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CONSERVATION SCIENCE
Trends: A Systematic Literature Review of Publications Between 2012-2022

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ABSTRACT

The purpose of the review article is to find out the research trends related to conservation science, which is very useful for developing teacher learning skills in line with the period of the Industrial Revolution 5.0, which uses a lot of technology integration in learning. In the Industrial Revolution 5.0, technology and humans will coexist to improve human life sustainably. This study is a systematic scientific literature review of the conservation of 500 Google Scholar-indexed journal articles published between 2012 and 2022, but only 17 journal articles that met the requirements were used. The findings show that the regions in Indonesia with the most scientific conservation research are Bandarlampung and North Lampung. Articles related to conservation-scientific research are primarily published in chemistry education and learning journals. Many science education research-based journals have published conservation science articles, but more chemistry coverage still needs to be provided. The most researched topics on the knowledge component in conservation science are colloids, salt hydrolysis, and mixture separation. The least studied are stoichiometry and thermochemistry, meaning these two topics have been of little interest to researchers in the last ten years. From some of the analyses in this literature review, we suggest sharing references and centers for conservation science in science education and formulating what topics need to be researched for further research.

Keywords: conservation science, research, education

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I. INTRODUCTION

In the national education system, education is an urgent and essential thing in improving the quality of human resources, which here is expected to be able to compete to advance the country and nation based on an educated attitude, broad knowledge, and qualified expertise in their fields. Education also plays a vital role in producing a society that is developmentally literate, harmonious, and democratic in running the wheels of life. Education plays a vital role in improving and developing the human resources of a nation. Education must be developed continuously by the times. Through education, the Indonesian people can improve the quality of human resources. The human resources are expected to be faithful, devoted, ethical, disciplined, responsible, independent and intelligent.

Scientific-based learning encourages students' learning process by observing the sequence of observing, questioning, trying, reasoning, and communicating. In this case, the scientific approach will prioritize students to gain knowledge through inquiry. The inquiry process is relevant to the nature of science, which directs students to find the proper method for obtaining biological facts, concepts, and principles scientifically. The scientific approach is closely related to the scientific method. The scientific method generally involves observations needed to formulate hypotheses or collect data.

The purpose of learning with a scientific approach is based on the advantages of the approach, among others:

1. Improve intellectual abilities, especially higher-order thinking skills,
2. To shape students' ability to solve a problem systematically,
3. Creating learning conditions where students feel that learning is a necessity,

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4. Achieving high learning outcomes,
5. To train students in communicating ideas, especially in writing scientific articles and
6. To develop students' character.

Conservation education is one of the essential components of school organization. Conservation education for school students is an application of the teaching and learning process of conservation and environmental materials based on Islamic teachings and a form of participation in environmental conservation. The delivery of conservation materials in the form of conservation education is a provision for students as the nation's next generation, who will become members of society, decision-makers, and environmental actors. Teaching conservation materials to students can be done through an integrated curriculum or extracurricular activities.

Four types of conservation characters can be developed during the education process, as follows:

1. Character education is based on cultural values, which are the truth of God's revelation (moral conservation);
2. Culture-based character education, among others, in the form of ethics, Pancasila, literary appreciation, exemplary historical figures, and national leaders (cultural conservation);
3. Environment-based character education (environmental conservation), and
4. Character education based on self-potential, a personal attitude, results from an awareness process of empowering self-potential to improve education quality (humanist conservation).

This review focuses on articles on scientific-conservation-based learning. This study's primary purpose is to determine the considerations of research and analyses on scientific conservation from 2012 to 2022. This review also aims to find out what has yet to be researched on scientific conservation. Therefore, this research will focus on answering questions about the number of topics, the number of citations per article, the maincontributors to conservation science, and the direction of publication of articles.

II. METHODS

This article uses a literature study (library research), which collects data by understanding and studying theories from various kinds of literature related to the research (Adlini, 2017). A literature review is a unique form of research that produces new knowledge about a topic by reviewing, criticizing, and synthesizing representative literature on a topic in an integrated manner to produce a new framework and perspective on the topic (Torraco, 2016). The study of this research is Conservation Science and Technology.

