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Local Wisdom-based Computational Thinking Diagnostic Test: A Bibliometric Analysis Mapping State-of-the-Art and Research Gaps

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Abstract

This research aims to prove the novelty of research related to the implementation of diagnostic tests to improve computational thinking skills based on local wisdom using bibliometric analysis. This type of research uses qualitative descriptive research. The data collection technique uses secondary data in the form of literature from the Google Scholar database. Data analysis uses bibliometric analysis with the help of VOSviewer software. The results of this study indicate that the topics of Computational Thinking, Diagnostic Test, and Local Wisdom have not been found research with these topics, so there are opportunities for research by collaborating topics.

Keywords*: bibliometric, computational thinking, diagnostic test, local wisdom*

Abstrak

Tujuan penelitian ini adalah untuk membuktikan kebaruan penelitian terkait implementasi tes diagnostik untuk meningkatkan kemampuan computational thinking berbasis local wisdom menggunakan analisis bibliometrik. Jenis penelitian ini menggunakan penelitian deskriptif kualitatif. Teknik pengumpulan data menggunakan data sekunder berupa literatur dari database Google Scholar. Analisis data menggunakan analisis bibliometrik dengan bantuan *software* VOSviewer. Hasil penelitian ini menunjukkan bahwa topik

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Computational Thinking, Diagnostic Test, dan *Local Wisdom* belum ditemukan penelitian dengan topik tersebut, sehingga terdapat peluang untuk dilakukannya penelitian dengan mengkolaborasikan topik-topik tersebut.

Kata kunci: bibliometrik, computational thinking, local wisdom, tes diagnostic

Introduction

Computational thinking (CT) skills are essential in preparing students to face challenges in the era of disruption.[1][2] In an increasingly digital and data-driven world, computational thinking skills are more than just learning how to code, they include a structured approach to problem-solving and critical thinking that can be applied across multiple disciplines and real-life situations. [3] Computational thinking fosters problem-solving skills, enabling students to break down complex problems into manageable steps and develop effective strategies for solving them. [4] By encouraging students to develop computational thinking skills, educators empower them to become active problem creators and solvers, not just passive consumers of technology.

[1] Maulina, Hervin, Abdurrahman Abdurrahman, and Ismu Sukamto. "How to Bring Computational Thinking Approach to the Non-Computer Sciences Studen'ts Class?" *Jurnal Pembelajaran Fisika* 9, no. 1 (2021): 101–12.
[2] Aminah, Neneng, Siti Mistima Maat, and Sudarsono. "Computational Thinking of Prospective Mathematics Teacher Viewed from Entrepreneur Character." *Mosharafa: Jurnal Pendidikan Matematika* 12, no. 2 (2023): 267–78.
[3] Agung Nugroho Pramudhita, Vipkas Al Hadid Firdaus, and Odhitya Desta Triwisdrananta, "Peningkatan Kemampuan Computational Thinking Untuk Guru Pendidikan Dasar Di Malang," *J-INDEKS* 7, no. 1 (2022): 72–83,
[4] Wenda Novayani et al., "Penerapan Computational Thinking Melalui Media Permainan Robot Untuk Melatih Kemampuan Critical Thinking Siswa SMK Taruna Persada Dumai," *Jurnal Inovasi Terapan Pengabdian Masyarakat* 1, no. 2 (2023): 31–39, https://doi.org/10.35143/jiter-pm.v1i2.5997.

Computational thinking equips students with the ability to solve complex problems into smaller, more manageable parts.[5] This process, known as decomposition, allows students to analyze and understand the underlying components of a problem before attempting to solve it. Furthermore, computational thinking also encourages algorithmic thinking, where students learn to design a step-by-step process to overcome challenges.[6] In addition, computational thinking encourages pattern recognition and abstraction[7], which allows students to identify similarities in different problems and create general solutions.

To solve problems in society, especially in the realm of local wisdom, the concept of computational thinking can be applied. The application of computational thinking to local wisdom can create a strong synergy between traditional knowledge and modern problem-solving techniques. Therefore, the application of computational thinking skills based on local wisdom is a valuable approach to preserve cultural heritage, address contemporary challenges, and promote sustainable development in society. By integrating computational thinking and local wisdom, students as part of society can enhance their ability to address contemporary challenges and preserve their cultural heritage.[8]

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[5] Swasti Maharani et al., *Computational Thinking Pemecahan Masalah Di Abad Ke-21* (WADE Group National Publishing, 2020).

[6] Margaretha P.N Rozandy and Yosafat P Koten, "SCRATCH Sebagai Problem Solving Computational Thinking Dalam Kurikulum Prototipe," *Jurnal In Create (Inovasi Dan Kreasi Dalam Teknologi Informasi)* 8 (2021): 11–17.

[7] Muslimawati, Ika, Edga Mahatma Kafi, Christiyanti Aprinastuti, and Mike Wadina. "Implementasi Computational Thingking Pada Pembelajaran Tematik Gerak Keseharian Dan Alam Dalam Tari Serta Mengukur Berat Benda Dalam Satuan Baku Kelas 2 Tema 6 Subtema 2." *Indonnesian Journal of Education and Teaching Innovation* 2, no. 2 (2023): 72–86.

[8] Inge Ayudia et al., *Pengembangan Kurikulum* (Deli Serdang: PT. Mifandi Mandiri Digital, 2023).

