

Prospective Science Teachers' Skills in Exploring Reference Sources of Scientific Articles through Science Education Research Methodology Course

Parmin^{1*}, Erna Noor Savitri² 

^{1,2}Department of Science Education, Universitas Negeri Semarang, Semarang, Indonesia

ARTICLE INFO

Article history:

Received July 08, 2022

Revised July 11, 2022

Accepted August 30, 2022

Available online September 25, 2022

Kata Kunci:

Eksplorasi, Artikel, Calon Guru Sains

Keywords:

Exploration, Article, Prospective Science Teacher



This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.

Copyright ©2022 by Author. Published by Universitas Pendidikan Ganesha.

ABSTRAK

Proposal penelitian oleh mahasiswa calon guru sains masih lemah pada sumber rujukan karena sitasi dari jurnal nasional atau internasional masih kurang. Kelemahan utama berasal dari sumber referensi yang dirujuk dan cara mengutip. Penelitian ini bertujuan untuk mengukur keterampilan calon guru sains dalam mengeksplorasi sumber referensi artikel ilmiah. Keterampilan eksplorasi dalam penelitian ini dibatasi sampai menyusun kajian teori proposal skripsi. Penelitian ini menggunakan mixed methods. Data kuantitatif diperoleh dari nilai proposal penelitian yang disusun 34 mahasiswa sebagai sasaran penelitian, sedangkan data kualitatif dari analisis sumber referensi pada proposal penelitian. Setiap mahasiswa menyusun satu proposal sehingga ada 34 proposal penelitian yang diteliti. Dari hasil penilaian proposal, calon guru sains masih lemah dalam menggunakan referensi yang memenuhi kriteria >80% dari jurnal dan tahun terbitan referensi yang memenuhi kriteria >80% terbitan 10 tahun terakhir. Simpulan penelitian adalah pembelajaran yang membekali calon guru dalam menyusun proposal penelitian memerlukan peninjauan kurikulum. Mahasiswa membutuhkan pengetahuan tentang referensi secara lebih dalam, mulai dari mengenal jurnal, memilih artikel, mencari temuan di dalam artikel, mengutip, sampai menyusun daftar pustaka.

ABSTRACT

Prospective science teachers' research proposals are still weak in reference sources because citations from national or international journals are still lacking. The main weakness comes from the reference sources and citation methods. This study aims to measure prospective science teachers' skills in exploring reference sources for scientific articles. Exploratory skills in this research are limited to organizing a theoretical review for a thesis proposal. This research uses mixed methods. Quantitative data is obtained from the score of research proposals prepared by 34 prospective science teachers as research targets, while qualitative data is from analyzing reference sources in research proposals. Each prepares one proposal so that there are 34 research proposals studied. From the results of the proposal assessment, prospective science teachers are still weak in using references that meet the criteria of >80% of journals and reference publication years that meet the criteria of >80% of publications in the last ten years. The study concludes that learning that equips prospective teachers in preparing research proposals requires a curriculum review. Students need more profound knowledge about references, starting from getting to know journals, selecting articles, looking for articles' findings, citing, and compiling a bibliography.

1. INTRODUCTION

Undergraduate students' academic papers are written in the form of an undergraduate thesis as a graduation requirement. Before writing a thesis, students write a research proposal. The prospective science teachers' skills in writing proposals are obtained through the science education research methodology course. From the analysis of course outcomes in the form of research proposals for the last three years, several weaknesses were found: references from primary sources in the introduction, theoretical review, and discussions are weak, citations from national and international journals are lacking,

*Corresponding author

E-mail addresses: parmin@mail.unnes.ac.id (Parmin)

citation methods are still not appropriate, and the result analysis in the discussion is lacking in reinforcement from the journal. The weaknesses are the reference sources, how to cite, and the use of citations. Citations from article journals are highly reliable as references in scientific papers (Chang et al., 2021; Liu et al., 2021; Lu et al., 2017; Wang et al., 2021). Various weaknesses found can potentially reduce the reliability of the academic papers.

