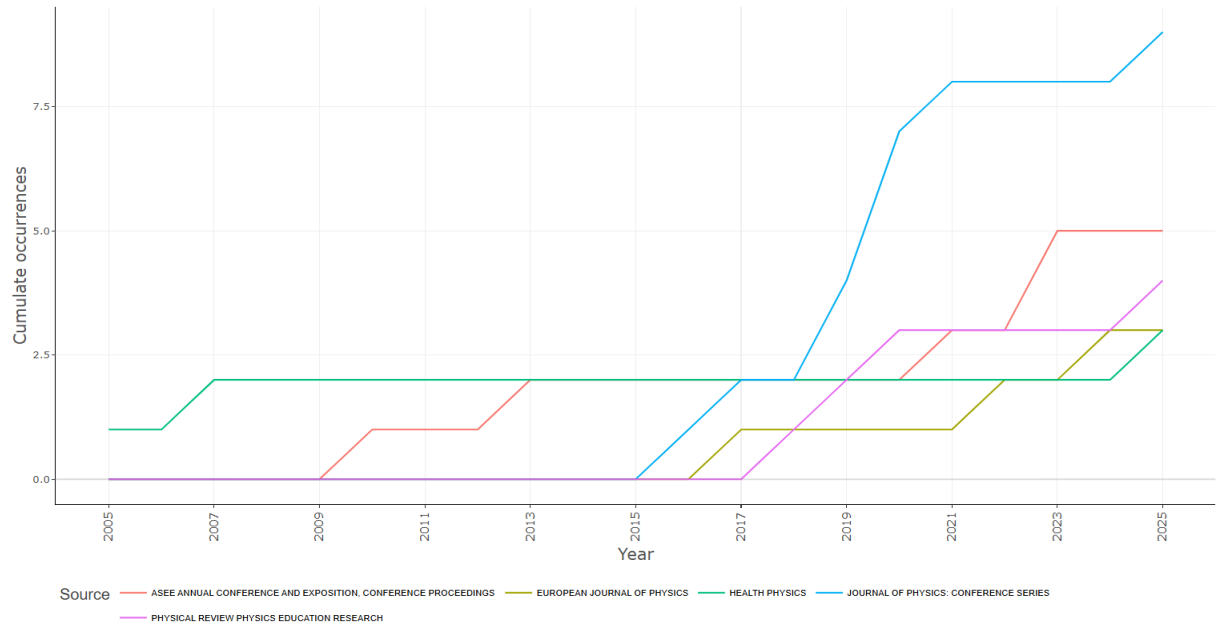


Figure 6. Source Publication Trends in 2005-2025

A bibliometric review was also conducted based on the publication sources contributing to this topic. Figure 6 presents a cumulative graph of publications from the top five sources on physics anxiety. Overall, the trend across these five sources is similar, characterized by a simultaneous increase from mid-2019 to mid-2021, followed by continued growth in subsequent years. Thus, Figure 6 provides a visualization of the cumulative production of each source contributing to research on physics anxiety.

Notably, the simultaneous increase observed between 2019 and 2021 occurred during the COVID-19 pandemic, a period that affected all aspects of human life, particularly education (Arribathi et al., 2021; Xu & Wang, 2023). The prevalence of anxiety increased due to the shift to virtual learning, which prevented students from directly experiencing a real-world learning environment. This situation triggered learning anxiety across all subjects, largely stemming from limited social interaction between teachers and students as well as among peers (Dou & Zwolak, 2019; Arribathi et al., 2021).

Further studies by Malespina & Singh (2024) and Mendoza-Lizcano et al. (2020) revealed similar findings specific to physics learning. Both studies indicated that remote learning had a significant impact on physics anxiety, particularly concerning student self-efficacy. This phenomenon suggests that environmental and social factors directly contribute to the emergence of physics anxiety in students (Maison et al., 2019; Durk et al., 2024).

