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Local Potential and Indigenous Knowledge as a Source of Biology Research Data: Integration of Structured Observation and Digital Technology

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Abstract

Local potential and indigenous knowledge are important data sources in biological research because they reflect the richness of biodiversity and community knowledge that has developed from generation to generation. However, the use of these resources in research requires a structured observation approach supported by digital technology to produce reliable biological data and facilitate the preparation of scientific papers. The article aims to explore the use of local potential and indigenous knowledge as sources of biological research data through structured observation and digital technologies. The study used a literature review method, examining various scientific sources on structured observation, local potential, indigenous knowledge, digital technology, and scientific writing. The results of the study show that structured observation helps with systematic data collection by determining objects, observation aspects, documentation, and data analysis. The use of digital technologies, such as Google Search, Mendeley, Pl@ntNet, iNaturalist, GBIF, Catalogue of Life, POWO, IUCN Red List, Publish or Perish, and VOSviewer, supports the processes of searching for literature, identifying organisms, managing references, exploring biodiversity data, and analyzing research trends. The data obtained can then be communicated through the preparation of systematic scientific papers using the IMRaD structure, which includes a conclusion, appropriate citations, and informative data presentation. The integration of local potential and indigenous knowledge, structured observation, digital technology, and scientific writing contribute to the development of biological research, biodiversity documentation, preservation of indigenous knowledge, and biological resource conservation. This approach also provides a practical framework for integrating local resources and digital technology into biology education, thereby strengthening students' research competencies, scientific inquiry, and scientific writing skills.

Keywords: structured observation, indigenous knowledge, local potential, biological research, digital technology

1. Introduction

Biology is a science closely tied to daily life because it studies living things and their interactions with the environment. The surrounding environment that is rich in local potential and indigenous knowledge or local wisdom can be used as a source of contextual and easily accessible biological research data (Adinugraha, Sangur, et al., 2025; Situmorang, 2016; Sura et al., 2026; Zubaidah & Adinugraha, 2024), such as medicinal plants (Silalahi & Nisyawati, 2018), Yard Biodiversity (Silalahi, 2016; Zukmadini et al., 2024), traditional foods (Adinugraha, Grace, et al., 2024; Shilkia. M et al., 2026; Sitinjak et al., 2025), as well as community conservation practices (Iskandar & Budiawati, 2016; Sabasti et al., 2024). However, the use of local potential and indigenous knowledge in biology research and learning is still not optimal, even though its integration has been proven to be able to improve scientific literacy, including understanding and awareness of biodiversity (Adinugraha, Zubaidah, et al., 2025b), students' critical thinking skills (Krishantari et al., 2025), and the character of the students (Lepiyanto et al., 2026).

Indigenous peoples have local wisdom or indigenous knowledge that has been passed down from generation to generation (Adam et al., 2019; Cajete, 2020) related to the use of plants, animals, and other biological resources, such as the use of medicinal plants, local foods, traditional conservation practices, and species naming based on regional languages or certain characteristics (Adinugraha, Zubaidah, et al., 2024, 2025a; Silalahi & Nisyawati, 2018; Zukmadini et al., 2024). This indigenous knowledge shows that there is a close relationship between the community and the surrounding biological environment (Gonçalves et al., 2021; Ishtiaq et al., 2013; Kosoe et al., 2020), but until now, most of the local potential and indigenous knowledge has been used traditionally and has not been widely developed as a source of structured scientific research data. In fact, local wisdom is an important source of information for supporting ethnobiological research, biodiversity conservation, and contextual biology learning grounded in the surrounding environment across various scientific studies.