For prospective science teachers, writing a thesis proposal is the application of various theories learned. Knowledge of science, learning, and research methodology determines the quality of a research proposal. A research proposal is a requirement before students conduct research and report the results in a thesis. The skill of exploring reference sources is needed because it affects the quality of the content of the research proposal. A quality research proposal outlines a research plan from a theoretical review from reliable sources (Mufid, 2017; Mulyadi, 2012). A theoretical review is built by citing various reliable sources such as journals. The skill of exploring up-to-date reference sources from the latest publications can make a solid theoretical framework (Azwar & Amalia, 2017; Ravitch & Riggan, 2016). The skill of exploring reference sources from scientific articles is weak, according to the preliminary study of this research. Exploration is one of the stages in the integrated science learning model (Parmin et al., 2017).

The skill of citing scientific articles requires knowledge of various names and websites of scientific journals. Various names and websites of scientific journals were identified by exploring journal websites. Reference exploration is an activity to explore information sources to make it a theoretical review according to the research topic. The skill of exploring information sources determines the quality of the theoretical review of scientific work (Damariswara & Wiguna, 2019; Rismen, 2015). Electronic journal websites can be used to get to know various scientific journals. The journal level has different reliability in the global scientific community. Reputable international journals are highly reliable because the articles published have a novelty and impact on the scientific field. Prospective science teachers can use reputable international journals as primary sources in research proposals.

Indonesia has over a thousand accredited national journals, and some publish science education papers. National journals are available as reference sources for scientific works, so students can use them by visiting the desired journal website. National journal levels are based on accreditation levels. Sinta 1 and Sinta 2 are national journals with better article quality than Sinta 3 to Sinta 6 journals. Students' difficulty was allegedly due to their lack of knowledge about the names of national journals, websites, and article citation methods. National journals can be used as reference sources in scientific works because they only publish selected articles (Istiana & Purwaningsih, 2016).

Analysis of various research results in journals reinforces the need to examine students' skills in exploring reference sources. Stated that getting to know scientific journals is an important step in choosing articles to read and cite (Salam et al., 2017; Turabian, 2013). Students need insights about various reputable international journals and national journals to have choices in exploring reference sources. The cited articles are selected regarding the research topic (Krismayani, 2021). Prospective science teachers learn about organizing theoretical reviews through the science education research methodology course. Theoretical reviews are organized rationally by referring to various theories and scientific findings (Ence Surahman & Sofyan, 2020; Karuru, 2013). The skills of organizing theoretical reviews train students to think rationally. Theoretical reviews are organized systematically and linked between references. It is not only organized but has links between references to build a framework of scientific thinking.

The prospective science teachers' skills in understanding articles can impact the quality of the composition of their thesis as a final project. Prospective science teachers are equipped with scientific knowledge (Dotger et al., 2018; Naidoo, 2017). Scientific knowledge provides the working way for scientists who apply the scientific method. The way scientists work is developed by students by research practices (Smith, 2021; Smith et al., 2020). The habit of conducting scientific tests makes them prospective science teachers with the skills to write articles worthy of publication in journals. Prospective science teachers' writing skills are formed by applying various discovery methods during learning activities (Copeland, 2019; DeBoer, 2019).

This study aims to measure prospective science teachers' skills in exploring reference sources for scientific articles. Students' skills in this study were measured through the science education research methodology course. Exploratory skills in this research are limited to organizing a theoretical review for a thesis proposal. The proposal in this study was prepared by prospective science teachers attending research methodology courses.

2. METHOD

This study used mixed methods, referring to Creswell (2014). Quantitative data is obtained from the score of research proposals prepared by research targets, while qualitative data is from analyzing

reference sources in research proposals. Interviews were conducted with research targets to explore quantitative and qualitative data. The research targets were 34 prospective science teachers participating in the science education research methodology course. Each student prepared one proposal, so there were 34 research proposals studied. Each proposal is assessed similarly in the introduction, theoretical review, and research methods chapters. The research flow is presented in Figure 1.

