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Content analysis of research in the context of socio-scientific issues in chemistry learning

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ABSTRACT
This article aims to describe research in the context of socio-scientific issues from 2016 to 2022. The method used is descriptive content analysis method to analyze 30 journal articles of national and international repute. The variables to be analyzed include the method, purpose, year of publication, region, sample, data collection tools, and data analysis techniques. The result showed that most research aims to improve student learning outcomes, interest and motivation to learn. Most of the research methods applied are qualitative and quantitative methods using the experimental class and control class and a small portion using the R&D/Development method. The instruments used were questionnaires, observation sheets and interviews. The data analysis technique used is quantitative analysis technique using statistics (Ancova, Manova, t-test) and qualitative data analysis. Most of the samples consist of students and a small part consists of teachers. This research is spread across Europe, the United States and Asia, with the most publication year being 2021. The issues raised are health and environmental issues related to organic chemistry and environmental chemistry. The most published articles are from the Journal of Chemical Education (JCE) and Journal Science Education (JSE), with the publication years 2021 and 2019.

KEYWORDS
Socio-scientific issues; chemistry learning; learning difficulties

1. Introduction

Science and technology continue to develop rapidly, and this is marked by the renewal of the sciences (1). The demand for scientific and technological literacy must

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be based on the idea that technology in today's society requires a number of professionals who can participate in science and technology (Genisa et al., 2020). Over the past three years, the fundamental goal of science education has been not just to teach more content but to focus on what is more important for scientific literacy (SL) and how to teach it must authentically involve students (Karisan & Zeidler, 2016).

Teaching chemistry is a problem for both teachers and students because concepts are abstract and have limited relation to the real in contextual applications (4). Chemistry learning, in general, still focuses on learning decontextualized content. Due to this approach, many students perceive chemistry as having low relevance to their education, their lives, and society as a whole(Zowada et al., 2018). The content in the textbooks used in chemistry learning is not much connected with the knowledge of students' social life (6). On the other hand, it is known that science teachers are in dire need of development professionals and educational materials on socio-scientific issues teaching to develop more effective lessons (Bayram-Jacobs et al., 2019).

Socio-scientific issues are very good to use as a basis for learning science in schools, SSI can be used as a liaison between real problems in society and learners in exploring science content (Rostikawati & Permanasari, 2016). SSI contextual learning can also improve students' scientific communication skills (Cha et al., 2021). In addition, SSI can also develop students' argumentation skills and chemical conceptions (Grooms, 2020). SSI involves the use of scientific topics or problems that require students to engage in dialogue, discussion, and debate (Yuliastini et al., 2018). however, the selected social issues should be issues that are clearly important and close to the student's environment or issues that make all students interested in participating in learning (Sofiana & Wibowo, 2019).

Based on the explanation above, it can be concluded that SSI contextual learning in chemistry learning can train problem-solving skills. The SSI model aims to stimulate intellectual morals and ethics as well as awareness of the inseparable relationship between science and society. In addition, SSI can also dig deeper into the nature of science which includes scientific attitudes, scientific processes, and products. The purpose of this study is to analyze research content regarding the context of scientific issues in chemistry learning.

2. Method

This study uses the content analysis method to analyze 30 journal articles of national and international repute from 2016 to 2022 related to a socio-scientific issues-based learning approach in chemistry learning. The content analysis method belongs to three groups of analysis, namely meta-analysis, meta-synthesis, and descriptive analysis(13). In this study, the method used is the descriptive content analysis method due to the tendency to analyze studies where the method is quantitative and qualitative research (Cohen et al., 2018).

The content analysis method aims to combine similar data into a framework of certain concepts and themes then compiled and interpret in such a way that readers can understand them(15). The population of this study is a collection of articles and national and international journals published from 2016 to 2022 on chemistry learning. The samples used are journals and articles that meet the criteria, including reputable national and international journals, can be accessed entirely on Google, and the title has at least the keywords "socio-scientific" and "chemistry learning". Therefore, taking into account the above criteria, the sample of this study consisted of 30 national and international journals published by different journals.