Applying computational thinking skills based on local wisdom can be a transformative approach, especially in learning information technology research. Integrating traditional knowledge and practices with modern computational methods can enrich the research process, resulting in innovative and contextually relevant solutions. In the field of information technology research, computational thinking can assist in data analysis, algorithm design, and modeling, by leveraging the depth of local wisdom to address complex problems. By using computational methods to analyze and interpret this data, researchers can gain valuable insights that may not be possible through conventional research approaches.

Thus, the application of computational thinking based on local wisdom can revolutionize information technology research. By utilizing the collective knowledge of communities and combining it with computational methods, researchers can generate culturally relevant solutions that meet the needs and aspirations of the communities they aim to serve. This approach not only improves the quality of research outcomes, but also promotes more inclusive, sustainable, and responsible technology integration in local contexts. Seeing the importance of applying computational thinking based on local wisdom in information technology research, an assessment is needed to measure student abilities. To measure students' abilities, a diagnostic test is needed to improve the ability of computational thinking based on local wisdom in learning information technology research.

The diagnostic test is aimed at detecting the difficulties faced by students in applying computational thinking in learning

information technology research.[9][10] Diagnostic tests are designed to assess students' abilities in the basic concepts of computational thinking with the aim of evaluating students' ability to analyze problems, design efficient solutions, and apply computational strategies to real-world challenges. However, the implementation of diagnostic tests to improve local wisdom-based computational thinking skills in information technology research learning has not been found. This can be seen in several studies that only discuss the application of computational thinking diagnostic tests in STEM (Science, Technology, Engineering, and Math)-based learning. [11][12][13][14][15]. Considering this, this study aims to prove the novelty of research related to the implementation of diagnostic tests to

[9] Komalawati, Rina. "Manajemen Pelaksanaan Tes Diagnostik Awal Di Sekolah Dasar Pasca Belajar Dari Rumah Untuk Mengidentifikasi Learning Loss." *Jurnal Edupena* 1, no. 2 (2020): 135–48.

[10] Iriyadi, Deni, Ahmad Rustam, and Ahmad. "Integrasi Pembelajaran Remedial Dan Tes Diagnostik." *Sultra Educational Journal* 2, no. 2 (2022): 78–86.

[11] Sagala, Rumadani, Rofiqul Umam, Audi Thahir, Antomi Saregar, and Indah Wardani. "The Effectiveness of Stem-Based on Gender Differences: The Impact of Physics Concept Understanding." *European Journal of Educational Research* 8, no. 3 (2019): 753–61. https://doi.org/10.12973/eu-jer.8.3.753.

[12] Anwar, Vita Nova, and Tatang Herman. "Analisis Bibliometrik Tren Publikasi Pendekatan Stem Berbasis Computational Thinking Dalam Pembelajaran Matematika." *Jurnal Pembelajaran Matematika Inovatif* 5, no. 5 (2022): 1387–96. https://doi.org/10.22460/jpmi.v5i5.1387-1396.

[13] Fauzan, Bambang Ahmad, St Faridah Akbar, Dedi Kusnadi, and Ahsan Sofyan. "Changes in Students' Cognitive Abilities through Stem-Based Learning in Elementary Schools." *Mosharafa: Jurnal Pendidikan Matematika* 12, no. 1 (2023): 89–100. https://doi.org/10.31980/mosharafa.v12i1.2122.Mart

[14] Martawijaya, M. A., S. Rahmadhanningsih, A. Swandi, M. Hasyim, and E. H. Sujiono. "The Effect of Applying the Ethno-Stem-Project-Based Learning Model on Students' Higher-Order Thinking Skill and Misconception of Physics Topics Related to Lake Tempe, Indonesia." *Jurnal Pendidikan IPA Indonesia* 12, no. 1 (2023): 1–13. https://doi.org/10.15294/jpii.v12i1.38703.

[15] Sinta, Carolina, Dea Kristiandari, Mohammad Ali Akbar, and Kintan Limiansih. "Integrasi Computational Thinking Dan Stem Dalam Pembelajaran IPA Pada Siswa Kelas V-B SD Kanisius Kadirojo." *INNOVATIVE: Journal Of Social Science Research* 3, no. 2 (2023): 4794–4806.

improve local wisdom-based computational thinking skills using bibliometric analysis.

Research Methods

This type of research uses qualitative descriptive research. Qualitative descriptive research is used to describe research trends and analyze the novelty of VOSviewer output. The data collection technique uses secondary data in the form of literature from the Google Scholar database. Data analysis uses bibliometric analysis. There are 5 stages in conducting bibliometric analysis, namely (1) defining search keywords, (2) initial search results, (3) refining search results, (4) compiling initial data statistics, and (5) data analysis. [16][17][18][19][20]

Research Results and Discussion

Bibliometric Analysis

Defining Search Keyword

The keywords "Computational Thinking, Diagnostic Test, Local Wisdom" were used to conduct a literature search in the

[16] Setyaningsih, Ira, Nurul Indarti, and Ferry Jie. "Bibliometric Analysis of the Term 'Green Manufacturing.'" *International Journal of Management Concepts and Philosophy* 11, no. 3 (2018): 315–39. https://doi.org/10.1504/ijmcp.2018.093500.
[17] Ilhami, M. A., Subagyo, and N. A. Masruroh. "Bibliometric Analysis of the Term 'Three-Dimensional Concurrent Engineering.'" IOP Conference Series: Materials Science and Engineering 673, no. 012077 (2019).
[18] Haq, Ahsanul, and Muhammad Bahit. "Visualization and Bibliometric Analysis of Fintech Trend Research." In *Proceedings of the 3rd Annual International Conference on Public and Business Administration (AICoBPA 2020)*, 191:80–84, 2021. https://doi.org/10.2991/aebmr.k.210928.017.
[19] Napitupulu, Darmawan. "Bibliometric Analysis of E-Government Research." *Library Philosophy and Practice* 5861 (2021): 1–20.
[20] Mutia, Ulmi Sri, Fatmawati, and Abdul Mahsyar. "Research Trends on Collaborative Governance Approaches in the Developing Country : A Bibliometric Analysis." In *Proceeding: International Conference Multi-Disclipines Approaches for the Sustainable Development*, 163–70, 2023.