In its implementation, scientific studies require objective, accountable data, so the data collection process must be carried out systematically through structured observation (Cohen et al., 2018; Verma et al., 2023). Structured observation helps researchers determine the observation objects, document the observations, record characteristics, and identify species more accurately, thereby producing more valid data (McKechnie, 2006). Various studies show that observation is an important method for obtaining systematic and objective data (Kumar, 2023), for understanding social phenomena in depth (Balcom et al., 2021), and for increasing the reliability of research through structured observations combined with other methods

(Dimitra et al., 2024). In the field of biology, structured observation has also been implemented to support biological analysis (Weinstein & Marks, 2021) and the development of biodiversity-based learning (Nurandari & T. Triatmanto, 2023).

The data obtained through subsequent observations need to be recorded, managed, and interpreted appropriately in order to support scientific analysis and the preparation of scientific papers (Miller & Spiegel, 2025). Along with the development of science, digital technologies are increasingly supporting research activities (OECD, 2025). Digital technology provides convenience, starting from the observation process to the preparation of scientific papers. Identification of organisms can be done through apps such as iNaturalist (Mason et al., 2025) and Pl@ntNet (Goëau et al., 2014; Velde et al., 2023), which help users quickly and conveniently identify species based on photo documentation (Bawingan et al., 2024). In addition, the search for scientific literature has become easier through Google Search (Fisher et al., 2022), while citation and reference management can be automated with Mendeley (Jain et al., 2023), thereby improving the efficiency of data processing and the writing of scientific papers, making the process more systematic and effective.

Previous studies have generally discussed local potential and indigenous knowledge in biology education, structured observation as a data collection method, or digital technology for organism identification and scientific writing separately. However, a comprehensive framework that integrates these components into a single approach for biology research has rarely been discussed. To the best of our knowledge, few review studies have systematically linked local potential and indigenous knowledge with structured observation and digital technology from biological data collection through scientific paper writing. Therefore, this review proposes an integrated conceptual framework that connects these components to support biology research based on local resources.

Although various studies have discussed structured observation and the use of digital technology separately, studies that integrate structured observation, local potential, indigenous knowledge, and digital technology in biological research remain relatively limited. In fact, structured observation plays an important role in producing systematic, consistent, reliable, and valid data, while digital technology can increase the efficiency, accuracy, and speed of research data processing (Kuiken, 2023; McKechnie, 2006). Unlike previous reviews that mainly discuss these topics independently, this article integrates local potential, indigenous knowledge, structured observation, and digital technology into a conceptual framework that supports biological research from data collection to scientific paper writing.

Therefore, this article aims to explore the potential and local wisdom of the surrounding environment as a source of biological research data through a structured observation approach and the use of digital technology to support organism identification, data management, literature search, and the preparation of scientific papers. In addition to synthesizing previous studies, this article provides practical examples illustrating how selected digital technologies can be applied throughout the biology research process. These examples are intended to facilitate the adoption of digital tools by students and novice researchers rather than to provide exhaustive software manuals.

2. Methods

2.1 Types of Research

This article was prepared using a descriptive narrative literature review method. This approach examines the potential and local wisdom of the surrounding environment as a source of biological research data, as well as the role of structured observation and digital innovation in supporting research activities and scientific paper writing. This approach was considered appropriate because it enables the synthesis of concepts from diverse sources and the development of a conceptual framework integrating local potential, indigenous knowledge, structured observation, and digital technology, rather than quantitatively evaluating empirical evidence or intervention effectiveness.

2.2 Data Source

The data used in this article are secondary data from various scientific sources, including national and international journal articles, books, proceedings, biodiversity databases, and scientific documents and websites relevant to the research topic. The literature used focuses on local potential, local wisdom, ethnobiology, structured observation, digital technology in research, and scientific paper writing. These sources were selected because they represent the key components required to develop the conceptual framework proposed in this review. Literature was retrieved primarily from Google Scholar because it provides broad multidisciplinary coverage relevant to biology education and biological research. Official biodiversity databases, including Plants of the World Online (POWO), Catalogue of Life (CoL), Global Biodiversity Information Facility (GBIF), and the IUCN Red List, were also used to obtain taxonomic, distributional, and conservation information on biological species.