3. Results and discussion

Based on the results of the analysis of the content of articles published from 2016 to 2022 regarding SSI contextual learning in chemistry learning, the analysis is carried out based on the name of the journal, year of research, place of publication, objectives, methods, data analysis techniques, chemistry materials and related issues. The results of the analysis are separated into several categories, which are presented in graphic form. The first category is the name of the journal and the number of journals published, which are presented in Figure 1.

Based on the findings in Figure 1 shows that, on average, the journal only published 1 to two articles regarding the SSI learning approach in chemistry learning from 2016 to 2022. The journal with the most publishers is the Journal of Chemistry Education, with a total of 4 research articles on the SSI learning approach in chemistry learning, namely published in 2017, 2020, and 2021. This may illustrate that SSI contextual learning in chemistry is still very rare because the existing issues are not relevant to the student learning environment. Then when 30 articles were analyzed based on the year of publication, it was found that from 2016 to 2021, there was an increase in the SSI contextual learning approach to chemistry learning,

namely 2016 2 articles, two articles in 2017, 5 articles in 2018, 6 articles in 2019, 5 articles in 2020, and 9 articles in 2021, but there was a decrease in 2022 only publishing 1 article, because in 2022 there were several articles that were still being accepted in the journal. This can be seen in Figure 2.

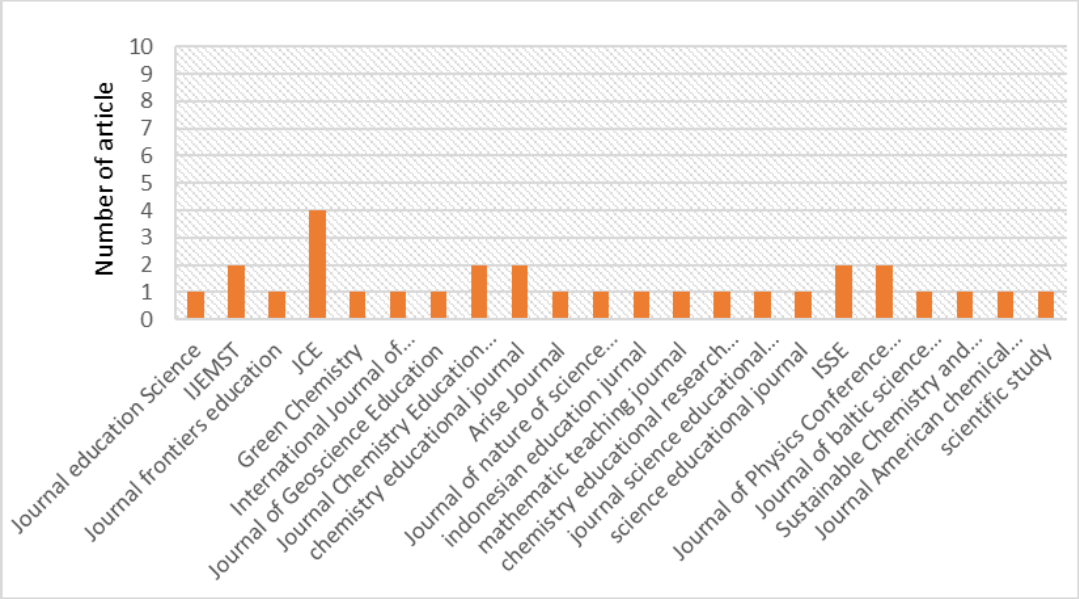

Figure 1. Number of articles related to socio-scientific issues

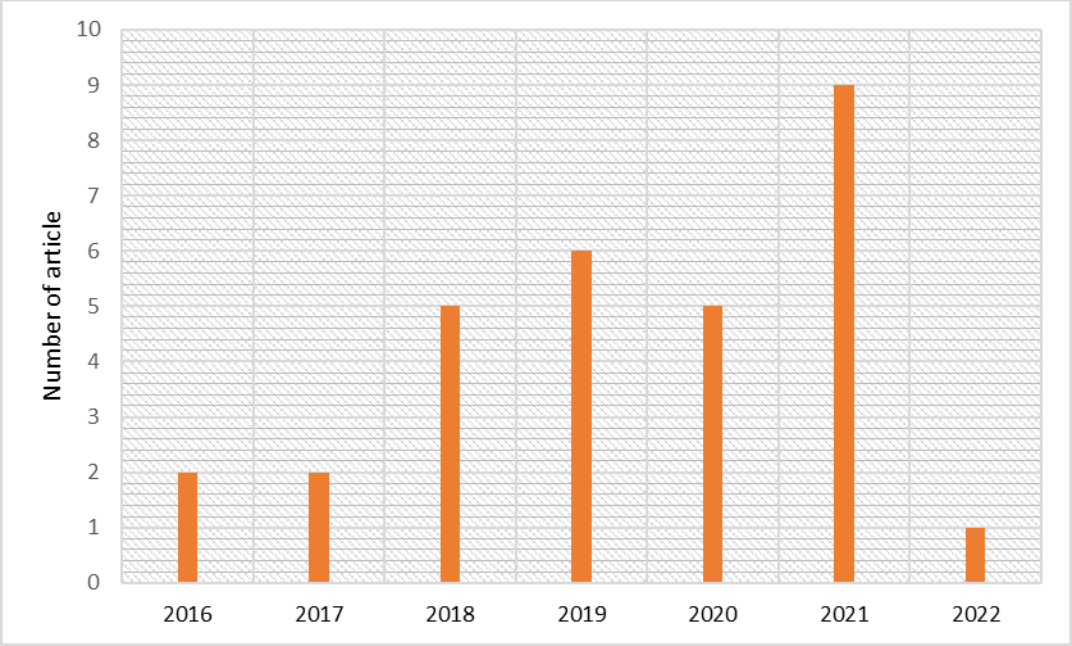

Figure 2. Number of articles by year of publication

Based on the distribution of articles analyzed by purpose, it was found that seven articles aimed at learning interest and motivation, seven articles aimed at mastery of concepts and learning outcomes, seven articles on argumentation skills, 1 article on attitudes, three articles on improving scientific literacy, and three on thinking skills. The number of articles aimed at learning outcomes, motivation and argumentation indicates that SSI learning is very popularly used for learning outcomes, motivation and argumentation. This distribution can be seen in Figure 3.