Research Strategy

Article searches were conducted on search engines using Publish or Perish software. The keyword combination chosen was scientific conservation, with a publication period between 2012-2022. The search was conducted on 17 May 2022. The search results obtained 500 articles indexed by Google Scholar, only reputable international articles indexed by Scopus, and only 17 articles were used in this study, according to the requirements of the journals that passed the selection. The steps of searching for articles are briefly shown in the following figure:

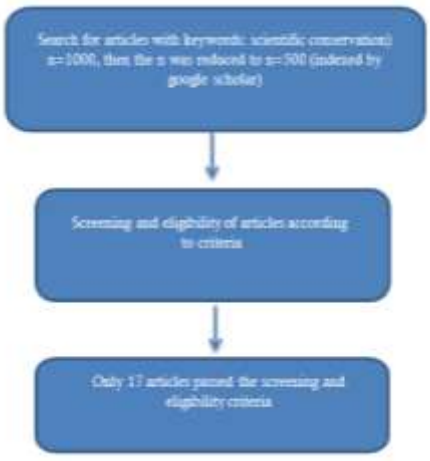

Figure 1. Illustration of Article Finding Diagram

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Article Selection

A total of 500 documents were processed for forwarding analysis. In the next step, articles in the title and abstract were analyzed sequentially to exclude articles that did not fit the scope of this study. The researcher then thoroughly analyzed the resulting number of 500 articles, resulting in only 17 articles that met the criteria.

Research Topic Analysis

Science research topics were obtained by analyzing word frequencies using NVivo 12 plus software. The researcher used words with at least seven letters and then selected them. We selected only the 15 most frequently occurring words. The 15 words can be seen in the figure below. Furthermore, the most and least researched research topics can be obtained.

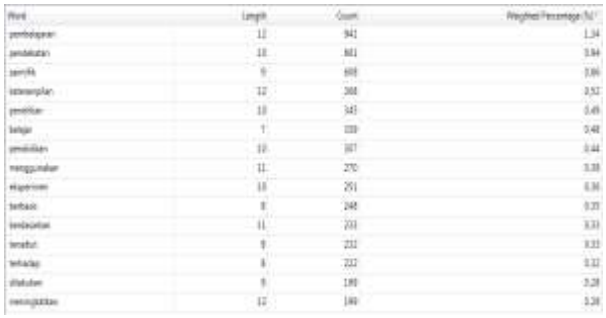
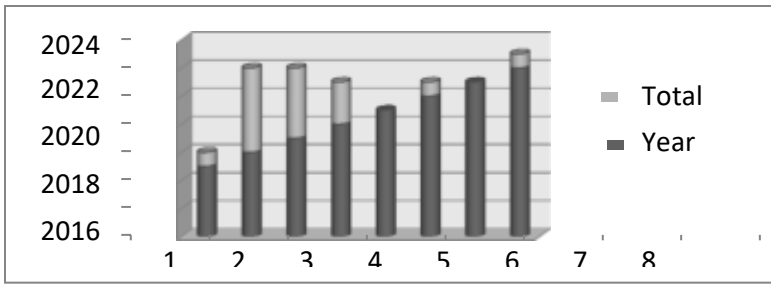


Figure 2. Word Frequency Results Using Nvivo 12 plus

III. RESULTS AND DISCUSSION

Article Search and Selection Results

In this study, research articles focusing on scientific conservation analysis were regularly published and indexed by Google Scholar between 2012 and 2022. Of the 500 articles analyzed, the group found only 17 that met the criteria for this article review assignment.



Graph 1. Number of article searches and selections

Based on the graph shown, 2016 journals on scientific conservation were the most widely used.

Location of Research Discussing Scientific-Conservation

Of the 17 articles that met the criteria in analyzing this article review, all, without exception, have mentioned or written the research location in discussing this scientific conservation. If seen in the articles, the location that examines specifically the scientific-conservation approach is dominated by the Bandarlampung region with six articles, followed by North Lampung with two articles, while in the Bandung, Telaga, Pontianak, Cirebon, Palu, Surakarta, Bengkulu, South Tapanuli, and finally East Lampung each only 1 article.