2.3 Data Collection

Data were collected through a literature review of relevant scientific sources. The literature search was conducted using Google Scholar and supported by official biodiversity databases. The search employed combinations of the following keywords: "structured observation", "indigenous knowledge", "local wisdom", "local potential", "biology research", "Google Search", "Mendeley", "Pl@ntNet", "iNaturalist", "scientific writing", and "digital technology". The retrieved literature was screened based on its relevance to the objectives of this review. The inclusion criteria comprised peer-reviewed journal articles, books, conference proceedings, official biodiversity databases, and scientific documents discussing biology research, indigenous knowledge, structured observation, digital technology, and scientific writing. Publications that were duplicated, lacked sufficient scientific information, or were not relevant to the scope of this review were excluded. Priority was given to recent publications to reflect current developments in biology research and digital technology, while seminal references were retained when they provided important theoretical or methodological foundations.

2.4 Data Analysis

Data were analysed descriptively through four stages: (1) literature screening and data reduction, (2) thematic grouping based on the major topics discussed, (3) literature synthesis to identify relationships among concepts, and (4) conceptual interpretation to develop an integrated framework linking local potential, indigenous knowledge, structured observation, digital technology, and scientific paper writing. To enhance the credibility of the synthesis, greater emphasis was placed on peer-reviewed publications, authoritative books, and official biodiversity databases, while findings from different sources were compared to ensure conceptual consistency.

3. Result and Discussion

3.1 The Concept of Potential and Local Wisdom in Biological Research

Local potential refers to the resources owned by an area and can be used to support people's lives and scientific development. Local potentials can include natural resources, flora and fauna, and traditional technologies (Septina et al., 2025). Local potential includes various components of biodiversity found in the surrounding environment, such as medicinal plants, food crops, yard biodiversity, insects, fungi, local birds, and wild vegetation. The term local potential is generally used as a practical or operational term to refer to the typical resources of an area that can be used as a source of research and learning data. In the context of biology, the existence of these biological resources makes the surrounding environment a natural laboratory for the study of taxonomy, ecology, ethnobiology, conservation, and biology education (Silalahi, 2016; Silalahi & Nisyawati, 2018; Zukmadini et al., 2024).

Local wisdom or indigenous knowledge is knowledge, values, practices, and experiences that develop in society and are inherited from generation to generation through a long process of interaction with the surrounding environment (Adam et al., 2019; Adinugraha, Zubaidah, et al., 2024; Cajete, 2020). In the field of biology, local wisdom can be found in various forms, such as the use of plants and animals in traditional ceremonies or rituals, such as ubarampe at wiwitan (Adinugraha, 2024), Siege (Adinugraha, Zubaidah, et al., 2024), and Manafo in the Nias area (Adinugraha, Gulo, et al., 2024). In addition, there is the manufacture of traditional foods that, of course, utilise plants, such as coconut sugar produced by the Javanese Somongari people (Adinugraha, Zubaidah, et al., 2025a) and a typical Batak pakpak pelle. (Sitinjak et al., 2025), bubbor paddas typical of Malay Sambas (Adinugraha, Grace, et al., 2024), Tanggo-Tango (Shilkia. M et al., 2026), the use of animals of the Enggano community (Zukmadini et al., 2024), and dekke na niarsik (Marpaung et al., 2025). The relationship of plants in protecting spring water and the environment can also be linked to biodiversity matter (Sabasti et al., 2024).