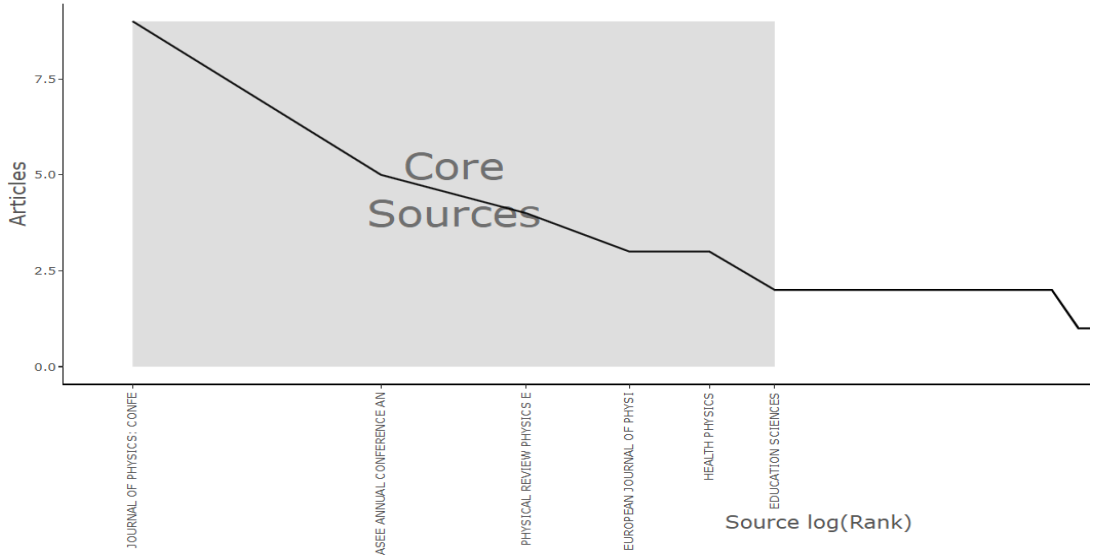
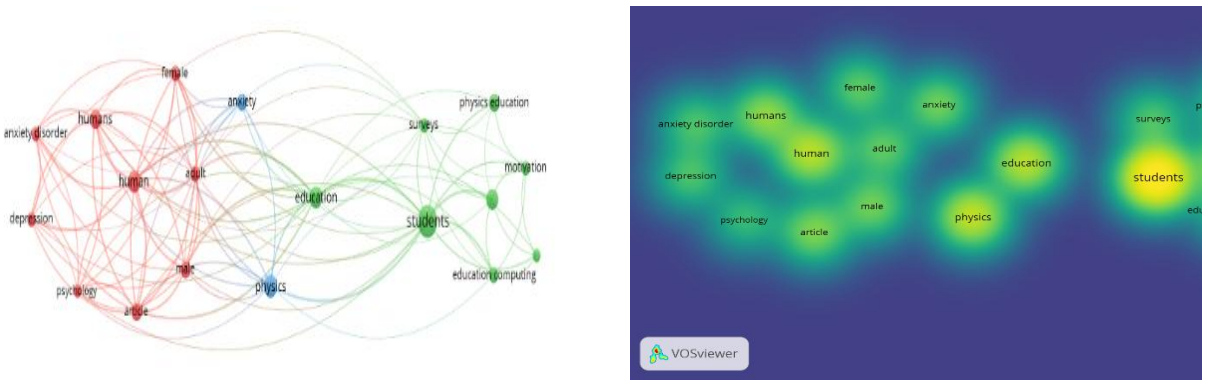


Figure 7. Bradford Law Graph

In addition, Figure 7 presents a Bradford graph, which serves to visualize the core sources in research on physics anxiety. Figure 7 identifies six core sources, each with a cumulative number of published articles exceeding two. These six sources represent a major contribution to the field, indicating that most articles produced on this topic share a similar orientation with those previously published in these sources. This bibliometric review contributes to the identification of central sources in physics anxiety research, aiming to uncover prior issues addressed in the literature and thereby sharpen the focus of future findings.

Physics Anxiety Keyword Trends



(a) (b)

Figure 8. (a) Network Visualization Produced by VOSviewer; (b) Density Visualization Produced by VOSviewer

Figure 8a shows three clusters of network visualization by VOSviewer. The green cluster contains the keywords "physics education" and "student," which are highlighted in this study. The blue cluster contains the keyword "anxiety," which is highlighted in this study. The results indicate that the green cluster has a high trend, as evidenced by Figure 8b, which has a high density and large circles. The blue cluster has a low density, indicating that research using this keyword is still limited. The findings indicate a gap between research on anxiety and physics education. This is evidenced by the lack of cluster relationships and the large distance between clusters. This suggests an opportunity for innovation in further research, as it provides an opportunity to address gaps in research findings in education.

