RESEARCH ARTICLE

The low percentage of local wisdom-based biology education research in SINTA-accredited journals

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Abstract: Local wisdom-based learning needs to be encouraged because it accommodates a contextual approach and preserves Indonesia's cultural heritage. The purpose of this study was to analyze the percentage and development of local wisdom-based research in biology subjects in articles published in Indonesian journals accredited by SINTA 1 to 3. Using a systematic procedure, 77 articles reporting local wisdom-based learning were obtained from 22 biology education journals. The results of the analysis showed that although the number of articles increased each year, the per-centage of publications was still small. This study also informs RnD as the most commonly chosen research design. In addition, this study also informs quasi-experimental as the most frequently used quantitative research design; validity, feasibility, and readability data are the most frequently collected development products; 10th grade students as the most frequently involved research subjects; biodiversity as the most frequently researched biology topic; as well as Banjarmasin and Bengkulu as the locations that most frequently conduct local wisdom-based biology research. The low percentage of research based on local wisdom needs to be followed up by increasing this research with a variety of designs, measured variables, research subjects, and improved research locations.

Keywords: ethnoscience; local-based learning; local wisdom, trend analysis

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Article history:
Received: 1 September 2024
Revised: 25 November 2024
Accepted: 26 November 2024
Published: 26 November 2024

10.22219/jpbi.v10i3.36108

p-ISSN: 2442-3750
e-ISSN: 2537-6204

How to cite:
Fauzi, A., Siswati, B. H., & Ramadani, S. D. (2024). The low percentage of local wisdom-based biology education research in SINTA-accredited journals. *JPBI (Jurnal Pendidikan Biologi Indonesia), 10*(3), 1098-1106. https://doi.org/10.22219/jpbi.v10i3.36108

Introduction

Biology learning plays an important role in improving students' understanding of nature, the environment, and biodiversity (Akinwumi, 2023; Rushton & Walshe, 2022; Shen, 2020). Through this subject, students' thinking skills are also expected to be optimally improved, such as critical thinking skills (Fitriani et al., 2019), problem solving (Ernawati & Sari, 2022), and other thinking skills. In addition, several other 21st Century competencies have also been proven to be optimally improved if biology learning is packaged optimally (Hiong & Osman, 2013; Hoskinson et al., 2013), such as science literacy, science process skills, and various soft skills needed in today's era (Jacque et al., 2016; Ngamskulrungroj, 2020). Although following technological developments, the use of media and learning resources also still needs to consider the local context because biology essentially studies all aspects around humans (Saro et al., 2023). Therefore, in designing biology learning, educators need to consider the design, sources, and learning media that can improve student competence while utilizing the environment around them.

One approach to biology learning design is local wisdom-based learning. Local wisdom is related to traditional knowledge that develops in society and reflects the interaction between humans and their environment (Kamakaula et al., 2024). Local wisdom in biology includes various aspects of life, such as the use of medicinal plants (Šūmane et al., 2018), environmental management systems (Congretel &

Pinton, 2020; Radcliffe et al., 2021), agricultural practices (Patel & Lepcha, 2023; Radcliffe et al., 2021; Šūmane et al., 2018), and animal use (Lemma et al., 2022). This kind of learning not only supports contextual learning, but also accommodates students to better understand the cultural heritage in their location (Hikmawati et al., 2024). Through this learning, students will also be encouraged to maintain the local culture they have so that local wisdom is not eroded by time (Erman & Wakhidah, 2024).

Local wisdom-based learning is also to be able to improve student competence. Various studies have informed the impact of local wisdom-based learning on the level of conceptual understanding (Izzah et al., 2022). Not only basic competencies, this learning is also able to empower various competencies that are in line with the needs of the 21st century (Hikmawati et al., 2024). In addition, learning that promotes local wisdom will also improve their ability to connect concepts in subjects with real-life problems and empower students' positive attitudes towards environmental conservation around them (Lusianawati et al., 2023; Marlina et al., 2023).

Along with its usefulness, research related to the integration of local wisdom in learning is increasingly developing. Most studies use a development research design to develop various products, such as modules (Setiawan et al., 2017), book (Sirait et al., 2024), media (Sugiyarti & Sukasih, 2024), and teaching material (Guslinda et al., 2024). Most of these studies are more towards measuring the validity of the products developed (Guslinda et al., 2024; Sirait et al., 2024), although some have measured their impact on students' 21st Century skills (Setiawan et al., 2017). In addition, there are indications that the implementation of local wisdom-based biology learning in Indonesia is still limited (Verawati & Ramdani, 2024). Therefore, the purpose of this study is to analyze the frequency and trends of local wisdom-based research in biology education journals in Indonesia. This study is important because the findings obtained can be used as a basis for follow-up by educators, researchers, and policy makers in the field of education.