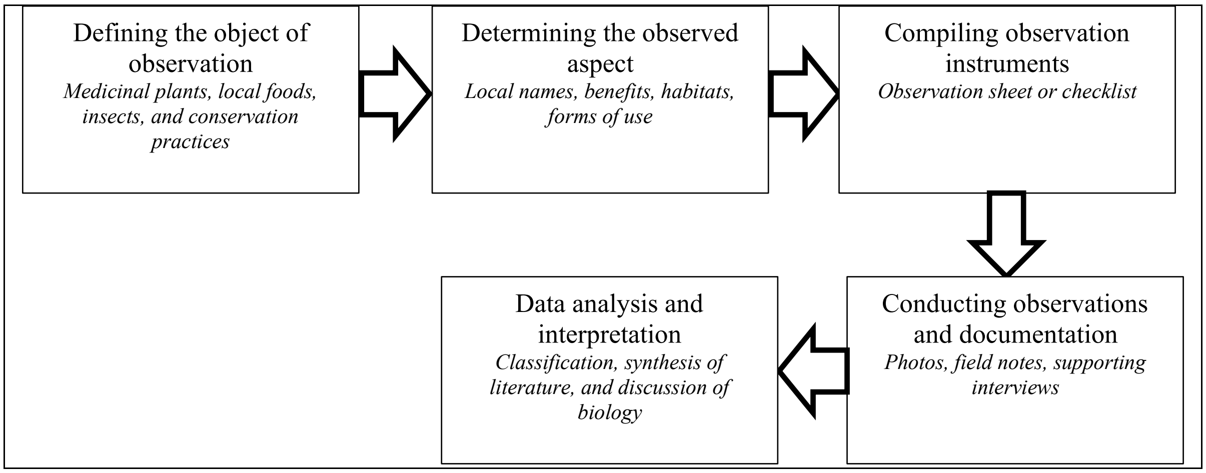
The potential and local wisdom that develop in society are closely related to various branches of the biological sciences, especially ethnobiology, ethnobotany, ethnozoology, and conservation. Ethnobiology studies the relationship between humans and the biological resources in their environment, while ethnobotany and ethnozoology specifically study the use of plants and animals by local communities (Cajete, 2020; Gonçalves et al., 2021). Various traditional conservation practices that develop in indigenous peoples, such as the protection of sacred forests, restrictions on the use of certain species, and natural resource management based on customary rules, are also important sources of information in the study of biodiversity conservation (Hidayah et al., 2025; Iskandar & Budiawati, 2016; Sabasti et al., 2024). Therefore, local potential and indigenous knowledge not only serve as a source of biological research data but also contribute to the preservation of biodiversity and the sustainability of local knowledge. To document and analyse this information scientifically, a systematic data-collection process is needed, using a structured observation approach.

3.2 Structured Observation as a Basis for Biological Data Collection

Structured observation is a method of data collection carried out systematically using predetermined guidelines or instruments, resulting in data that are more objective, consistent, and scientifically accountable (Cohen et al., 2018; Verma et al., 2023). In biological research, structured observation plays an important role by enabling researchers to gather information from clear, measurable variables. In contrast to unstructured observation, which is freer, structured observation emphasises uniformity of observation procedures, systematic data recording, and organised documentation (Kumar, 2023). This approach is very suitable for producing valid data and facilitating the analysis and interpretation of research results (McKechnie, 2006).

The main characteristics of structured observation, as described by McKechnie (2006), consist of four main points. First, structured observation is a data collection method carried out using predetermined variables, parameters, procedures, and instruments based on the research objectives. Second, this method uses a systematic recording format, such as observation sheets or checklists, so that the data obtained are more objective, consistent, and easier to analyse. Third, this method allows the recording of frequency, duration, and sequence of events in an organised manner. Fourth, structured observation can also increase the reliability and validity of data, making research results easier to compare, replicate, and use as a basis for studies in similar contexts.