Google Scholar database. The selection of keywords was written in the document sub-section, namely the search document. The "publication name, keywords, years" format in the Google Scholar database was chosen to find more literature.

Initial Search Result & Refinement of the Search Result

The initial literature search, researchers determined the range of years of publication of articles ranging from 2018 to 2023. Based on the initial search, 100 relevant articles were found with the keywords "Computational Thinking, Diagnostic Test, Local Wisdom". Then, a filtering process was carried out on articles that did not meet the criteria. The results of data filtering can be seen in Table 1.

Table 1. Article Screening Criteria

Search Screening	**Number of Articles**
Unidentified/citation link only/rejected website	2
Less than four pages	-
Not in English	-
Not open access	6
Total	92

After filtering the articles, out of 100 articles there are 8 articles that do not meet the criteria. Therefore, researchers used 92 articles that met the criteria for further analysis. Comparison of data matrix before and after filtering can be seen in Table 2.

Table 2. Data Matrix Comparison

Matrix Data	**Initial Search**	**Refinement Search**
Source	Journal	Journal
Publication year	2018-2023	2018-2023
Paper	100	92
Citation	5367	5292
Cite/year	1073.40	1058.40
Author/paper	3.55	3.57

Matrix Data	Initial Search	Refinement Search
h-indeks	34	34
g-index	72	72
hI,norm	19	19
hI,annual	3.80	3.80
hA-index	21	21

Furthermore, 92 articles that fit the criteria obtained the top 10 articles that have the most citations displayed in Table 3.

Table 3. Top 10 Articles

Year	Author	Title	Publication	Cites
2020	Sarah Dryhurst, Claudia R. Schneider, John Kerr, Alexandra L. J. Freeman, Gabriel Recchia, Anne Marthe van der Bles, David Spiegelhalter, Sander van der Linden	Risk perceptions of COVID-19 around the world	Journal of Risk Research	1621
2018	Kun Lan, Dan-tong Wang, Simon Fong, Lian-sheng Liu, Kelvin K. L. Wong & Nilanjan Dey	A survey of data mining and deep learning in bioinformatics	Journal of Medical Systems	227
2018	Xin Yi & Paul Babyn	Sharpness-aware low-dose CT denoising using conditional generative adversarial network	Journal of Digital Imaging	225

2021	Connor Shorten, Taghi M. Khoshgoftaar & Borko Furht	Deep Learning applications for COVID-19	Journal of Big Data	225
2018	Katarina Rus, Vojko Kilar, David Koren	Resilience assessment of complex urban systems to natural disasters: A new literature review	International Journal of Disaster Risk Reduction	211
2019	Hye Yoon Chang, Chan Kwon Jung, Junwoo Isaac Woo, Sanghun Lee, Joonyoung Cho, Sun Woo Kim, Tae-Yeong Kwak	Artificial intelligence in pathology	Journal of Pathology and Translational Medicine	152
2020	Laura Bradford, Mateo Aboy, Kathleen Liddell	COVID-19 contact tracing apps: a stress test for privacy, the GDPR, and data protection regimes	Journal of Law and the Biosciences	145
2020	Abu Sufian, Anirudha Ghosh, Ali Safaa Sadiq, Florentin Smarandache	A survey on deep transfer learning to edge computing for mitigating the COVID-19 pandemic	Journal of Systems Architecture	126
2019	Wei Sun, Xiongkuo Min, Guangtao Zhai, Ke Gu, Huiyu Duan	MC360IQA: A multi-channel CNN for blind 360-degree image quality assessment	IEEE Journal of Selected Topics in Signal Processing	117
2020	Anees Abrol, Manish Bhattarai, Alex Fedorov, Yuhui	Deep residual learning for neuroimaging: an application to predict	Journal of Neuroscience Methods	98

Du, Sergey Plis, Vince Calhoun	progression to Alzheimer's disease

Compiling the Initial Data Statistics

Compiling the initial statistical data from 92 articles is then analyzed to obtain statistical results in the form of scientific article production.