Method

This study uses a trend analysis approach with a quantitative descriptive design. The research procedure consists of several stages that are systematically arranged to be reproducible, including determining the database, compiling a journal search strategy, compiling an article search strategy, analyzing the context of the article, extracting data, and synthesizing findings.

Data collection was conducted from SINTA 1 to 3 accredited journals with a focus on articles published in the period 2013 to 2022. The main data source is the SINTA portal (https://sinta.kemdikbud.go.id/) which provides access to a database of scientific journals in Indonesia. An initial search for relevant journals was conducted using the keyword "biology". Furthermore, the journals were further selected to ensure that their scope includes biology education. Journals that only focus on pure and applied biology were not included in this study. From the selection results, there were 44 journals that met the criteria, consisting of 2 SINTA 1 journals, 7 SINTA 2 journals, and the rest SINTA 3.

After the selected journals were identified, the next step was to search for articles that discussed local wisdom. The search was conducted using the search menu on each journal site. Relevant articles were identified based on the title, abstract, and keywords that showed a relationship with local wisdom in the context of biology education. Articles that did not discuss local wisdom were not included in the analysis. Data collection was conducted until mid-November 2023. Articles published after that date were not included in the next stage. From this process, 77 articles were found that met the criteria published in 22 journals.

The data obtained were analyzed quantitatively to identify research trends based on the year of publication, type of research design, development model used, biology material taught, data measured, research subjects, and geographic area where the research was conducted. The analysis was carried out by calculating the frequency of occurrence of each category and its percentage of the total articles analyzed. In addition, the data were also presented in the form of tables and graphs to facilitate interpretation of the results.

Results and Discussion

This study has collected 22 biology education journals accredited by SINTA 1 to 3. Of the 4034 articles published in these journals during the period 2013-2022, only 77 articles (1.91%) discussed local wisdom. Figure 1 presents the total number of articles published by all journals each year along with the percentage of articles discussing local wisdom. Based on Figure 1, the percentage of articles discussing local wisdom has increased from year to year, with the most significant increase occurring in 2019 to 2022. In that span of years, the percentage reached more than 2% each year. This increase shows a positive trend in the integration of local wisdom in biology learning, although the number is still relatively small compared to the total number of articles published. Although the frequency of research on local wisdom in biology education shows an increasing trend from year to year, the number is still relatively

low and the increase is not always consistent.

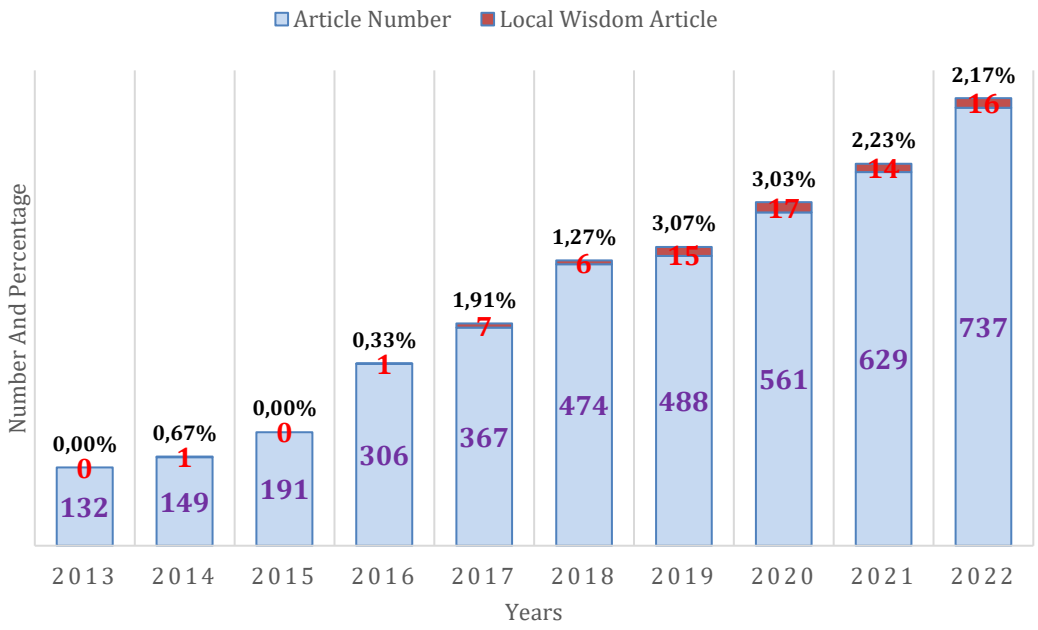

Figure 1. Development of the percentage of articles reporting local wisdom-based learning in biology education journal

