Review Science Process Skill in Chemistry Learning

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Abstract. From various articles on Science Process Skills is the most important assessment in arning chemistry. Various models are utilized to increase Science Process Skill (SPS) in chemistry learning. The objective of this article is to give a review linked to the topic SPS in chemistry. Articles are found using publish or perish software and the Google Scholar database. Scanning using scimagojr.com (Q1, Q2, Q3, and Q4), evaluated 20 papers from 6 international journals over a period of 10 years. Zotero software is used to manage and summarize references. We have analyzed this database and tried to categorize articles using VOS reader software. Six groups were analyzed; and the phrases that appear most frequently in each category are inquiry, laboratory, practicum, Problem Based Learning model, and Project Based Learning. This group represents the direction of the Science Process Skill in chemistry learning research.

Keywords: Science Process Skill; review articles; publish or perish; Google Scholar; VOSviewer

1 Introduction

Through google schooler to search for articles on science process skills (SPS) on chemistry with the keywords (SPS chemistry learning in high school) on the link, you will find about 6000 articles in the last 10 years. It turns out that the majority of the articles do not discuss SPS in chemistry learning, but in the article there is mention of SPS. High School Science Teachers' Views on SPS is the most viewed SPS-related journal in the last 10 years, but contains sciences including physics, chemistry and biology. According to Gultepe that SPS can be improved by learning in the laboratory [1]. The most referenced articles in the last 10 years related to SPS still discuss SPS in general in various subjects such as mathematics, or science. Based on a review of articles from various international and national journals related to science process skills in the last decade, it shows that there is a need to improve SPS.

SPS can be used for a variety of reasons, including the fact that pupils are better able to grasp abstract concepts when they are accompanied with concrete examples. Aside from the most fundamental SPS, such as observation and classification, there are also more complicated SPS that include variable identification and experimentation [2]. The capacity to observe, classify, assess or interpret, forecast, apply, plan research, and communicate can be developed through process skills, [3, 4, 5, 6, 7]. Success in assessing SPS results cannot be separated from the role of effective learning. Effective teaching is the foundation of learning. Effective instruction has a significant impact on students' attitudes, knowledge, and other outcomes, such as the SPS. An effective teaching and learning process is possible when proper tactics are used [8]. Different learning approaches have been found to be effective in improving SPS in studies conducted in the previous ten years. There are a variety of ways to implement learning models

BIC 2021, October 11-12, Batusangkar, Indonesia

DOI 10.4108/eai.11-10-2021.2319482

that are specifically tailored to a student's needs. Using a laboratory technique, Yadav and Mishra discovered that students' SPS levels were greater [9]. It is now more beneficial for students to employ a laboratory method after the findings. This study examined the impact of cooperative learning practices on the chemistry accomplishment of students conducted by Adesoji, Omilani, and Nyinebi. Cooperative learning practices were found to be beneficial in increasing students' chemistry learning outcomes, according to the researchers [10]. The ability of students to use SPS will develop along with the development of the learning experience and the class level or cognitive level of students biologically. In general, chemistry is considered a subject that tends to be difficult to accept and understand by students. If a student is faced with a certain chemical material while he is not ready to understand it, then he will not only fail in learning but will also avoid the lesson. The purpose of this article is to answer the formulation of the problem as follows. 1). What are the variations of research that has been done regarding science process skills? 2). What is the most effective learning method used to improve the SPS for chemistry lessons in 10 years? 3). What learning model should be used for the implementation of the next chemistry lesson in an effort to improve SPS?

2 Method

This research is a review of research articles related to Science Process Skills (SPS) in learning chemistry from international and national journals. The total population is around 957 from a search on google schooler with a sample of 20 articles that describe science process skills in chemistry. This research was conducted for 6 months to find articles and review each article in a column containing the title, question/objective, results and research weaknesses. In the past 10 years, the population of articles seeking process skills has been around 957 articles using the publish or perish (POP) application to obtain RIS data. Then continue to use the VOSviewer application so as to get clusters with the following steps:

2.1 Search for articles from various reputable journals.

Researchers searched for articles using google schooler, website springer, Eric's website, with the keywords "science process skills in chemistry learning high school" at the link: https://bit.ly/3MgsUbr then limits the search to the last 5 years (years 2016-2020). In this search, keywords are obtained both from the title and from the abstract, so the results are quite broad. In addition, on further searches, the keyword *science process skill in chemistry education*. Continuing with the search for articles at this early stage, it was narrowed again by selecting categories that were already available on Eric's website. The initial article search results obtained as many as 957 articles using the *PoP software*.

2.2 Save data with the help of the *Zotero*

The article data that has been obtained through an initial search with the help of Eric's website is then saved to the Zotero application to facilitate the process of mapping research trends. The collection of files is saved in the form of ris so that it can be processed further using the help of the next application, namely the *VOSviewer*.

2.3 Mapping using the *VOSviewer*

Application *VOS* makes it easier for researchers to get an overview of the keywords that appear most often in the articles that have been collected. After that, clusters are obtained that show the most frequently found word groups. Furthermore, a mapping of the main topics of science process skills in chemistry education was carried out (excluding the keyword *science process skills*).