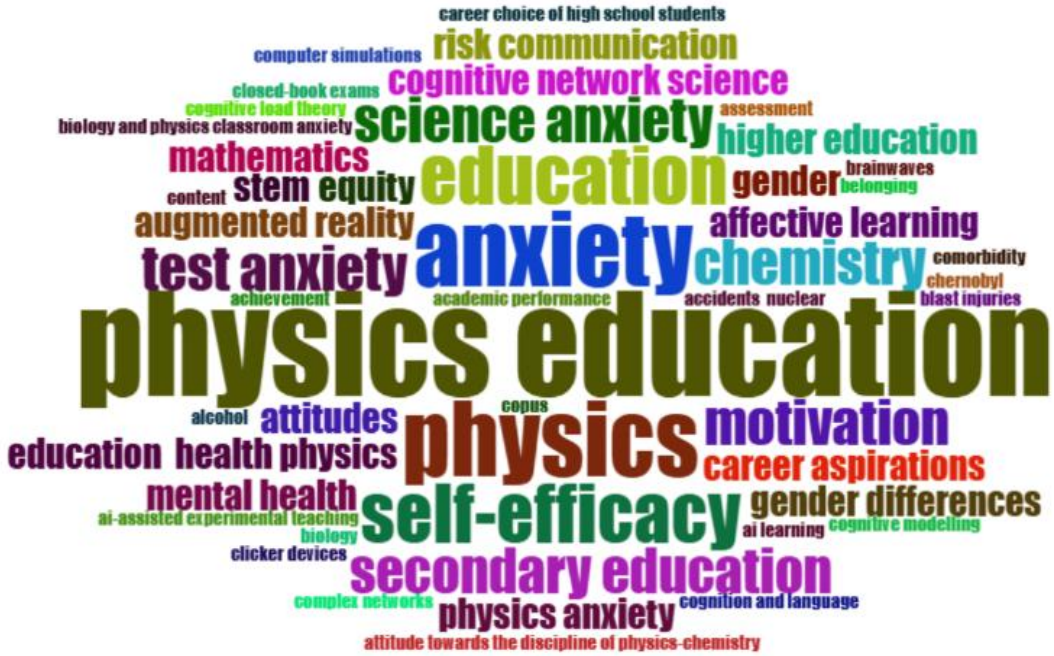


Figure 9 Wordcloud Result According to Keywords Preference

Figure 9 presents a word cloud derived from keyword searches using the Scopus database. The findings indicate that the keyword "physics education" appears with the frequency equal to 7, suggesting a stronger research trend. In contrast, the keyword "anxiety" appears less prominently with the frequency equal to 5, indicating that it is not yet a high-ranking research trend. This disparity suggests that research on anxiety remains limited in comparison to research on physics education. Therefore, future researchers have a significant opportunity to develop studies on anxiety, in relation to physics education.

Furthermore, the word cloud findings are consistent with those particularly presented in Figures 3, 8(a), and 8(b). Keywords such as "self-efficacy" and "motivation" reappear prominently. Additional student-related factors, including "mental health," "gender" (or "gender differences"), and "brainware," also appear in research on physics anxiety. These factors appear inside students mind and perception, therefore included factors can lead to physics anxiety problem in classroom.

Beyond revealing intrinsic student factors, the discussion of Figure 9 also highlights learning-related tendencies within the word cloud. Keywords such as "affective learning," "AI-assisted experimental teaching," and "AI learning" emerged in the mapping. This indicates that these factors may influence the likelihood of physics anxiety in physics learning (Yu et al., 2023; Thalmann et al., 2019; Collectively, the bibliometric findings from productivity trends, citation impact, core sources, keyword co-occurrence, and word cloud mapping confirm that physics anxiety is a growing yet underexplored research domain, shaped by both intrinsic student factors (e.g., self-efficacy, motivation, gender, mental health) and external pedagogical influences (e.g., AI learning, affective teaching, remote learning environments).

Factors Affecting Physics Anxiety

The factors that have been analyzed in bibliometrics can be modeled in Figure 11. Figure 3 and

Figure 10 provide a foundation for describing the modeling, and Table 2 clarifies the conceptual position of physics anxiety in human cognitive modeling.