Furthermore, the variety of research designs is presented in the pie chart in Figure 2. Based on Figure 2, the Research and Development (RnD) design dominates research related to local wisdom. There are 42 articles that use this design. This finding indicates that the majority of research aims to develop products or learning models based on local wisdom. Through a deeper analysis, Thiagarajan's 4D development model (Thiagarajan et al., 1974) and Sugiyono's development model (Sugiyono, 2021) are the two models most often chosen by researchers in developing their products. The 4D model is one of the oldest and most widely known development models by Indonesian researchers. Meanwhile, Sugiyono's model is one of the simplest development models compared to other models. Therefore, many researchers prefer the Sugiyono model.

One of the most frequently identified weaknesses in these RnD studies is that all stages of development research have not been completed according to the chosen model. In the 4D model, many articles only carry out the first three stages. Another weakness is the inaccuracy of the development stages. Some development studies also use other development models, such as the ADDIE model (Branch, 2009) or Borg & Gall model (Borg & Gall, 1983). However, even though they have referred to a particular model, the stages reported are different from the original development model.

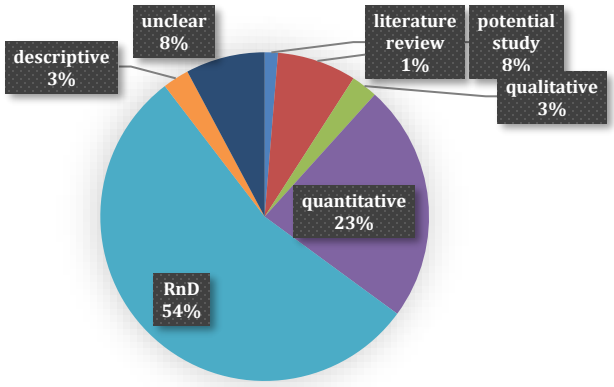

Figure 2. Distribution of local wisdom-based learning research designs

The next research design with the second highest percentage is quantitative research design (Figure 2). The number of researchers in the field of education who are asked to use quantitative designs is in line

with other trend analysis studies, although with different research topics, for example, research trend analysis related to critical thinking (Susetyarini & Fauzi, 2020). Through a more detailed analysis, most quantitative studies use quasi-experimental designs (Figure 3). This finding is in line with previous studies that reported the dominance of quasi-experiments compared to other quantitative designs in educational research (Fauzi & Pradipta, 2018; Susetyarini & Fauzi, 2020). Pre-experiments are the second most frequently used quantitative designs. Pre-experiments are the simplest and weakest experimental designs (Knapp, 2016). However, because of the simplicity of this design, many researchers choose pre-experiments as their research design.

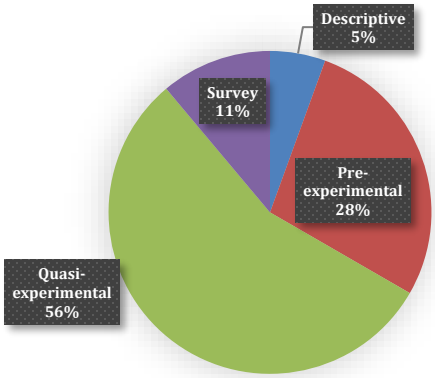

Figure 3. Distribution of quantitative research designs reporting local wisdom-based biology learning

The next parameter examined in this trend analysis is the diversity of data collected. The diversity of the data is presented in Figure 4. Based on Figure 4, as many as 44 studies collected data on validity, feasibility, and readability. This finding is in line with the distribution of design diversity that has been explained previously. Validity, feasibility, and readability are important data in ensuring the quality of a product from a RnD study. Given that the most common research design is RnD, the diversity of data that is most often found is also related to the quality of the development product.
Furthermore, conceptual understanding is in second place as the most frequently reported data by research related to local wisdom. On the one hand, conceptual understanding is included in the low-level cognitive domain (Adams, 2015; Ramdiah et al., 2019). However, conceptual understanding is a dependent variable commonly chosen by educational research. On the other hand, research that collects data based on thinking skills is still rarely chosen by researchers. Some of the thinking skills measured are problem-solving and critical thinking skills. Both are included in 21st-century skills that should be the main issue in research in the current era (Dwyer et al., 2014; Rahman, 2019).