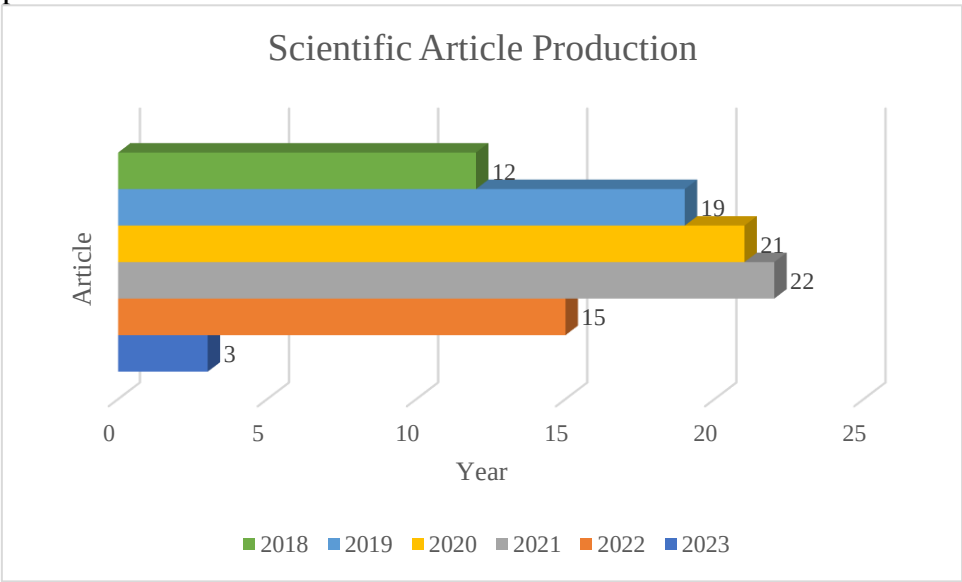

Figure 1. Scientific Article Production

Based on Figure 1, it is known that the production of scientific articles in 2018 has 12 publications, 2019 has increased publications to 19 articles, 2020 has increased publications to 22 articles, 2021 has decreased publications to 21 articles and 2023 only 3 new articles have been published.

Data Analysis

Analisis data dari 92 artikel yang diperoleh dari proses penyaringan Data analysis of 92 articles obtained from the filtering process is then stored in RIS format and analyzed using VOSviewer. The results of VOSviewer data analysis can be seen in the network visualization, overlay visualization and density visualization.