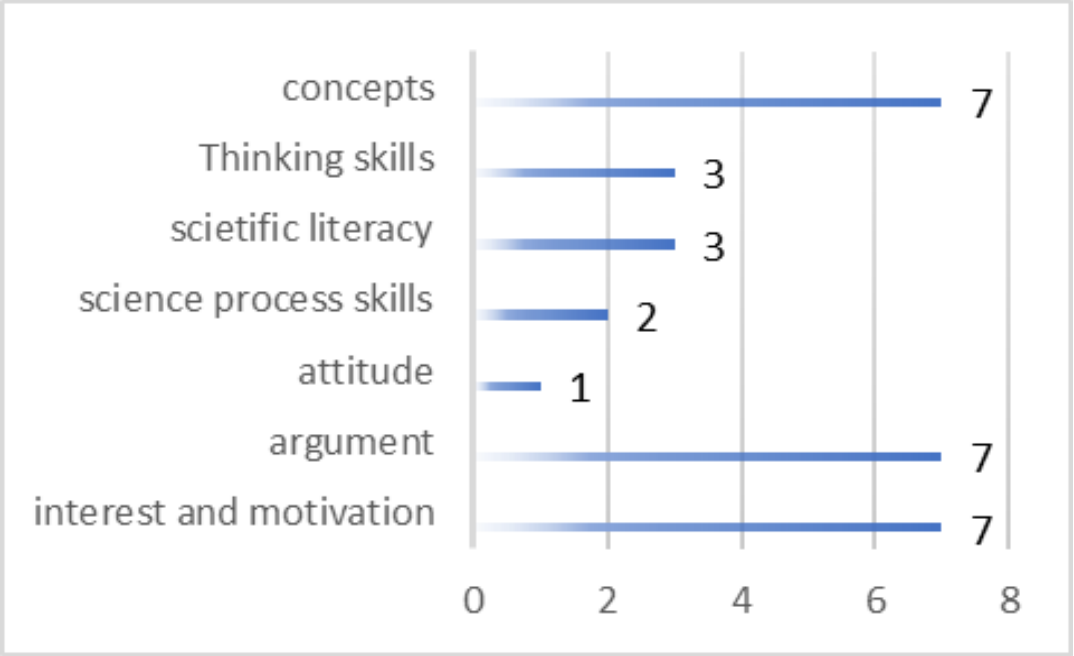

Figure 3. Articles by purpose

The distribution of articles examined by region found that eight articles were published in the Europa region, namely Germany, Turkey, England, Sweden, and the Netherlands. Six articles were published in America, while 16 articles were published in Asia, namely Korea, Malaysia, Indonesia, and Israel. This indicates that learning in the SSI context is still popular in Asia and Europa. The number of issues related to chemistry in America and Asia is an attraction for researching these issues. This distribution can be seen in Figure 4. The distribution of articles analyzed found that 11 articles were published, with the sample being students, 13 articles being the sample for students, three articles being sampled by teachers, and three articles using samples from students and teachers. These results indicate that the SSI context of learning in chemistry learning tends to use a sample of students and college students. This distribution can be seen in Figure 5.

The distribution of articles analyzed based on research methods found that qualitative research was the most widely used among 30 articles, of which 12 articles were published using the qualitative method, nine articles using the quantitative method, five articles using the R&D method, and four articles using the mixed method. This distribution can be seen in figure 6. The results of the analysis of 30 articles based on data collection tools found that the data collection tool using questionnaires was the most widely used, where 18 articles were found using questionnaires, 1 article using student worksheets, 1 article using modules, and seven articles using worksheets, observation and interviews.