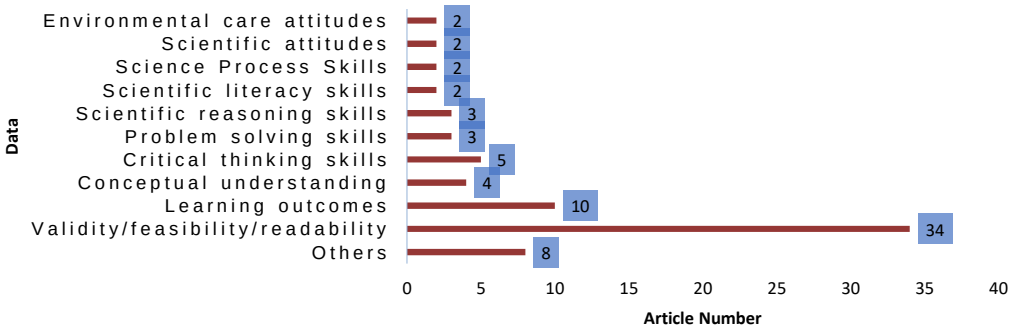

Figure 4. Variety of data collected in local wisdom-based biology learning

The research subjects that are most involved in local wisdom-based learning research are high school grade X students and undergraduate students. In line with this finding, there are many topics that are easily associated with local wisdom in high school grade X (Figure 5). Furthermore, grade X is the first year in high school in Indonesia, where students begin to study biology in more depth and specifically. Because students already have basic knowledge from science lessons in elementary and junior high schools, they will find it easier to understand abstract and complex concepts. In addition, in general, contributors to biology education researchers are undergraduate students of Biology Education. Usually, undergraduate students of Biology Education are high school students because Biology subjects in schools are only available at the high school level. Related to this condition, grade XII is often difficult to

involve as research subjects considering that this class is prepared for graduation exams.