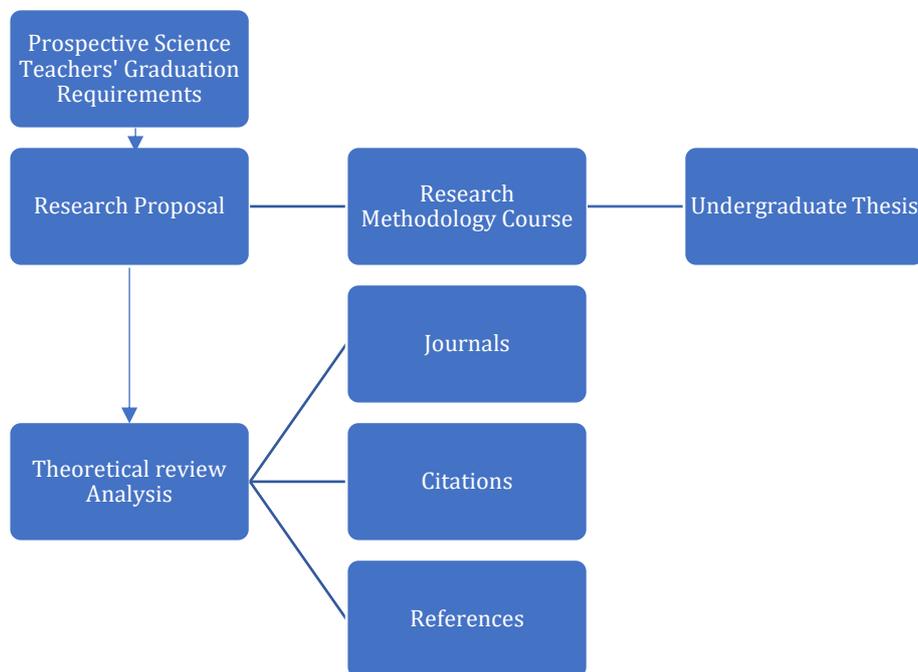


Figure 1. Research Flow

Quantitative data in this study were collected from the assessment of research proposals. The grid of instruments in the research are; six aspects are assessed: source of reference, year of publication, citation methods, citation contents, suitability with research variables, and bibliography writings. The interview data includes knowing the journal's name and website, selecting the cited articles, writing the citation contents, and ensuring that the citation applies ethical standards. The supervising lecturer fills in instruments for quantitative data collection. Qualitative data were collected with an open-ended interview with all prospective science teachers as research targets.

The instruments used have specifications from the results of specific arrangements because similar research is still difficult to find. The score for each aspect is assessed using a Linkert scale with a score range of 1-5: Scores of 1 (very poor), 2 (poor), 3 (fair), 4 (good), and 5 (very good). The assessment for the interview instruments uses the same range. Before use, the instrument was tested on students who completed their thesis proposals or on more senior students. A science learning evaluation expert validated the content of the interview instrument. Data analysis of the results of the proposal assessment was carried out quantitatively to obtain the highest, lowest, and average scores. The results of the interviews were analyzed descriptively and qualitatively because the interviews were open-ended.

3. RESULT AND DISCUSSION

Result

An assessment of students' research proposals was carried out. The assessment results of prospective science teachers' proposals in the score range of <69, 70-84, and >85 are presented in Figure 2. An assessment of students' research proposals was carried out. The assessment results of prospective science teachers' proposals in the range of scores <69, 70-84, and >85 are presented in Figure 2. There are 25 proposals (74%) scoring below <85. Each proposal is assessed in detail on six aspects: source of reference, year of publication, citation methods, citation contents, suitability with research variables, and bibliography writings. The complete results of the assessment of the six aspects of the proposal are presented in Table 1. After assessing the six reference aspects of the research proposal, an average score of 66.5 was obtained from a maximum score of 100. The study was conducted through open-ended interviews with prospective science teachers. The results of the interviews are presented in Table 2.