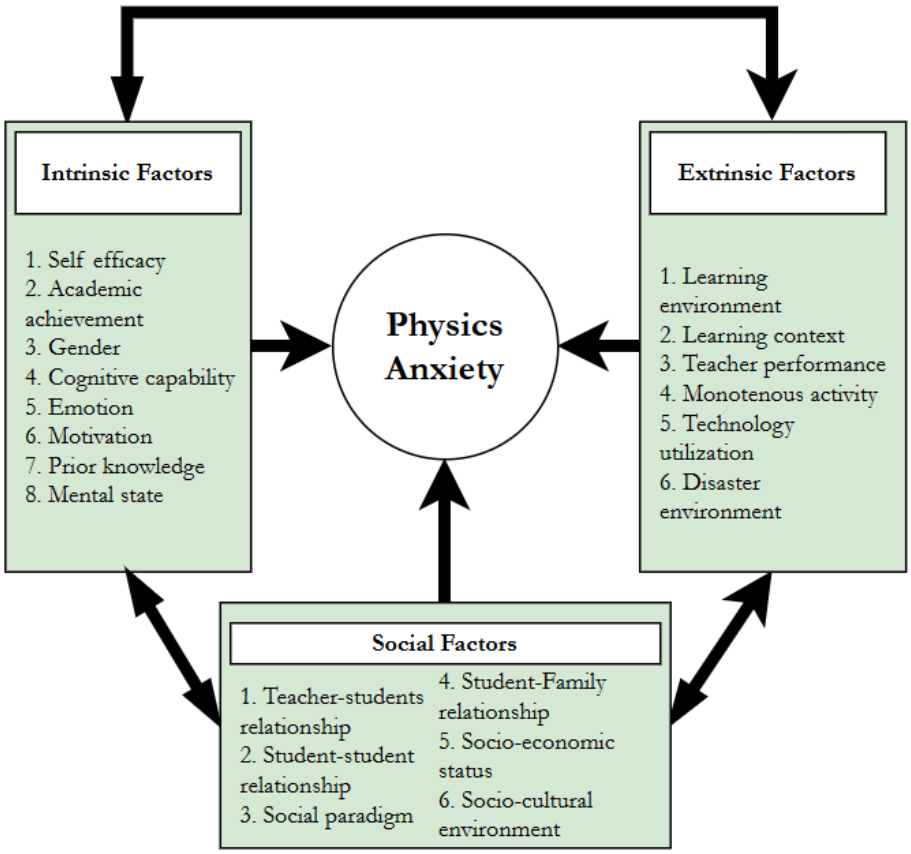


Figure 11. Potential Factors Affecting Physics Anxiety Diagram

Figure 11 above has been synthesized based on the distribution of keywords found in the extracted bibliography. The model depicted in Figure 11 divides anxiety into three major factors that can influence physics learning. First, intrinsic factors encompass elements inherent within the student (Panjaitan et al., 2025). Second, extrinsic factors encompass external environmental elements that can influence students (Malespina et al., 2024). Third, relationships and connections also exert a significant influence on physics learning situations (Dou & Zwolak, 2019).

Intrinsic factors relate to issues concerning students' personal well-being. Based on Figure 10, self-efficacy related to emotional states is significantly associated with anxiety in physics learning. Gupta et al. (2018) and Lamminpaa & Vesterinen (2018) revealed that students' emotional approaches significantly influence retention in learning. Furthermore, gender differences also influence students' cognitive capacity. Malespina et al. (2024) further revealed that gender differences significantly influence anxiety in learning.

These findings are related to cognitive load theory (CLT), a relationship also depicted in Figure 9. Linearity in findings was observed in studies by Tabbers et al. (2004) and Brockbank & Feldon (2024), which suggest that learning content should be tailored to the cognitive capacity of students at specific ages. This content adjustment is carried out to prevent cognitive fatigue in students, which can affect both mental and emotional states (Thalmann et al., 2019; Chen et al., 2023).

The influences previously mentioned cannot be separated from the interaction between the individual and the environment (Maison et al., 2019). The learning context also contributes to anxiety, particularly in exam settings (Roberts & Berry, 2023; Yu et al., 2023). Other conditions further contribute to anxiety, such as monotonous and repetitive activities and a heavy reliance on traditional media for delivering material (Oshiro et al., 2025).

Furthermore, Sugarman & Hardin (2025) note the link between social factors and anxiety. Human interactivity is based on the strength of an individual's network, and this principle also applies in the classroom environment. Teachers, as role models for students, play a significant role in fostering active and student-centered learning through classroom networking (Kamata et al., 2025). An interesting finding from

Masek et al. (2019) also suggests that humour is recommended for reducing stress during student retention. However, applying humour need to be contextual in lesson materials to avoid wasting time in learning process (Robinson et al., 2024).

These three factors (intrinsic, extrinsic, and relational) are interconnected, as modeled in Figure 11. This aligns with Bronfenbrenner's ecological theory, which posits that students are shaped by multiple layers encompassing personal and broader environmental domains (Slavin, 2014; El Zaatari & Maalouf, 2022). This theory is also supported by social constructivism, which argues that an individual's cognitive development can be understood through social and academic influences (Marougkaz et al., 2023).

Theories that reveal potential learning supports significantly benefit pedagogical research. However, if these supporting opportunities are not optimized, they can instead lead to anxiety in the learning process. Insufficient optimization of the Zone of Proximal Development (ZPD) may waste students' time and emotional energy because their long-term memory is not properly facilitated or accommodated (Lambright, 2024; Azizi & Khafaga, 2023).