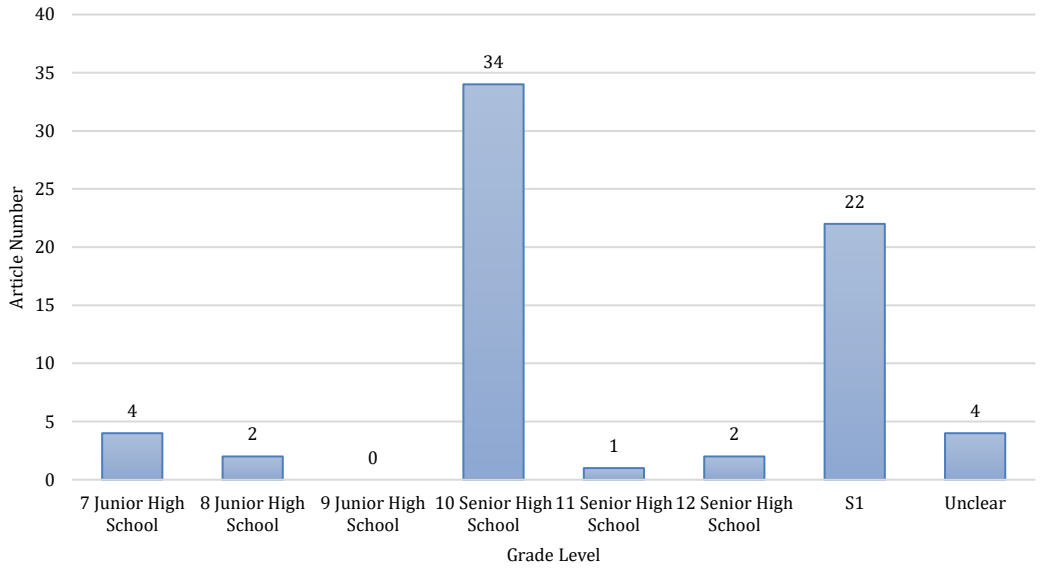

Figure 5. Distribution of class levels of students involved as research subjects

In terms of biological material, biodiversity is the most widely discussed topic, with 21 articles examining the relationship between local wisdom and biodiversity. Another topic that often appears is the environment, with 10 articles (Figure 6). Biodiversity is the most frequently studied topic because it is relevant to local wisdom. Many local wisdoms are applied by communities with the aim of managing the natural resources around them. Local wisdom that is oriented towards the sustainable use of natural resources will support biodiversity conservation efforts (Congretel & Pinton, 2020; Matuk et al., 2020). There are also many local wisdom practices that are oriented towards preserving and maintaining the quality of the environment. In addition to biodiversity and the environment, the next topic of study that is often chosen by researchers is the ecosystem. The ecosystem discusses the relationship between biotic and abiotic components. Given that communities are one of the biotic components in the ecosystem, there are many local wisdoms that can be explored by researchers to be integrated into biology courses. In fourth place is ethnobotany. Ethnobotany, which studies the relationship between humans and plants, is also an important focus because there is a lot of local wisdom related to the use of plants for medicine, food, and traditional ceremonies (Anwar et al., 2024; Dean, 2024; Flores-Silva et al., 2024).

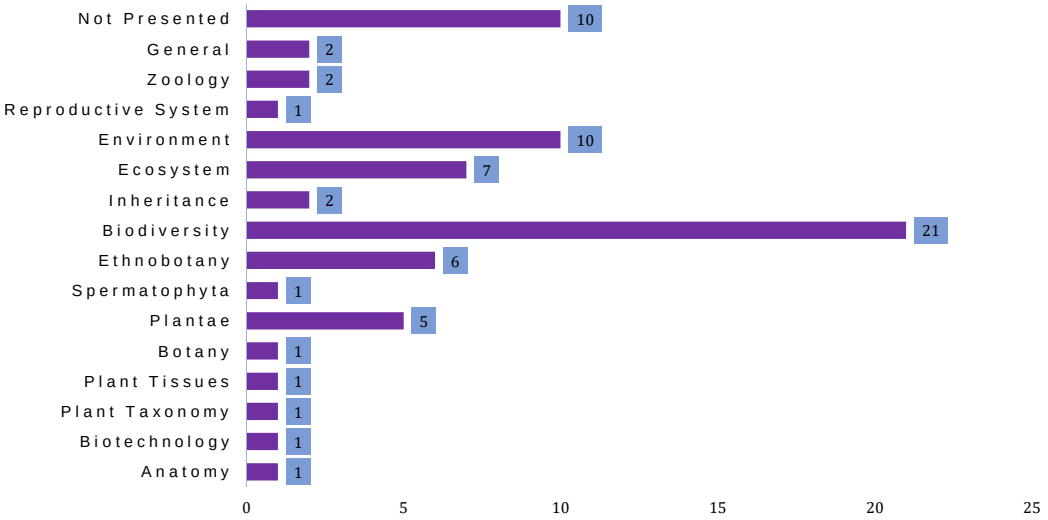

Figure 6. Variety of topics studied in publications reporting on local wisdom-based biology learning

The last parameter examined in this trend analysis study is the distribution of research locations. The distribution of research locations is presented in Figure 7. Based on Figure 7, of the 47 locations listed,

Banjarmasin and Bengkulu have the largest number of studies with 8 studies each. Mataram follows with 4 studies, followed by Kudus and West Lombok which each have 3 studies. Other locations, including cities such as Bogor, Malang Regency, Palembang, and Lampung, each only have 1 study. This shows that some areas have a much higher frequency of research than other areas.