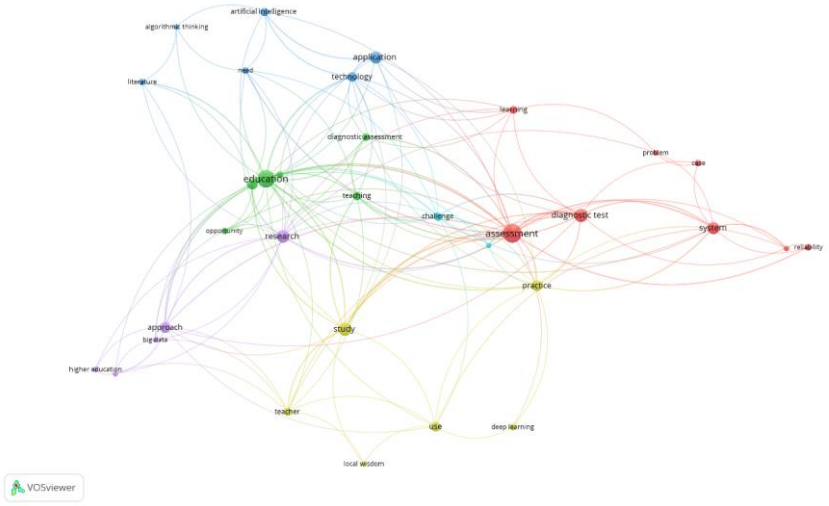

Figure 2. Network Visualization

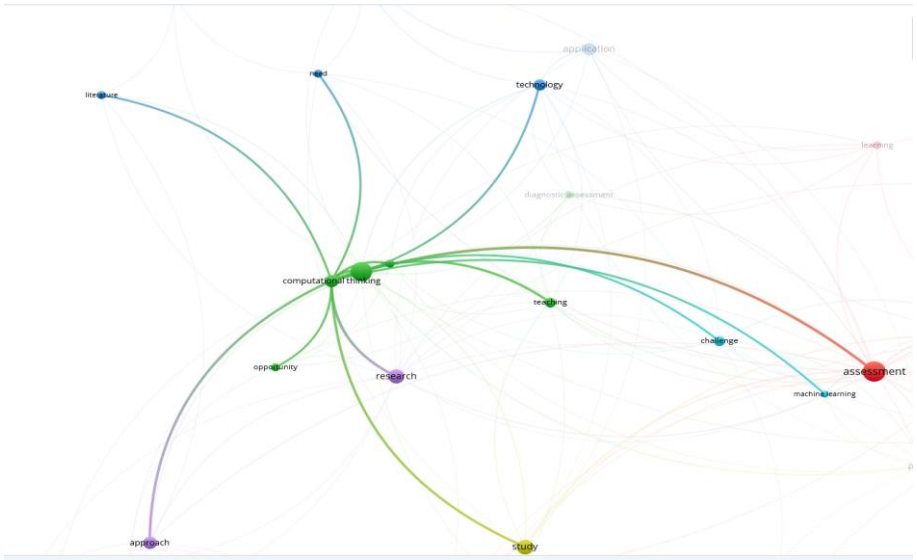

Figure 3. Network Visualization_ Computational Thinking

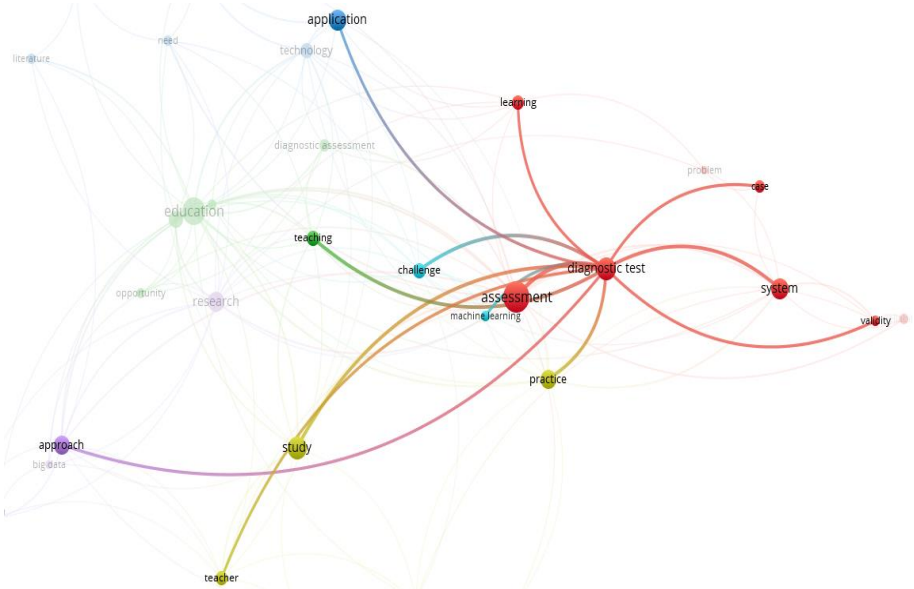

Figure 4. Network Visualization_Diagnostic Test

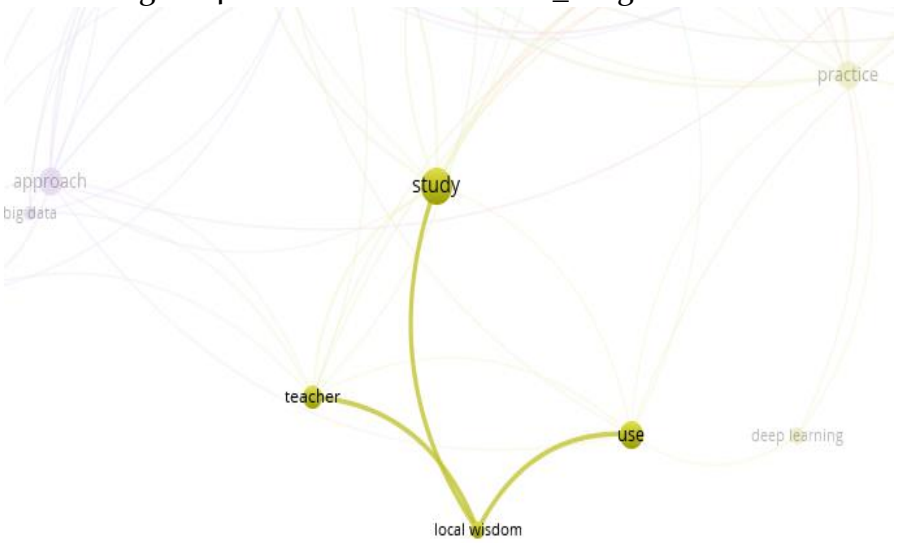

Figure 5. Network Visualization_Local Wisdom

The results of network visualization are 6 cluster colors associated with 72 keyword items that represent each cluster. The following is a description of each cluster: 1) **cluster 1** in red consists of 8 items, namely assessment, case, diagnostic test, learning, problem, reliability, system, validity; 2) **cluster 2** in green consists

of 6 items, namely computational thinking, diagnostic assessment, education, opportunity, stem, teaching; 3) **cluster 3** in blue consists of 6 items, namely algorithmic thinking, application, artificial intelligence, literature, need, technology; 4) **cluster 4** in yellow consists of 6 items, namely deep learning, local wisdom, practice, study, teacher, use; 5) **cluster 5** in purple consists of 5 items, namely approach, big data, higher education, learner, research; 6) **cluster 6** in light blue consists of 2 items, namely challenge, machine learning. In relation to that, the network visualization output in Figure 1 displays the spheres that form a network between the spheres, there are large spheres and small spheres. The small circle in network visualization is a keyword that is still not widely discussed in scientific articles[21][22], so there is an opportunity for researchers to make research using or combining these keywords.

Referring to Figure 3, Figure 4, Figure 5, it is known that the keywords "Computational Thinking, Diagnostic Test, Local Wisdom" have small spheres and do not form a network. Thus, researchers are interested in combining these three keywords to conduct research. This is because, the three keywords have not found many research results and are not connected to each other so there is an opportunity for researchers to conduct renewable research by combining the three keywords.

[21] Karim, Arifin, Joko Soebagyo, Rahma Puspa Nuranti, and Ana Luklu Uljanah. "Analisis Bibliometrik Menggunakan Vosviewer Terhadap Trend Riset Matematika Terapan Di Google Scholar." *Jurnal Riset Pendidikan Matematika Jakarta* 3, no. 2 (2022): 23–33. https://doi.org/10.21009/jrpmj.v3i2.22264.

[22] Novia, Tri, and Ahmad Toni. "Analisis Bibliometrik Jurnal Komunikasi Tahun 2010 -2022." *Syntax Literate ; Jurnal Ilmiah Indonesia* 7, no. 6 (2022): 8561–79.