CONCLUSION

This bibliometric study uncovered several key findings for physics education. Research patterns on physics anxiety showed a significant increase in publications from 2023 to 2025. Indonesia emerged as the top contributing country, while Koul, R. and Stella, M. ranked as the first and second most productive authors, respectively. The findings also indicate highly relevant research, as reflected by the FWCI of Panjaitan et al. (2025). However, this pattern reveals potential discontinuities in the discussions among most authors contributing to this topic. An in-depth analysis of keyword trends further revealed that "self-efficacy" and "motivation" consistently appeared in discussions of physics anxiety, suggesting both have the potential to trigger anxiety in physics learning. Additionally, keywords such as "gender" and "AI learning" emerged in this research domain. Collectively, these keywords form a unified factor structure model divided into three dimensions: intrinsic factors (within the student), extrinsic factors (environmental), and social factors (interactions with others).

Despite providing a comprehensive overview, this study still has several limitations. The bibliometric approach used does not fully capture real empirical conditions in the field. In addition, the number of articles included in the analysis is relatively limited, suggesting that other potential findings may not have been fully represented. These limitations highlight the need for further empirical studies to gain a deeper and more contextualized understanding.

Based on these findings, future research is recommended to optimize empirical approaches in order to directly examine the dynamics of physics anxiety in learning processes. Furthermore, the application of Cognitive Load Theory should receive special attention, particularly in designing learning materials and strategies that align with students' cognitive capacities. This effort is essential to prevent cognitive overload, which may lead to boredom and increased anxiety in physics classrooms.

REFERENCES

Achor, E. E., Kyado, J. J., Ejeh, E. E., & Eba, K. I. (2023). Perceived influence of test anxiety on the academic performance of secondary school students in Physics. *Journal of Research in Science and Mathematics Education (J-RSME), 2*(2), 102-116. https://doi.org/10.56855/jrsme.v2i2.495

Alhusni, H. Z., Prahani, B. K., Sunarti, T., Ramadani, R., & Hamiydah, S. H. (2026). Mapping the Landscape of Reflective Practice in Inquiry Based Physics Education: A Bibliometric Analysis. *Studies in Bibliometrics of Education and Technology*, *1*(1), 45–66.

AlRyalat, S. A. S., Malkawi, L. W., & Momani, S. M. (2019). Comparing bibliometric analysis using PubMed, Scopus, and Web of Science databases. *JoVE (Journal of Visualized Experiments)*, (152), e58494. https://doi.org/10.3791/58494

Arcoverde, Â. R. D. R., Boruchovitch, E., Góes, N. M., & Acee, T. W. (2022). Self-regulated learning of Natural Sciences and Mathematics future teachers: Learning strategies, self-efficacy, and socio-demographic factors. *Psicologia: Reflexão e Crítica*, *35*(1), 1. https://doi.org/10.1186/s41155-021-00203-x

Arribathi, A. H., Suwarto, Miftakhu Rosyad, A., Budiarto, M., Supriyanti, D., & Mulyati, F. (2021). An analysis of student learning anxiety during the COVID-19 pandemic: A study in higher

education. *The Journal of Continuing Higher Education*, *69*(3), 192-205. https://doi.org/10.1080/07377363.2020.1847971

Azizi, Z., & Khafaga, A. F. (2023). Scaffolding via group-dynamic assessment to positively affect motivation, learning anxiety, and willingness to communicate: A case study of high school students. *Journal of Psycholinguistic Research*, *52*(3), 831-851.

Bartling, M., Resch, B., Reichenbacher, T., Havas, C. R., Robinson, A. C., Fabrikant, S. I., & Blaschke, T. (2022). Adapting mobile map application designs to map use context: a review and call for action on potential future research themes. *Cartography and Geographic Information Science*, *49*(3), 237-251. https://doi.org/10.1080/15230406.2021.2015720

Berutu, R., & Mutiawati, M. (2023). Understanding learning anxiety and mental health of final year students: A qualitative study. *ProGCouns: Journal of Professionals in Guidance and Counseling*, *4*(1), 42-51. https://doi.org/10.21831/progcouns.v4i1.60000

Bray, A., & Williams, J. (2020, April). Why is physics hard? Unpacking students' perceptions of physics. In *Journal of Physics: Conference Series,* 1512(1), 012002. https://10.1088/1742-6596/1512/1/012002

Brockbank, R. B., & Feldon, D. F. (2024). Cognitive Reappraisal: The Bridge between Cognitive Load and Emotion. *Education Sciences*, *14*(8), 870. https://doi.org/10.3390/educsci14080870

Chen, O., Paas, F., & Sweller, J. (2023). A cognitive load theory approach to defining and measuring task complexity through element interactivity. *Educational Psychology Review*, *35*(2), 63. https://doi.org/10.1007/s10648-023-09782-w