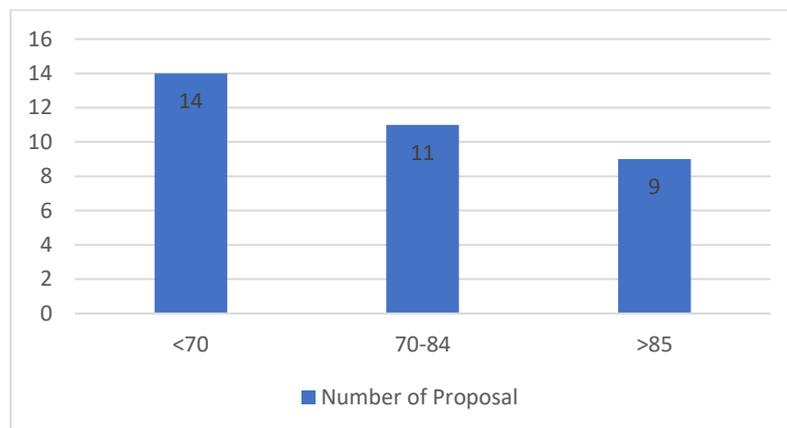


Figure 2. Research Flow

Table 1. Assessment of Six Aspects of Research Proposals

Aspek Penilaian	Rata-Rata Skor
Source of Reference (>80% journal)	42
Year of Publication (>80%, ten years)	47
Citation Methods	70
Citation Contents	65
Suitability With Research Variables	80
Bibliography writings	95
Average Score	66,5

Table 2. Interview Results

Question	Respondent's Answer
How do you find the name of journals according to the scientific field?	When searching for articles through Google, most students get to know the journal by accident.
How do you find journal websites?	Students find the journal websites using keywords on Google to find articles published in the journal. Very few students know the journal name from the official website, such as Sinta, Scimagojr, and journal websites.
How do you choose articles to cite?	Students choose according to the required theoretical review. There are still very few students who choose based on qualifications or journal level.
How to write citation contents in a research proposal?	Students copy from the abstract and the conclusion of the article. Only a few students cite the results and discussion.
Do you ensure the article citation applied ethical standards?	Some articles are cited but not listed in the bibliography.

Discussion

From the results of the proposal assessment, the prospective science teachers' skills to use references with criteria >80% from journals are still weak. Reference publication years with criteria >80% of publications from the last ten years are also weak. Most theoretical reviews are cited from books or sources other than journals. The lack of journal references makes the research rationale on the reasoning in the introduction section not strong enough. The introduction still tends to be conceptual, not yet supported by the study of data and facts as rationality for formulating research problems. Research rationale is built from an analysis of research problems strengthened by data (Bourke & Loveridge, 2017; Hou et al., 2022; Nasution, 2021). If the research proposal has citations from journals, the author read and analyzed various published research results (Marlina et al., 2015; Janssens et al., 2020). The habit of using

>80 references from journals and publications from the last ten years can increase literacy in reading articles.

The citation methods are good enough. However, there are still mistakes when citing concepts from journal sources. Citations from books are concepts, while citations from journal articles are findings. The citation method following the reference can be used to strengthen the theory or research rationale. Based on theoretical review analysis, citations from books are still more dominant, and only a few are from journals. Most journal findings citations are correct, but a few students cite concepts from journals. The difference between journals and other references lies in the author's findings written in the citation contents (Kulczycki et al., 2021; Rodríguez, 2017). Students who are accustomed to citing various findings published in journals since preparing research proposals can strengthen their skills in organizing scientific papers.

Citations in the proposal contents correspond to the research variables. Students find appropriate citation reference sources through the science education research methodology course. References that are not related to the research variables are not referenced. Most of the bibliography writings are also under the correct rules. The citation follows the bibliography, which means the citation is listed in the bibliography. Findings or statements that are cited but not in the references have the potential for plagiarism (Akbar & Picard, 2019; Ali, 2021). Students have an awareness of the potential for plagiarism in the research proposals. Building awareness of potential errors in citing references can familiarize students with being more careful in citing. Plagiarism can be prevented by citing the reference sources listed in the bibliography. The citations in the research proposal are not only per the research topic but are free from allegations of plagiarism.

The number of references in students' research proposals is lacking or weak because only a few students are familiar with journals. Students are unfamiliar with journals with official websites such as Sinta and Scimagojr. As confirmed from the interview results, students did not consider the accreditation or reputation level of the journal whose articles are cited. Requiring the number and sources of citations from journals is a form of introducing various journals to students. Visiting journal websites can build a culture of reading various findings in articles. Prospective science teachers preparing research proposals must be introduced to multiple national and international journals. The limitation of this article is that it does not measure students' prior knowledge of scientific journals and directly analyzes their research proposals. Reference studies in students' research proposals can be expanded by measuring the various prerequisites before organizing a proposal.