Table 1: Number of published articles by region

Region	Number of Articles	Percentage (%)
Bandarlampung	6	**35,29**
Lampung Utara	2	**11,76**
Bandung	1	**5,88**
Telaga	1	**5,88**
Pontianak	1	**5,88**
Cirebon	1	**5,88**
Palu	1	**5,88**
Surakarta	1	**5,88**
Bengkulu	1	**5,88**
Tapanuli Selatan	1	**5,88**
Lampung Timur	**1**	**5,88**

Dominant Research Topic

Research topics related to conservation science were obtained by analyzing word frequencies using Nvivo 2 Plus software. The authors selected only the 15 most frequently occurring words whose

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criteria were related to conservation science topics. These 15 words indicate research topics that are frequently researched. The author traced the article contains and seeks the idea of the article as the topic idea of this topic. This shows the words that appear more frequently in the analyzed articles. The first word that appears frequently is learning because all the articles analyzed examined learning, so this word does not explicitly indicate the research topic. Furthermore, the word approach does not specifically indicate the research topic because it is found in many theoretical reviews about this conservation science. Furthermore, the word scientific cannot be separated from the previous words, namely learning, approach, and scientific, so it does not indicate a specific research topic.

Figure 3. Conservation Scientific Research Topics 2012-2022, by Frequency of Frequent Words

One of the most researched topics is skills. This is reasonable because skills are a very influential aspect of scientific-conservation-based learning. A teacher must have skills in teaching, both in mastering the substance of the material or teaching material to be taught (what to teach) and mastering or having various skills to teach it (how to teach). A teacher must possess scientific-conservation-based learning and at least basic teaching skills; as Dadang Sukirman (2013) stated, basic teaching skills are generic or primary or general and complex that every teacher must master. There are eight basic teaching skills, as mentioned by Tunney 1998 which include:

1. Questioning skills,
2. Reinforcement skills,
3. Variation skills,
4. Explanation skills,
5. Opening and closing skills,
6. skills in guiding small group discussions,
7. classroom management skills and
8. small group and individual teaching skills.

Not only having skills, a teacher must also be able to improve the skills of his students. In scientific learning, students are targeted to have an increase in intellectual abilities, especially higher-level thinking skills, the formation of student's ability to solve a problem systematically, the creation of learning conditions where students feel that learning is a necessity, the acquisition of high learning outcomes, training students in communicating ideas, especially in writing scientific articles, and developing student character (Machin, 2014).

Furthermore, T. Hillway (1964), in the book Introduction to Research, added that research is a study conducted by someone through careful and perfect investigation of a problem so that an appropriate solution to the problem is obtained. This topic is widely discussed because, in the scientific context of conservation itself, it indeed discusses research that researchers must review to improve the lack of research to be even better in the future when they want to do research again.

Then, the next topic is learning. According to Gagne, learning is a person's disposition or ability to change through activity. The change in disposition is not obtained directly from a person's natural growth process. This topic must exist in all journals, especially regarding education because the learning process is closely related to the world of education. Conservation science is also a learning approach in every student's learning process.

Education is a fascinating topic to discuss. According to H. Horne, education is a continuous (eternal) process of higher adjustment for human beings who have developed physically and mentally, who are free and conscious of God, as manifested (manifested) in the intellectual, emotional, and humanitarian surroundings of humans. Education certainly

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must be distinct from the previous topic related to learning. This is because the two have a very close or inseparable relationship. Education is a planned effort to create a learning atmosphere and learning process so that students can actively develop the potential that exists in themselves.

The next topic of interest is experimentation. This topic is familiar because experimentation is closely related to the scientific context of conservation. The experimental method, also known as "experimental learning" was introduced in 1984 by David Kolb in his book "Experimental Learning: Experience as a Source of Learning and Development". The experimental method is defined as knowledge that is created through a form of experiential change. "Learning is the process by which knowledge is created through the transformation of experience" (Kolb, 1984, p. 38). The Experiment Method, according to Rostiyah (2001: 80) is an activity in which an experiment is carried out by observing the process and results. According to Djamarah (2002), the experimental method is a way of presenting learning where children experiment by experiencing something they are learning. Through the experimental method, children are given the opportunity to experience for themselves, follow a process, observe an object and situation. Thus, children can find the truth, or try to find a law or postulate, and draw conclusions from the process they experience through experiments conducted. The experimental method is a child-centered way of learning. Learning by using the experimental method does not only make children know and memorise but children understand. The aspects of social development that exist in the experimental method carried out are:

1. Reflecting an attitude of patience, for example, when children queue to take the tools used in experiments.
2. Not disturbing friends who are doing activities reflects a caring attitude, for example, willing to play with peers, willing to cooperate with peers, and share with peers.