Damarsha, A. B., Safitri, A. I., Rizki, I. A., Suprapto, N., & Harnawan, A. A. (2023). Mapping and Analyzing High School Physics Misconceptions: Novel Insights from a 20-Year Bibliometric Study (2002-2022). *Berkala Ilmiah Pendidikan Fisika*, *11*(3), 354-369. https://doi.org/10.20527/bipf.v11i3.17256

Damarsha, A. B., Saputra, O., Suprapto, N., Hariyono, E., & Nisa', K. (2025). Integration of Virtual Simulation of Traditional Kekehan Games on The Material of Moment of Inertia and Angular Momentum. *JPPS (Jurnal Penelitian Pendidikan Sains)*, *14*(1), 51–63. https://doi.org/10.26740/jpps.v14n1.p51-63.

Damarsha, A. B., Irani, D. W., Ariana, I. M., Pertiwi, P. M., Suprapto, N., & Hariyono, E. (2025a). Identification of misconceptions of moment of force and moment of inertia in senior high school using CRI method. In *Journal of Physics: Conference Series* (Vol. 3132, No. 1, p. 012009). IOP Publishing. https://10.1088/1742-6596/3132/1/012009

Dou, R., & Zwolak, J. P. (2019). Practitioner's guide to social network analysis: Examining physics anxiety in an active-learning setting. *Physical Review Physics Education Research*, *15*(2), 020105. https://doi.org/10.1103/PhysRevPhysEducRes.15.020105

Durk, J., Smith, A., Rahman, N., & Christie, R. (2024). Exam Experiences, Motivational Beliefs, and Belonging in First-Year University Physics Students: Insights from the COVID-19 Pandemic. *Teaching & Learning Inquiry*, *12*. https://doi.org/10.20343/teachlearninqu.12.30

El Zaatari, W., & Maalouf, I. (2022). How the Bronfenbrenner bio-ecological system theory explains the development of students' sense of belonging to school?. *Sage Open*, *12*(4), 21582440221134089. https://doi.org/10.1177/21582440221134089

González, A., Fernández, M. V. C., & Paoloni, P. V. (2017). Hope and anxiety in physics class: Exploring their motivational antecedents and influence on metacognition and performance. *Journal of Research in Science Teaching*, *54*(5), 558-585. https://doi.org/10.1002/tea.21377

Gungor, A., Eryılmaz, A., & Fakıoglu, T. (2007). The relationship of freshmen's physics achievement and their related affective characteristics. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, *44*(8), 1036-1056. https://doi.org/10.1002/tea.20200

Gupta, A., Elby, A., & Danielak, B. A. (2018). Exploring the entanglement of personal epistemologies and emotions in students' thinking. *Physical Review Physics Education Research*, *14*(1), 010129. https://doi.org/10.1103/PhysRevPhysEducRes.14.010129

Kamata, N., Koul, R., Tanitteerapan, T., & Srisupawong, Y. (2025). Teacher-student relationships, classroom anxiety, and physics identity of high school students. *Eurasia Journal of Mathematics, Science and Technology Education*, *21*(7), em2657. https://doi.org/10.29333/ejmste/16559

Lambright, K. (2024). The effect of a teacher's mindset on the cascading zones of proximal development: A systematic review. *Technology, Knowledge and Learning*, *29*(3), 1313-1329. https://doi.org/10.1007/s10758-023-09696-0

Lamminpää, J., & Vesterinen, V. M. (2018). The use of humour during a collaborative inquiry. *International Journal of Science Education*, *40*(14), 1718-1735. https://doi.org/10.1080/09500693.2018.1508926

Lund, B. D., Mannuru, N. R., & Agbaji, D. (2024). AI anxiety and fear: A look at perspectives of information science students and professionals towards artificial intelligence. *Journal of Information Science*, 01655515241282001. https://doi.org/10.1177/01655515241282001

Malespina, A., Seifollahi, F., & Singh, C. (2024). Bioscience students in physics courses with higher test anxiety have lower grades on high-stakes assessments and women report more test anxiety than men. *Education Sciences*, *14*(10), 1092. https://doi.org/10.3390/educsci14101092

Malespina, A., & Singh, C. (2024). Introductory physics during COVID-19 remote instruction: Gender gaps in exams are eliminated, but test anxiety and self-efficacy still predict success. *European Journal of Physics*, *45*(4), 045710. https://doi.org/10.1088/1361-6404/ad57b2

Maison, Syahrial, Syamsurizal, & Tanti. (2019). Learning environment, students' beliefs, and self-regulation in learning physics: Structural equation modeling. *Journal of Baltic Science Education*, *18*(3), 389.