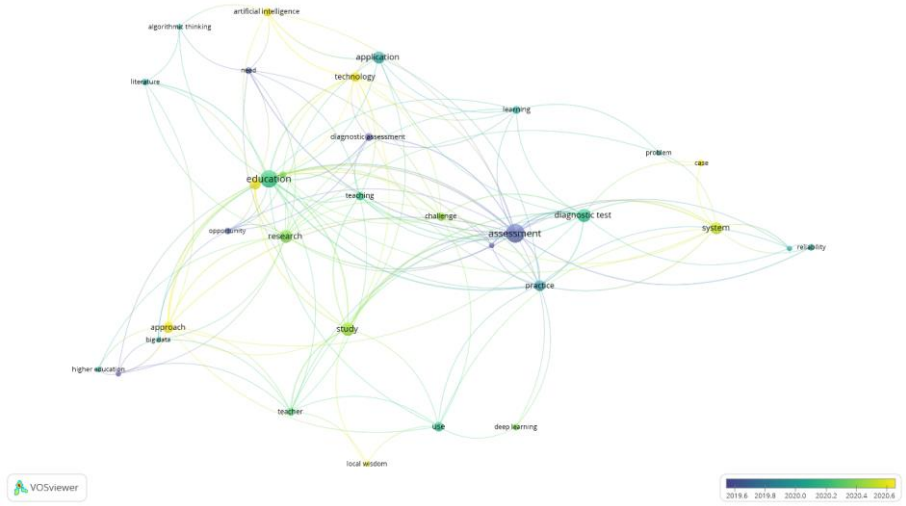

Figure 6. Overlay Visualization

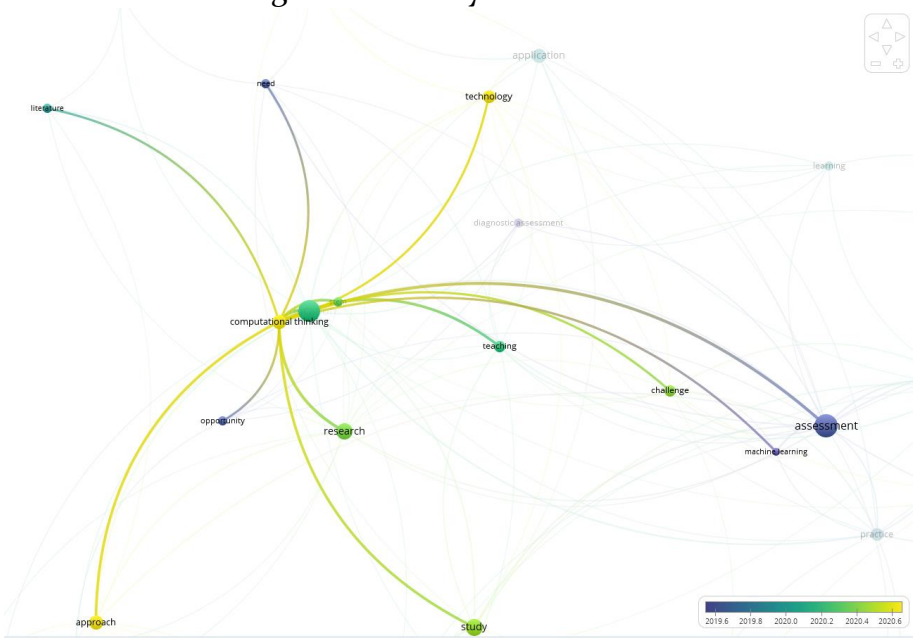

Figure 7. Overlay Visualization_Computational Thinking

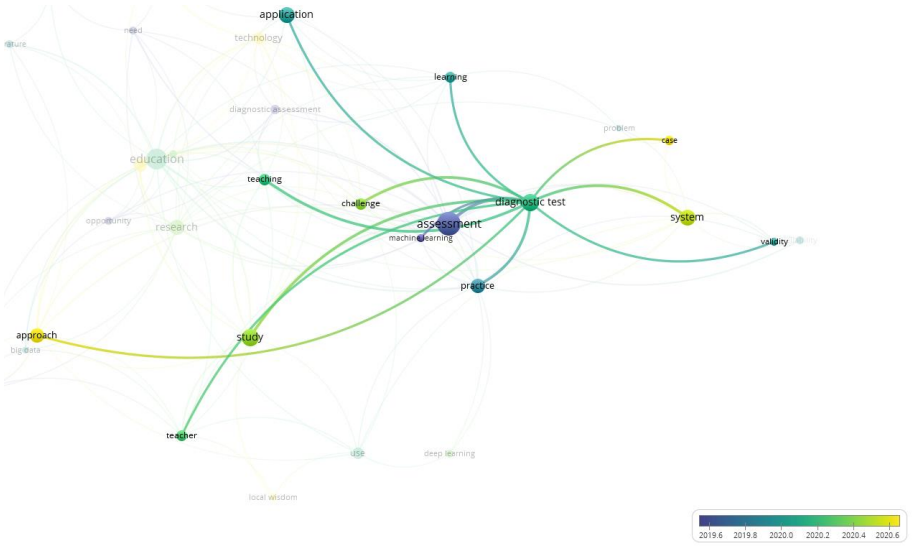

Figure 8. Overlay Visualization_Diagnostic Test

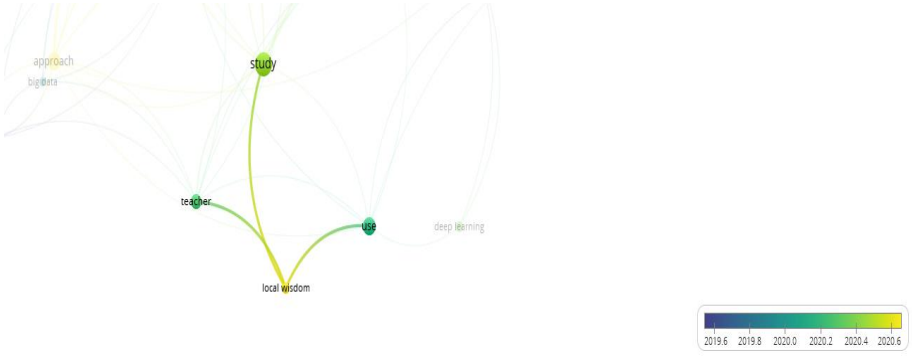

Figure 9. Overlay Visualization_Local Wisdom

The results of the overlay visualization output in Figure 6 show several research topics based on the year of publication of the research results. When viewed in Figures 7 and 9 the topics of Computational Thinking and Local Wisdom have yellow circles, which means that the research topic was published in 2020 in quarter 6. Meanwhile, in Figure 8 the Diagnostic Test topic has a dark green circle, meaning that the research topic was published in 2020 quarter 2. The meaning of the color of the circle on the overlay visualization means that the darker the color of the year, the older the year of publication of the scientific article, on the other hand,

the brighter the color of the year, the more recent the year of publication of the scientific article on the topic concerned [23][24][25][26][27]. Thus, it can be said that the combination of Computational Thinking, Diagnostic Test, and Local Wisdom topics is a popular topic category for further research.