Most Referenced Articles

The citation search results using publish or perish indexed by Google Scholar found the most referenced research articles on the scientific approach to conservation. The top article is listed as the most referenced article. Otherwise, if it goes down, it is listed as the article with the most minor references.

Table 2. Articles with the Most Citations According to Publish or Perish Indexed by Google Scholar

Author	Article title	Number of citations	Year
Sari, Resti Yulianti Hidayat	Development of Students' Creative Thinking Skills in the Practicum of Colloid Types: Scientific Approach	10	2016
Fidya, Mangara Sihaloho, Deasy N. Botutihe	The Effect of the Use of the Scientific Approach on Student Learning Outcomes on Material Salt Hydrolysis	6	2018
Istamarra Aditya Anindya, Eny Enawaty, Rody Putra Sartika, Masriani, Rahmat Rasmawan	Development of Module Based The Scientific Approach to Element, Compound, and Mixture Materials	1	2022
Oktavia Nur Rezki, Nina Kadaritna, Ratu Betta R	Development of Student Worksheets Based on the Scientific Approach to the Material System Colloids	6	2016
Nadya Putri Aulia, Noor Fadiawati, Lisa Tania	Effectiveness of the Scientific Approach in Improving Conceptual Understanding on	4	2017

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	Mixture Separation Material		
Dewiantika Azizah, Banu Kisworo	Implementation of the Use of Scientific-Based Qur'anic LKPD on Atomic Structure Material on the Formation of Religious Science Characters of MAN 1 Learners Plered, Cirebon Regency	3	2018
Dian Mira Fadela, Noor Fadiawati, Lisa Tania	Improvement of Students' Science Process Skills on Reaction Rate Material Through Approach Scientific	4	2016
Heri Saldi, Siti Nuryati, Jamaludin Sakung	Implementation of the Scientific Approach through the Jigsaw Type Cooperative Learning Model in Class X SMA Negeri 9 Palu on Stoichiometry material	3	2017
Pradiska Nawang Anggara, Nina Kadaritna, Emmawaty Sofya	The Effectiveness of the Scientific Approach in Improving Planning Skills on Salt hydrolysis material	4	2015
Ari Syahidul Shidiq	Ethnoscience-based Chemical Science Learning to Increase Interest and Achievement Student Learning	40	2016
Yustina Retno Kusuma Wardani, Noor Fadiawati, Lisa Tania	Effectiveness of the Scientific Approach in Improving Science Process Skills on	2	2017
	Mixture Separation Material		
Rika Juwita Saputri, Sumpono, Rina Elvia	Comparison of Chemistry Learning Outcomes and Interests of Class X IPA Students Using Cooperative Learning Model Snowball Throwing and Talking Stick in Curriculum-2013 at SMAN 10 Kota Bengkulu	4	2018
Galuh Oktriana, Nina Kadaritna, Emmywaty Sofia	Effectiveness of reaction rate worksheets based on a scientific approach in improving KPS By Gender	0	2017
Nenni Farida Lubis, Ermawita	Validity of Integrating the Scientific Approach with the Inquiry Learning Model in Chemistry Learning Curriculum 2013 to Improve Students' Soft Skills and Hard Skills Competencies Review of Content Appropriateness	0	2020
Annisa Siti Zulaicha, Noor Fadiawati, Lisa Tania	Development of Student Worksheets Based on the Scientific Approach to Material Thermochemistry	0	2016
Wayan Gracias, Noor	Effectiveness of the Scientific Approach in Improving	1	2017

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Fadiawati, Lisa Tania	Critical Thinking Skills on Separation Materials Mixed		
Ayuda Pangestika, Nina Kadaritna, Ika Rosilawati	Worksheet for Vapour Pressure Decrease and Boiling Point Increase Based on Discovery Model	0	2016