Mendoza-Lizcano, S. M., Palacios Alvarado, W. L. A. M. Y. R., & Medina Delgado, B. (2020). Influence of COVID-19 confinement on physics learning in engineering and science students. In *Journal of Physics: Conference Series*, 1671(1), 012018. https://doi.org/10.1088/1742-6596/1671/1/012018

Miedijensky, S., Sasson, I., & Yehuda, I. (2021). Teachers' learning communities for developing high order thinking skills—a case study of a school pedagogical change. *Interchange*, *52*(4), 577-598. https://doi.org/10.1007/s10780-021-09423-7

Molin, F., Cabus, S., Haelermans, C., & Groot, W. (2021). Toward reducing anxiety and increasing performance in physics education: Evidence from a randomized experiment. *Research in Science Education*, *51*(Suppl 1), 233-249. https://doi.org/10.1007/s11165-019-9845-9

Mufit, F., Asrizal, Hanum S.A., Fadhilah, A. (2020). Preliminary Research in The Development of Physics Teaching Materials that Integrate New Literacy and Disaster Literacy. IOP *Conf. Series: Journal of Physics: Conf. Series*, *148*. https://doi.org/10.1088/1742-6596/1481/1/012041

Oshiro, N., Ueda, T., & Nakasho, K. (2025). Design and Evaluation of Learning Support Features for Projectile Motion in the VR Application Holothrow. In *2025 25th International Conference on Control, Automation and Systems (ICCAS),* 1615-1620. https://doi.org/10.23919/ICCAS66577.2025.11301149

Oyewola, D. O., & Dada, E. G. (2022). Exploring machine learning: a scientometrics approach using bibliometrix and VOSviewer. *SN Applied Sciences*, *4*(5), 143. https://doi.org/10.1007/s42452-022-05027-7

Page, M. J., Moher, D., & McKenzie, J. E. (2022). Introduction to PRISMA 2020 and implications for research synthesis methodologists. *Research synthesis methods*, *13*(2), 156-163. https://doi.org/10.1002/jrsm.1535

Panjaitan, M. B., Hamdanah, H., Sirait, J., Sutikno, S., Fatmawati, E., Herman, H., & Mamadiyarov, Z. (2025). The role of emotional regulation in shaping students'perception of physics problemsolving tasks. *TPM–Testing, Psychometrics, Methodology in Applied Psychology*, *32*(2), 1109-1118.

Pessin, V. Z., Yamane, L. H., & Siman, R. R. (2022). Smart bibliometrics: an integrated method of science mapping and bibliometric analysis. *Scientometrics*, *127*(6), 3695-3718. https://doi.org/10.1007/s11192-022-04406-6

Prahani, B. K., Rizki, I. A., Suprapto, N., Irwanto, I., & Kurtuluş, M. A. (2024). Mapping research on scientific creativity: A bibliometric review of the literature in the last 20 years. *Thinking Skills and Creativity*, 52, 101495. https://doi.org/10.1016/j.tsc.2024.101495

Resbiantoro, G., & Setiani, R. (2022). A review of misconception in physics: the diagnosis, causes, and remediation. *Journal of Turkish Science Education*, *19*(2), 403-427. https://doi.org/10.36681/

Roberts, L., & Berry, J. (2023). Should open-book, open-web exams replace traditional closed-book exams in STEM? An evaluation of their effectiveness in different disciplines. *Journal of Learning Development in Higher Education*, (28). https://doi.org/10.47408/jldhe.vi28.1030

Robinson, H. L., Rose, S. E., Elliott, J. M., & Vivaldi, R. A. (2024). Teachers' humour use in the classroom: A scoping review. *Educational Psychology Review*, *36*(3), 73. https://doi.org/10.1007/s10648-024-09913-x

Rusmaya, A., & Utami, P. L. (2026). From Theory to Immersion on Ten Years of Augmented Reality in Physics Learning: A Comprehensive Bibliometric Analysis. *Studies in Bibliometrics of Education and Technology*, *1*(1), 10–21

Saphira, H. V., Prahani, B. K., Jatmiko, B., Sunarti, T., & Andari, S. (2024). Unlocking the Potential of Digital Learning: A Bibliometric Analysis of Learning and Teaching in Digital Learning Environments. In *Proceedings of the 2024 8th International Conference on Education and Multimedia Technology*. 242-248. https://doi.org/10.1145/3678726.3678756

Singh, A., Kapoor, N., Kumar, A., Sharma, R., & Kumar, M. (2025). "Ecotourism" and "Sustainability": A Bibliometrics Analysis using Biblioshiny and VOS viewer. *Journal of Environmental Management & Tourism, 16*(1), 49-67. https://doi.org/10.14505/jemt.v16.1(77).04

Slavin, R. E. (2014). *Educational psychology: Theory and practice* (Vol. 142). London: Pearson.