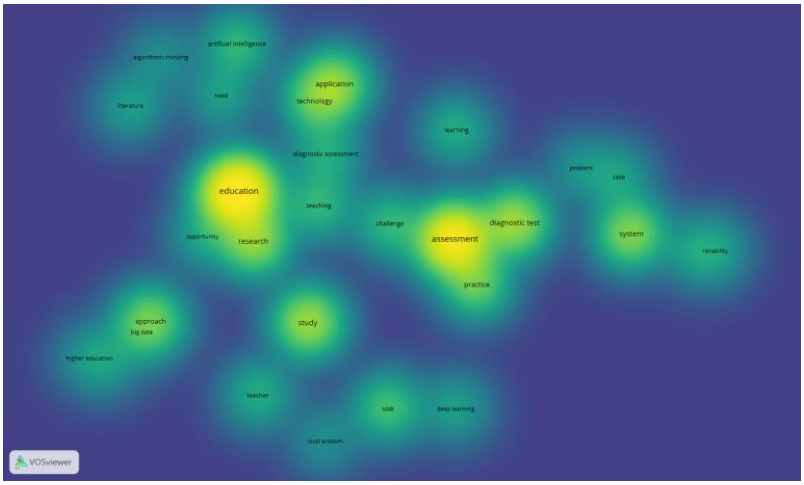

Figure 10. Density Visualization

[23] Effendi, Denti Nanda, Irwandani, Welly Anggraini, Agus Jatmiko, Henita Rahmayanti, Ilmi Zajuli Ichsan, and Md Mehadi Rahman. "Bibliometric Analysis of Scientific Literacy Using VOS Viewer: Analysis of Science Education." *Journal of Physics: Conference Series* 1796, no. 1 (2021): 012096. https://doi.org/10.1088/1742-6596/1796/1/012096.

[24] Finandhita, Alif, Raiswati Unsta Mega, Rizky Jumansyah, Agis Abhi Rafdhi, and Dina Oktafiani. "VOSviewer Application Analysis: Computational Physical Chemistry Case Study." *Moroccan Journal of Chemistry* 10, no. 1 (2022): 91–101. https://doi.org/10.48317/IMIST.PRSM/morjchem-v10i1.31756.Afan

[25] Afandi, Kurnia Ningsih, Mustika Sari, Syavira Indiyani, and Eflin Djaroneh. "Bibliometric Analysis of Environmental Literacy: A Systematic Literature Review Using VOSviewer." In *AIP Conference Proceedings*, 2751:020001, 2023.

[26] Fauzan, Tegar Ahmad, and Eddy Soeryanto Soegoto. "Computational Bibliometric Analysis of Education Technology Using VOSviewer Application with Publish or Perish (Using Google Scholar)." *Journal of Engineering Science and Technology* 18, no. 3 (2023): 1498–1508.

[27] Jumansyah, Rizky, Eddy Soeryanto Soegoto, and Chepi Nur Albar. "Computational Bibliometric Analysis of Evolutionary Game Theory (Egt) Research Using Vosviewer." *Journal of Engineering Science and Technology* 18, no. 2 (2023): 1153–63.