4. CONCLUSION

Learning that equips prospective teachers in preparing research proposals requires a curriculum review. Students need more profound knowledge about references, starting from getting to know journals, selecting articles, looking for articles' findings, citing, and compiling a bibliography. Knowledge of references enables students to build strong research rationales and theoretical reviews and prevent the potential for plagiarism. The impact of the skill of citing articles from journals can improve the quality of the undergraduate thesis as a student's final project.

5. REFERENCES

- Akbar, A., & Picard, M. (2019). Understanding plagiarism in Indonesia from the lens of plagiarism policy: lessons for universities. *International Journal for Educational Integrity*, 15(1), 1–17. <https://doi.org/10.1007/s40979-019-0044-2>.
- Ali, M. F. (2021). Attitudes towards plagiarism among faculty members in Egypt: a cross-sectional study. *Scientometrics*, 126(4), 3535–3547. <https://doi.org/10.1007/s11192-021-03872-8>.
- Azwar, M., & Amalia, R. (2017). Pemanfaatan Jurnal Elektronik Sebagai Sumber Referensi Dalam Penulisan Skripsi di Institut Pertanian Bogor. *LIBRARIA: Jurnal Perpustakaan*, 5(1), 87–110.
- Bourke, R., & Loveridge, J. (2017). Exploring wicked problems and challenging status quo thinking through educational research. *New Zealand Journal of Educational Studies*, 52(1), 1–5. <https://doi.org/10.1007/s40841-017-0083-2>.
- Chang, L. L. H., Phoa, F. K. H., & Nakano, J. (2021). A generative model of article citation networks of a subject from a large-scale citation database. *Scientometrics*, 126(9), 7373–7395. <https://doi.org/10.1007/s11192-021-04037-3>.
- Copeland, S. (2019). On serendipity in science: Discovery at the intersection of chance and wisdom. *Synthese*, 196(6), 2385–2406. <https://doi.org/10.1007/s11229-017-1544-3>.
- Damariswara, R., & Wiguna, F. A. (2019). Analisis Kemampuan Menulis Karya Ilmiah dalam Mata Kuliah