Sofita, M., Damarsha, A. B., Prasetya, J. E., Yuliatin, E. D., Rahma, N. F., Jauhariyah, M. N. R., & Saphira, H. V. (2025). Human Versus Artificial Intelligence in Creative Physics Thinking: A Philosophical Reflection on Learning and Cognition. *Studies in Philosophy of Science and Education*, *5*(3). https://doi.org/10.46627/sipose.v5i3.676

Sugarman, S., & Hardin, H. (2025). Radiation Communication: Thoughts and Considerations. *Health Physics*, *128*(3), 257-263. https://doi.org/10.1097/HP.0000000000001871

Suprapto, N., Sukarmin, S., Puspitawati, R. P., Erman, E., Savitri, D., Ku, C. H., & Mubarok, H. (2021). Research trend on TPACK through bibliometric analysis (2015-2019). *International journal of evaluation and research in education*, 10(4), 1375-1385. https://doi.org/10.11591/ijere.v10i4.22062

Tabbers, H. K., Martens, R. L., & Van Merriënboer, J. J. (2004). Multimedia instructions and cognitive load theory: Effects of modality and cueing. *British journal of educational psychology*, *74*(1), 71-81.

Taibu, R., & Ferrari-Bridgers, F. (2020). Physics language anxiety among students in introductory physics course. *EURASIA Journal of Mathematics, Science and Technology Education*, *16*(4), em1835. https://doi.org/10.29333/ejmste/111993

Thalmann, M., Souza, A. S., & Oberauer, K. (2019). How does chunking help working memory?. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *45*(1), 37. https://doi.org/10.1037/xlm0000578

Thangavel, P., & Chandra, B. (2023). Two decades of M-commerce consumer research: A bibliometric analysis using R biblioshiny. *Sustainability*, *15*(15), 11835. https://doi.org/10.3390/su151511835

Torres-Rivera, A. D., Guevara-Valdez, J. A., & Cruz-Morales, V. (2025). Energy transition and sustainability education: Bibliometric insights for holistic graduate program design. *Energy Strategy Reviews*, *59*, 101768. https://doi.org/10.1016/j.esr.2025.101768

Tudge, J. R., Merçon-Vargas, E. A., Liang, Y., & Payir, A. (2022). The importance of Urie Bronfenbrenner's bioecological theory for early childhood education. In *Theories of early childhood education* (pp. 50-61). Routledge.

Veiga, G. R. S., da Silva, G. A. P., Padilha, B. M., & de Carvalho Lima, M. (2023). Determining factors of child linear growth from the viewpoint of Bronfenbrenner's Bioecological Theory. *Jornal de pediatria*, *99*(3), 205-218. https://doi.org/10.1016/j.jped.2022.10.009

Wang, H., Sun, F., Su, J., Bold, S., & Koondhar, M. A. (2025). Mapping research trends and identifying missing research gaps in green environment and public health: a bibliometric analysis for 2003–2021. *Environment, Development and Sustainability*, *27*(2), 3343-3372. https://doi.org/10.1007/s10668-023-04018-x

Xu, T., & Wang, H. (2023). High prevalence of anxiety, depression, and stress among remote learning students during the COVID-19 pandemic: Evidence from a meta-analysis. *Frontiers in psychology*, *13*, 1103925. https://doi.org/10.3389/fpsyg.2022.1103925

Yu, S., Liu, Q., Ma, J., Le, H., & Ba, S. (2023). Applying Augmented reality to enhance physics laboratory experience: does learning anxiety matter?. *Interactive Learning Environments*, *31*(10), 6952-6967. https://doi.org/10.1080/10494820.2022.2057547

Author (s):

Joenathan Eka Prasetya (Corresponding Author)
Department of Physics Education, Faculty of Mathematics and Natural Sciences,
Universitas Negeri Surabaya, Indonesia
Email: joenathan.23011@mhs.unesa.ac.id

Adrian Bagas Damarsha
Master Program of Science Education, Faculty of Mathematics and Natural Science,
Universitas Negeri Surabaya, Indonesia
Email: 24031635009@mhs.unesa.ac.id

Mita Sofita
Department of Physics Education, Faculty of Mathematics and Natural Sciences,
Universitas Negeri Surabaya, Indonesia
Email: mita.23141@mhs.unesa.ac.id

Hanandita Veda Saphira
Master of Digital Technologies for Learning, Faculty of the Arts, Social Sciences and Humanities,
University of Wollongong, New South Wales, Australia
Email: hanandita.saphira@outlook.com