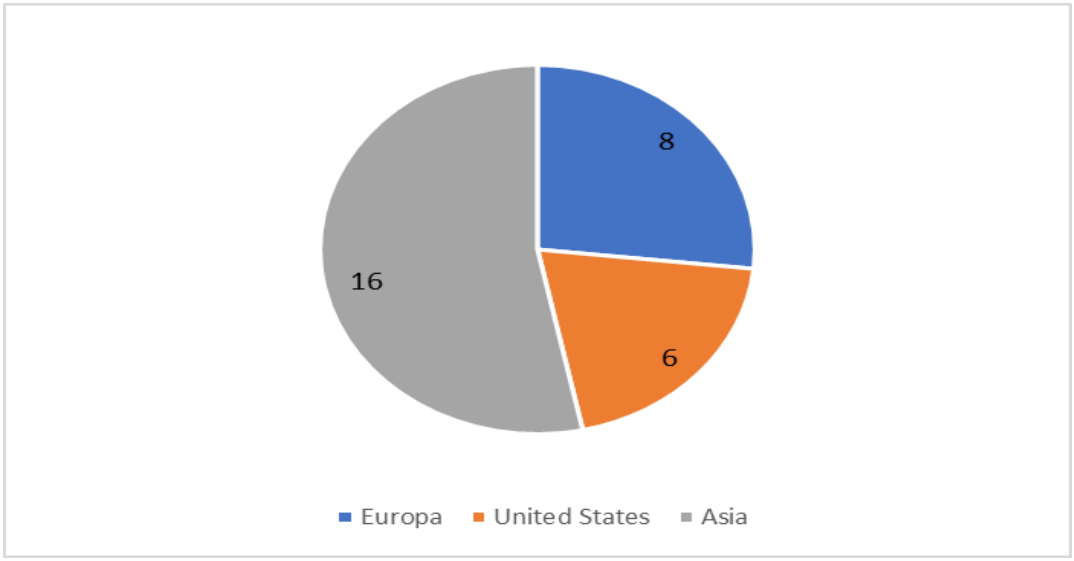

Figure 4. Distribution of article publications by region

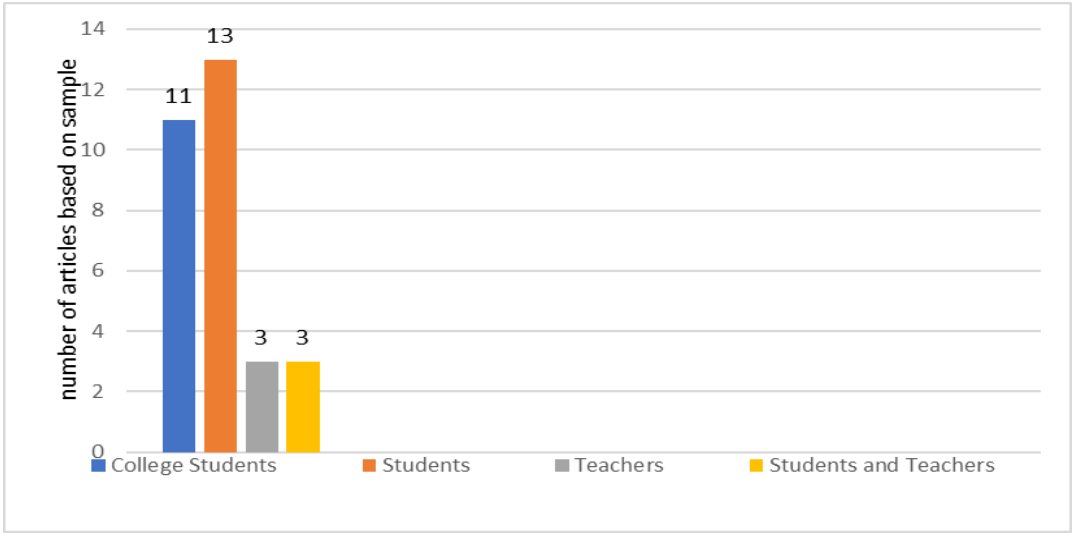

Figure 5. distribution of article publications by sample

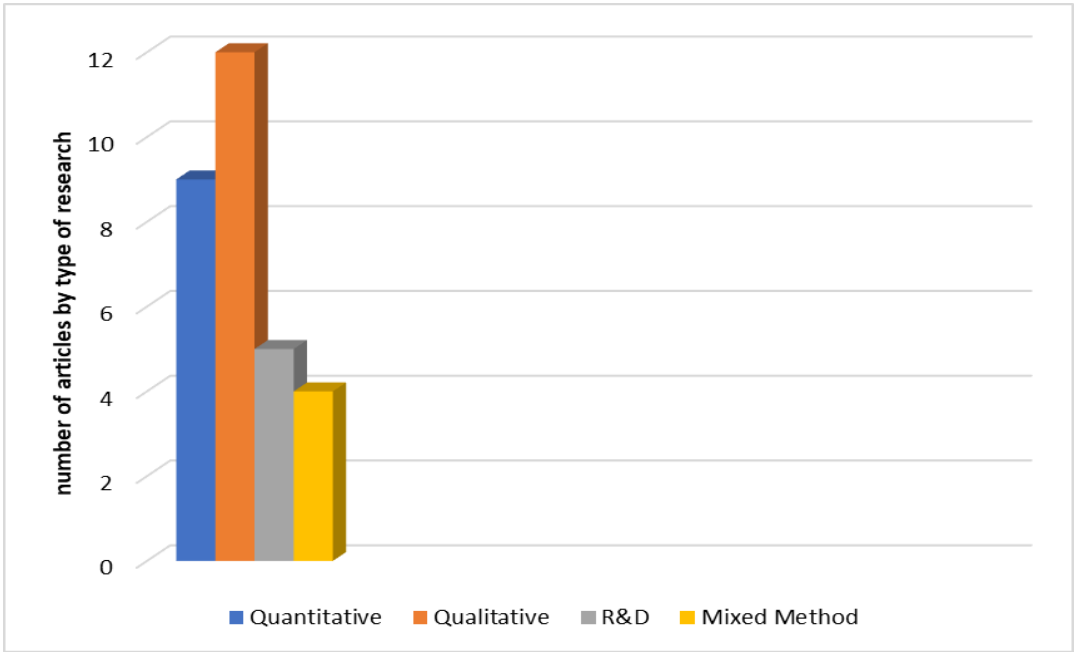

Figure 6. Distribution of article publications by research method

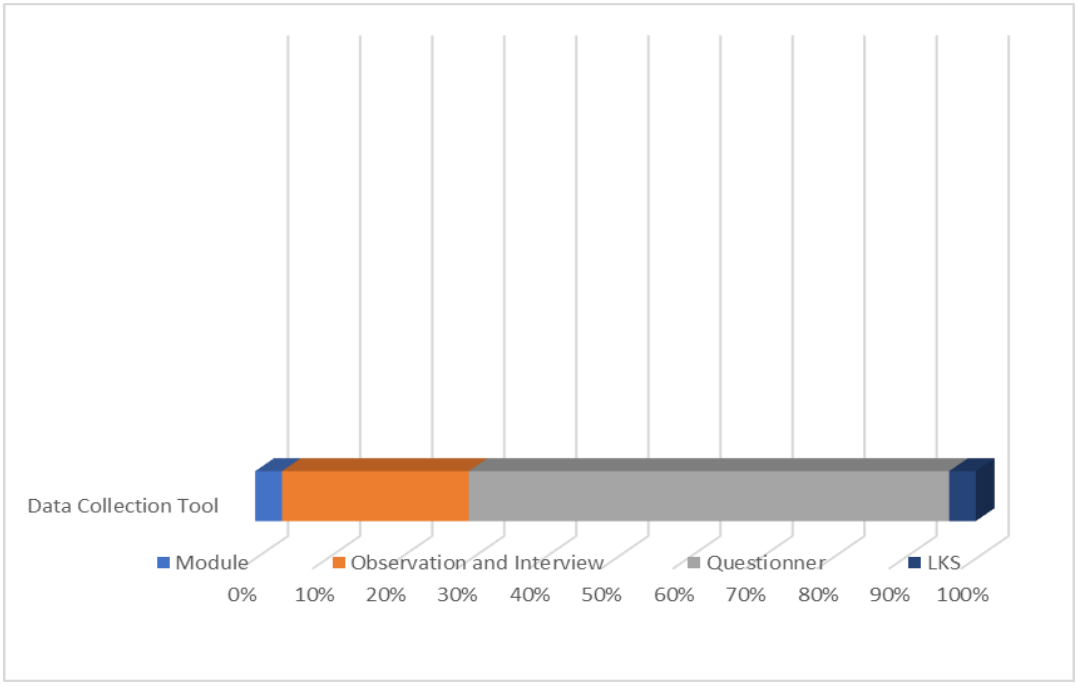

Figure 7. Distribution of article publications by data collection tool

Based on the results of the analysis, it was found that some of the data analysis techniques used were t-tests, where nine articles used the t-test to analyze the data. The t-test was used to show the normal distribution in experimental research, because it shows stronger validity to make generalizations compared to the results

obtained from non-parametric tests and descriptive analysis. It is estimated that the small number of articles found on non-parametric data analysis and descriptive analysis is reasonable because non-parametric tests tend to be selected less because they do not have a normal distribution and weaker validity than parametric tests. In addition, the results of other analyzes observation that statistical analysis techniques such as ANOVA, ANCOVA, Manavo, Mancova, and factor analysis were not very favoured.

4. Conclusion

This study uses the content analysis method to analyze 30 articles about learning in the SSI context in chemistry learning from 2016 to 2022. Most of the research was carried out in 2021. The journal with the most publications was the Journal of Chemistry Education, most of the research aimed to measure mastery of concepts, interest and motivation to learn. The most widely used methods are qualitative and quantitative. Most use students as a sample, the region with the highest number of published articles is Asia. The most widely used data analysis technique is the t-test. The learning approach in the SSI context is based on the collaboration that is built between social concepts and issues in everyday life that support learning. The results of the content analysis obtained indicate the need for studies that examine the effect of learning SSI on high level skills such as social skills, creativity, and entrepreneurship. This is considered a deficiency that may have to be corrected in the next research.

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Conflict of interest

The authors declare that they have no conflict of interest.

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