- Bahasa Indonesia (Studi pada Mahasiswa PGSD Angkatan 2016). *Stilistika: Jurnal Pendidikan Bahasa Dan Sastra*, 12(2), 111–123. <https://doi.org/10.30651/st.v12i2.2898>.
- DeBoer, G. (2019). *A history of ideas in science education*. Teachers college press.
- Dotger, B., Dotger, S., Masingila, J., Rozelle, J., Bearkland, M., & Binnert, A. (2018). The Right “Fit”: Exploring Science Teacher Candidates’ Approaches to Natural Selection Within a Clinical Simulatio. *Research in Science Education*, 48(3), 637–661. <https://doi.org/10.1007/s11165-016-9582-2>.
- Ence Surahman, A. S., & Sofyan, H. (2020). Kajian Teori dalam Penelitian. *Jurnal Kajian Teknologi Pendidikan*, 3(1).
- Hou, X., Li, R., & Song, Z. (2022). A Bibliometric Analysis of Wicked Problems: From Single Discipline to Transdisciplinarity. *Fudan Journal of the Humanities and Social Sciences*, 1–31. <https://doi.org/10.1007/s40647-022-00346-w>.
- Istiana, P., & Purwaningsih, S. (2016). Pemanfaatan e-journal oleh mahasiswa: Kajian analisis sitasi terhadap tesis mahasiswa klaster saintek Universitas Gadjah Mada. *Berkala Ilmu Perpustakaan Dan Informasi*, 12(2), 150–158. <https://doi.org/10.22146/bip.17295>.
- Karuru, P. (2013). Pentingnya Kajian Pustaka Dalam Penelitian. *Jurnal Keguruan Dan Ilmu Pendidikan*, 2(1), 1–9. <http://journals.ukitoraja.ac.id/index.php/jkip/article/view/149>.
- Krismayani, I. (2021). Analisis Sitasi Pada Artikel Jurnal Anuva Tahun 2017. *Anuva: Jurnal Kajian Budaya, Perpustakaan, Dan Informasi*, 5(2), 307–314. <https://doi.org/10.14710/anuva.5.2.307-314>.
- Kulczycki, E., Hołowicki, M., Taşkın, Z., & Krawczyk, F. (2021). Citation patterns between impact-factor and questionable journals. *Scientometrics*, 126(10), 8541–8560. <https://doi.org/10.1007/s11192-021-04121-8>.
- Liu, Y., Wu, Q., Wu, S., & Gao, Y. (2021). Weighted citation based on ranking-related contribution: a new index for evaluating article impact. *Scientometrics*, 126(10), 8653–8672. <https://doi.org/10.1007/s11192-021-04115-6>.
- Lu, C., Ding, Y., & Zhang, C. (2017). Understanding the impact change of a highly cited article: A content-based citation analysis. *Scientometrics*, 112(2), 927–945. <https://doi.org/10.1007/s11192-017-2398-7>.
- Mufid, M. (2017). Strategi dan pertimbangan etis dalam penulisan proposal penelitian ilmu perpustakaan dan informasi. *Tik Ilmew: Jurnal Ilmu Perpustakaan Dan Informasi*, 1(2), 131–144.
- Mulyadi, M. (2012). Riset desain dalam metodologi penelitian. *Jurnal Studi Komunikasi Dan Media*, 16(1), 71–80.
- Naidoo, K. (2017). Capturing the transformation and dynamic nature of an elementary teacher candidate’s identity development as a teacher of science. *Research in Science Education*, 47(6), 1331–1355. <https://doi.org/10.1007/s11165-016-9550-x>.
- Nasution, A. R. S. (2021). Identifikasi Permasalahan Penelitian. *ALACRITY: Journal of Education*, 1(2), 13–19. <https://doi.org/10.52121/alacrity.v1i2.21>.
- Parmin, P., Sajidan, S., Ashadi, A., Sutikno, S., & Fibriana, F. (2017). Science integrated learning model to enhance the scientific work independence of student teacher in indigenous knowledge transformation. *Jurnal Pendidikan IPA Indonesia*, 6(2), 365–372. <https://doi.org/10.15294/jpii.v6i2.11276>.
- Ravitch, S. M., & Riggan, M. (2016). *Reason & rigor: How conceptual frameworks guide research*. Sage publications.
- Rismen, S. (2015). Analisis kesulitan mahasiswa dalam penyelesaian skripsi di Prodi Pendidikan Matematika STKIP PGRI. *Lemma*, 1(2), 145551. <https://doi.org/10.22202/jl.2015.v1i2.538>.
- Rodríguez, J. M. (2017). Disciplinarity and interdisciplinarity in citation and reference dimensions: knowledge importation and exportation taxonomy of journals. *Scientometrics*, 110(2), 617–642. <https://doi.org/10.1007/s11192-016-2190-0>.
- Salam, R., Akhyar, M., Tayeb, A. M., & Niswaty, R. (2017). Peningkatan Kualitas Publikasi Ilmiah Mahasiswa dalam Menunjang Daya Saing Perguruan Tinggi. *Jurnal Office*, 3(1), 61–65.
- Smith, D. V. (2021). Educating future scientists towards post-patrimonial governance. *Cultural Studies of Science Education*, 16(1), 173–192. <https://doi.org/10.1007/s11422-020-09992-6>.
- Smith, D. V., Mulhall, P. J., Hart, C. E., & Gunstone, R. F. (2020). Contemporary scientists and their interactions with non-scientists: alternative companion stories for school curricula. *Research in Science Education*, 50(5), 2111–2130. <https://doi.org/10.1007/s11165-018-9765-0>.
- Turabian, K. L. (2013). *A manual for writers of research papers, theses, and dissertations: Chicago style for students and researchers*. University of Chicago Press.
- Wang, K., Shi, W., Bai, J., Zhao, X., & Zhang, L. (2021). Prediction and application of article potential citations based on nonlinear citation-forecasting combined model. *Scientometrics*, 126(8), 6533–6550. <https://doi.org/10.1007/s11192-021-04026-6>.