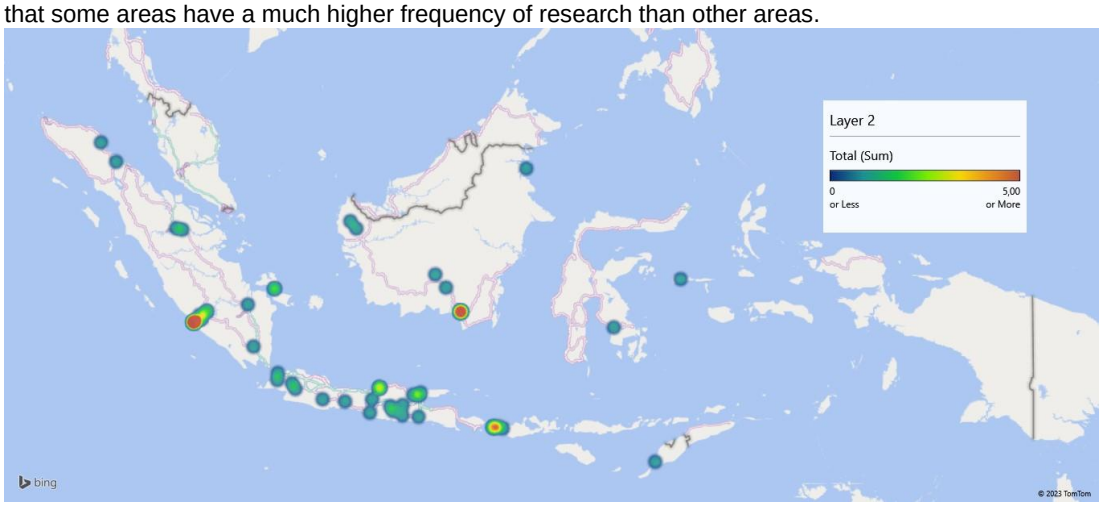

Figure 7. Distribution of research locations reporting local wisdom-based biology learning

Local wisdom-based learning is one of the learning approaches that is relevant to biology learning (Congretel & Pinton, 2020; Patel & Lepcha, 2023; Radcliffe et al., 2021; Šūmane et al., 2018). Various studies recommend the application of this learning because of its benefits. In addition to being able to contextualize the concepts learned by students, students are also trained to connect what they learn with problems around them. They are also trained to apply biological concepts to real contexts related to local wisdom (Handayani et al., 2018). By highlighting local wisdom, students will also be more aware of the cultural richness of the local community. Therefore, students will also be encouraged to maintain and pass on local wisdom-based practices that are in line with the sustainability of their environment (Erman & Wakhidah, 2024).

Local wisdom-based learning also has a positive impact on student competence. Several studies report its impact on improving students' conceptual understanding (Izzah et al., 2022). Several other studies also report its influence on various thinking skills. In addition, several other competencies that students need to master can also be improved, such as thinking skills (Kwangmuang et al., 2021) and science process skills (Dwianto et al., 2017).

Regarding the still low frequency of local wisdom-based research, there are several strategies that can be implemented. First, increasing awareness of the importance of integrating local wisdom into the biology curriculum needs to be implemented. One strategy that can be implemented is to organize teacher training that is oriented towards this issue. As professional teachers, the presence of this kind of training is important to improve teacher professionalism. In addition, the higher education curriculum also needs to accommodate lectures that discuss local wisdom and ethnoscience. Another strategy is to organize various webinars, workshops, and seminars, both for learning design and research design based on local wisdom. Providing research grants with a local wisdom scheme also needs to be implemented.

Although there are several important findings related to the trend of local wisdom research in biology learning in Indonesia, this study has several limitations. The main limitation is that this trend analysis study only involves articles from biology education journals accredited by SINTA 1 to SINTA 3. Journals with accreditation below SINTA 3 or those that have not been accredited are not included in the analysis. This limitation of the study allows many local wisdom-based studies in Indonesia that are not included in this trend analysis study. In addition, this study only uses a keyword-based search method. The weakness of this search strategy is that the search results may not be able to capture all relevant articles, especially if the keywords used are not explicit in the title or abstract of the article. Therefore, further research needs to be designed with a more optimal search strategy.

Conclusion

Based on the analysis that has been done, this study found that although there is an increase in the number of studies related to local wisdom in biology education, the frequency is still low and the increase is not always consistent every year. The most dominant research design is research and development (RnD). Quasi-experimental research is also widely used in quantitative research. Research tends to

focus on 10th grade high school students and undergraduate students. The most widely discussed topics are biodiversity, environment, and ethnobotany.

Based on the findings of this study, it is recommended that the integration of local wisdom in biology learning continues to be improved and supported by broader and more in-depth research. Strengthening research methodology is also an issue that needs to be considered in further research. In addition, further research is expected to develop more innovative learning models that adapt to local needs. Researchers also need to expand the focus of lesson topics to cover more aspects of relevant local wisdom. In addition, more research is needed involving students at various levels of education and using more varied research designs.

Acknowledgment

The researcher would like to express his deepest gratitude to LPPI (Institute for Research and Community Service) of the Universitas Muhammadiyah Malang for the support that has always been given in realizing the publication of this paper.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

A. Fauzi: methodology, data collection, writing original draft preparation, review and editing; **B. H. Siswati:** review and editing: **S. D. Ramadani:** review and editing

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