Fig. 1. VOS network visualization mapping.

2.4 Mapping of articles with an application as a follow-up.

At this stage, this is done by entering the keyword *process skill in chemistry* in the Publish or Perish 7 application, the search is focused on Google Scholar in 2020. Next, limiting the number of articles is 100, and Finally choose the appropriate article. The final results found 50 suitable articles and continued with the selection of a sample of articles.

2.5 Mapping articles based on research variables.

At the article mapping stage, articles related to SPS in chemistry learning were selected by grouping learning methods/strategies, chemical materials discussed and types of SPS. The researcher examines in depth each article to answer the formulation of the research problem. Each article's variables were analyzed by researchers. A systematic, explicit, and reproducible technique or a mind-mapping method that stresses the boundaries of knowledge are important in creating a literature review [11].

3 Result and Discussion

The results of the study obtained data on SPS. Based on a review of articles about SPS in the journals Q1, Q2, Q3, Q4.

Table 1. Distribution of Articles in Journals.

Articles	Number
of Initial Population Articles	957
Q1-Q4 About SPS	50
Articles according to	20

Then 20 These corresponding articles are mapped according to the learning model used to improve SPS. The following is a data link for searching journals related to SPS in chemistry learning:

Table 2. Journals used to search for SPS articles.

Journal		
https://bit.ly/3Kbn5Kv	**https://bit.ly/3ChfIyE**	**https://bit.ly/3KhBBRf**
https://bit.ly/3KcXtwO	**https://rsc.li/3vzvH9K**	**https://bit.ly/35uUMbc**

The results of the articles were extracted from the original collection of 957 articles consisting of articles from Q1, Q2, Q3, and Q4 based on the Scimagojr database. The gaps in the current study indicate a direction for the future agenda in science process skills. To answer this first research question, what are the variations of research that has been done regarding SPS? It turns out that after mapping and reviewing articles related to SPS in chemistry learning, it is shown in table 3. Regarding what learning methods are most effectively used to improve SPS in chemistry learning for 10 years, there are various but the majority of teachers use chemistry practicum learning in the laboratory. There are also several studies that reveal that in an effort to improve SPS, it is done by using practicum software that is connected to a device on a laptop. In answering the third research question related to what learning model should be used for the implementation of the next chemistry lesson in an effort to improve SPS? Researchers for 6 months reviewed and mapped articles from 50 articles obtained and then mapped the research results and weaknesses as shown in table 3.

Table 3. Research Variations related to SPS.

Research that has been carried out	**The model used**	**Findings**
How does a student's ability to understand physics concepts differ from their ability to learn chemistry?	Inquiry with the help of learning media for practicum	Comparing the inquiry model and direct learning class
Laboratory approach	Jigsaw cooperative model	Student's SPS test results can improve
chemistry Practicum to	Use the PBL	model PBL model can improve SPS
Project correlation and PPP	PjBL model By	providing projects in chemistry learning can improve SPS
Effect of POGIL	Using POGIL	POGIL can increase student activity.
Efforts to improve SPS	Using the PjBL and LKPD models	

Table 4. Data Search articles.

Metric data	**Initial**	**Search Final**
Q	Journals,	Journals,
Sources	Google Scholar	Google Scholar
Articles	957	20
Quotations	227	447

To answer the first question in This review article describes that there are various models used in chemistry learning to improve SPS including inquiry, POGIL, PBL, Jigsaw, and PjBL.

The method used to improve SPS is by combining learning models with chemistry practicum and LKPD [15].

The importance of laboratory activities in chemistry education cannot be overstated since they allow students to demonstrate a wide range of abilities. In SPS's Activity Lab, this is an essential ability. When it comes to problem solving, SPS really refers to a set of cognitive and motor skills [3][17]. SPS define students' cognitive activities and need the use of logic. " Through a variety of scientific learning processes, educators play an essential role in the classroom when it comes to teaching SPS. Students must grasp science in addition to skills if they are to comprehend scientific concepts. The capacity to think analytically is a skill that may be learned in the laboratory. Abstract notions can be compared and contrasted using analytical thinking capacity [19]. Analytical thinking is demonstrated by the ability to separate, organize, and attribute chemical ideas. Many difficulties may be solved through analytical thinking and a variety of mental processes [19]. SPS and analytical thinking are intertwined concepts. Students are supposed to learn and grow as critical thinkers as a result of laboratory-based active learning [20]. In other words, because they are so important to the study of chemistry, SPS can't be separated from practical activities [21][22][23].

4 Conclusion

SPS-related topics are discussed in this review of 20 publications from various journals. PoP software was used to gather articles from a database (Google Schooler). These 20 articles were selected from a total of 957 articles from the Scimagojr database, which included papers from Q1, Q2, Q3, and Q4. There are flaws in the review article I wrote. This study relies on a limited number of keywords and may possibly be constrained by the database (Google Schooler) utilized for the collecting of articles. Second, despite the use of formal tools (PoP software, VOSviewer, Zotero, Microsoft Excel), the authors' subjective assessments persist and might still result in mistakes. It is imperative that future studies utilize a wide number of samples by broadening the keywords and databases that are searched.

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