It can be seen that the article by Ari Syahidul Shidiq (2016) is the most referenced among others in this article analysis. When viewed from the article's content, Ari Syahidul Shidiq's (2016) article is a theoretical article about the scientific approach regarding chemical science or chemical mathematics. The second article with ten references is by Sari, Resti Yulianti Hidayat (2016), which discusses the types of colloids. Articles with scientific approach models in the form of jigsaw-type cooperatives and discovery learning are not widely referenced, namely Heri Saldi, Siti Nuryati, Jamaludin Sakung (2017) and Ayuda Pangestika, Nina Kadaritna, Ika Rosilawati (2016). Furthermore, articles on student learning outcomes should be more widely referenced, namely Fidya, Mangara Sihaloho, and Deasy N. Botutihe (2018), through a scientific approach to salt hydrolysis material. There are also a few references to student worksheets, namely Oktavia Nur Rezki, Nina Kadaritna, and Ratu Betta R (2016), on developing student worksheets based on a scientific approach to colloidal system material. A few references to improving conceptual understanding are Nadya Putri Aulia, Noor Fadiawati, and Lisa Tania (2017). There are also a few references to forming scientific and religious characters, namely Dewiantika Azizah Banu Kisworo (2018). Only four times were referenced for improving science skills: Dian Mira Fadela, Noor Fadiawati, and Lisa Tania (2016). The ability to plan is also not widely referred to by Pradiska Nawang Anggara, Nina Kadaritna, and Emmawaty Sofya (2015). Furthermore, the improvement in critical thinking was only referred to once: Wayan Gracias, Noor Fadiawati, Lisa Tania (2016). Articles that discuss mixture separation and chemistry are also not widely referenced by Yustina Retno Kusuma Wardani, Noor Fadiawati, Lisa Tania (2017), Rika Juwita Saputri, Sumpono, and Rina Elvia (2018). Moreover, for articles that discuss reaction rates by Galuh Oktriana, Nina Kadaritna, Emmawaty Sofia (2017), then articles that discuss thermochemistry by Anninsa Siti Zulaicha, Noor Fadiawati, Lisa Tania (2016), and the last article that discusses the decrease in vapor pressure and the increase in boiling point by Ayuda Pangestika, Nina Kadaritna, Ika Rosilawati (2016) there are no references.

Key Contributors

We found 36 authors who contributed to the scientific-conservation approach research. A ranking was then conducted from the number of authors to determine which authors deserve to be called the main contributors in this field. We only presented authors with two or more articles because other authors only contributed to one article. The data is presented in the table below.

Table 3. Authors with the Most Article Contributions from 2012-2022

Author	Number of Articles	Affiliate
Noor Fadiawati	5	**Universitas Lampung**
Lisa Tania	5	**Universitas Lampung**
Nina Kadaritna	4	**Universitas Lampung**
Emmawaty Sofya	**2**	**Universitas Lampung**

Based on the table above, the most productive writers in this field are Noor Fadiawati and Lisa Tania. Both have the same affiliation, namely the University of Lampung. Not only Noor Fadiawati and Lisa Tania have the same affiliation, but everything from Noor Fadiawati to Emmawaty Sofya is from the same affiliation, namely Lampung University. This result implies that Lampung University is very concerned about research related to the scientific approach to conservation.

Journals that have published scientific-conservation approach research

Another critical factor that can help researchers adjust to the scientific-conservation approach is journals publishing scientific-conservation approach research. This analysis

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shows that only one journal published ten research articles, and the other seven published only 1 article.

Table 4. Scientific journals with the highest number of conservation scientific research articles

Journal	Journal article
Journal of Chemical Education and Learning	10
Others, (7 articles)	1 article for each journal

CONCLUSIONS

It is known that from the initial stage, namely the abstract, to the last stage, namely the discussion findings, especially in journals that have published research, it can be concluded that many education researchers have paid attention to the topic of scientific conservation approaches for the period 2012-2022. This result aligns with the need for skills for the scientific-conservation approach to face 22nd-century education trends that rely heavily on science integration in learning. The Bandarlampung region is the location of most scientific-conservation approach research from the articles we analyzed, followed by the North Lampung region. The most productive authors in this area are Noor Fadiawati, Lisa Tania, Nina Kadaritna, and Emmawaty Sofya. All four have the same affiliation, namely Lampung University.

Furthermore, journal analysis showed that articles related to conservation science research were primarily published in chemistry education and learning journals. This result is in line with the conservation science framework, which makes the integration of technology into 21st-century learning. An interesting result is that only some science education research-based journals publish articles on conservation science; significantly, articles on the conservation context that discuss chemistry are sporadic.

Analysis of topics related to conservation science shows that the most researched topics in the scientific component of conservation are learning, scientific approaches, skills, research, learning, education, and experimentation. This literature review analysis is expected to make it easier for researchers interested in conservation science research, to find appropriate and diverse references and reference centers and formulate what topics need to be researched for future research..

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