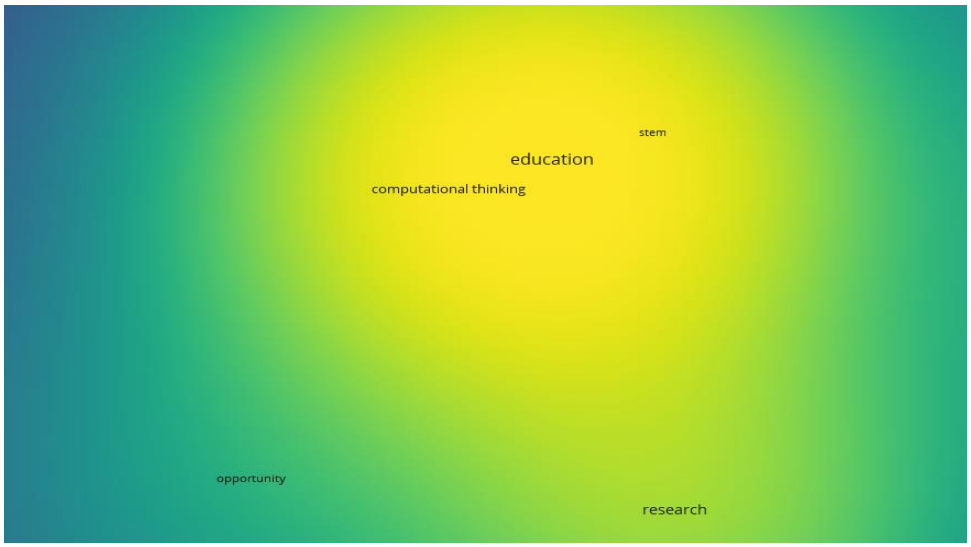

Figure 11. Density Visualization_Computational Thinking

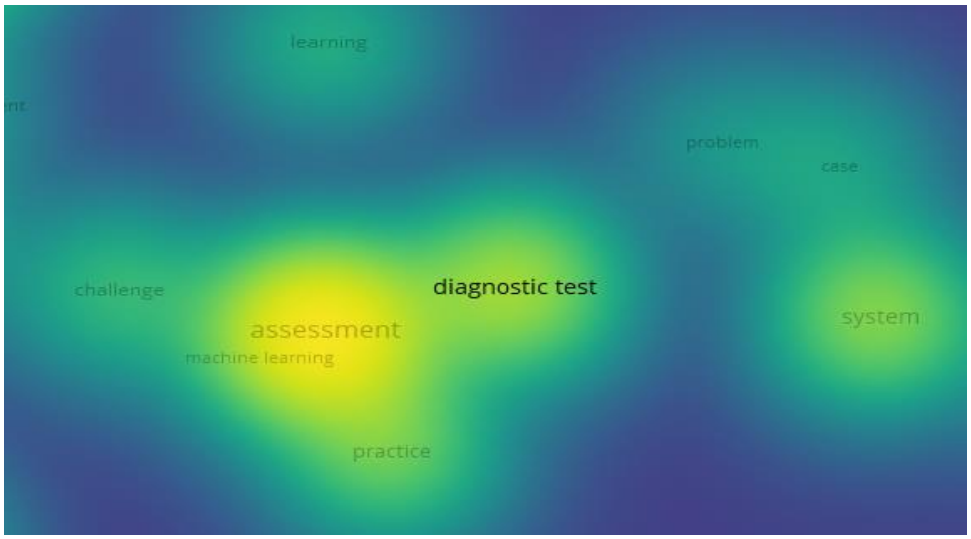

Figure 12. Density Visualization_Diagnostic Test

Figure 13. Density Visualization_Local Wisdom

The results of the density visualization output in Figure 10 show some research topics that are dim and bright. The meaning of color in the density visualization output, namely the dimmer the color, the topics are still rarely researched, on the other hand the brighter the color, the research topics have been widely researched.[28][29][30][31][32] If you look at Figure 11, the topic of Computational Thinking is bright yellow, meaning that the research topic has been widely studied. Meanwhile, in Figure 12 the Diagnostic Test topic is slightly dim greenish yellow, meaning that the research topic has been researched but is still rare. Meanwhile, in Figure 13 the Local Wisdom topic is dim green, meaning that the research topic is still rarely researched. Therefore, research topics that have been widely researched can be linked to topics that have not been researched, so that updates in research can be obtained. Thus, there are opportunities for renewable research by studying these topics.

Based on the output of network visualization, overlay visualization, and density visualization, it can be concluded that the topic "Computational Thinking, Diagnostic Test, and Local

[28] Luckyardi, Senny, Ratih Hurriyati, Disman Disman, and Puspo Dewi Dirgantari. "The Influence of Applying Green Marketing Mix by Chemical Industries; VOSviewer Analysis." *Moroccan Journal of Chemistry* 10, no. 1 (2022): 73–90.

[29] Azizah, Annisa Aprilianti Nur, Ai Nur Bayinah, and Luqman Hakim Handoko. "Literature Analysis of Cash Waqf : Trends and Future Research Agenda." *ZISWAF: Jurnal Zakat Dan Waqaf* 10, no. 1 (2023): 12–27. https://doi.org/10.21043/ziswaf.v10i1.17095.

[30] Balahurovska, Inna. "Network Leadership Is a Promising Direction in Management Science." *Marketing and Management of Innovations* 1 (2023): 133–45.

[31] Ginting, Selvia Lorena Br. "A Computational Bibliometric Analysis of Esport Management Using VOSviewer." *International Journal of Informatics , Information System and Computer Engineering* 4, no. 1 (2023): 31–48.

[32] Lestari, Dinda Rizki, Winny Josephine, and Asep Nuryadin. "Analisis Bibliometrik Perkembangan Pembelajaran Online Dengan Aplikasi Zoom Menggunakan Vosviewer." *Jurnal Ilmu Pendidikan* 14, no. 2 (2023): 194–204.

Wisdom" is a renewable topic that has not been found in research that combines the three topics. This is because, on network visualization, the topics of Computational Thinking, Diagnostic Test, and Local Wisdom do not form a network then on ovelay visualization and density visualization show that the combination of the topics of Computational Thinking Diagnostic Test, and Local Wisdom is a popular topic category for further research because no research has been found. Thus, the combination of the three topics can be an opportunity for researchers to conduct further research.

Conclusion

Based on the findings of this study, the results of the VOSviewer output on the network visualization found 6 cluster themes. While in the results of overlay visualization and density visualization, this study shows that for the topics of Computational Thinking, Diagnostic Test, and Local Wisdom no research has been found with the topics studied. This is a novelty so that there are opportunities for research by taking or collaborating these topics.

Recommendation

The researcher realizes that this study has limitations that affect the results of the study, namely this study is limited by the small number of keywords captured by the Google Scholar database. Therefore, future researchers are advised to increase the number of keywords in the literature search process in order to obtain a lot of literature to be studied more deeply. In connection with that, the results of this study can be used as a reference for further research that will map the state-of-the-art and see the research gap using bibliometric analysis, especially with the topic of local wisdom-based computational thinking diagnostic test.

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