Figure 1.
Structured observation stages for local potential and indigenous knowledge-based biology research



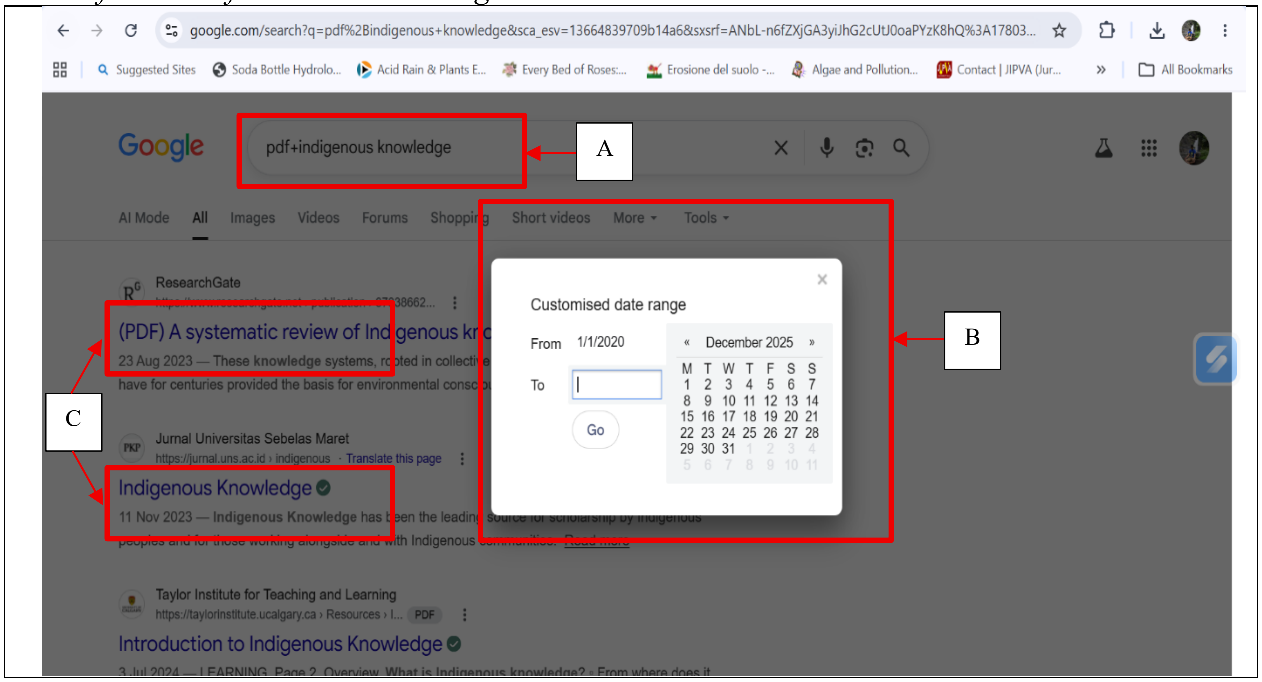
Structured observation is carried out using observation aspects and predetermined recording formats, so that the data obtained are more systematic, consistent, and easier to analyse (Cohen et al., 2018). In biological research based on potential and local wisdom, observation instruments can be arranged according to the observed objects and the information needed. An example of the stages of structured observation is presented in Figure 1.

Figure 1 shows the stages of structured observation, starting from the determination of objects and aspects of observation, the preparation of observation instruments, the implementation of observation and documentation, and data analysis and interpretation. These stages are carried out systematically to produce data that is more consistent, objective, and scientifically accountable. However, as science and technology have advanced, structured observation no longer relies solely on manual recording. Various digital innovations can now be used to support the identification of organisms, searching the scientific literature, managing references, and compiling scientific papers, enabling biological research based on potential and local wisdom to be carried out more effectively and efficiently.

3.3 Utilization of Digital Technology in Structured Observation

The use of digital technology not only increases research efficiency but also helps researchers obtain more accurate, well-documented, and easily accessible data to support the preparation of scientific papers (Madanchian & Taherdoost, 2025). Digital technology allows students to access information widely and independently, strengthening exploration and research skills (Menon, 2024). Digital technology has provided various conveniences in the conduct of biological research, ranging from information search and reference management to organism identification and access to global biodiversity databases.

Figure 2.
Search for scientific articles via Google search



3.3.1 Scientific Literature Search

Literature search is an important stage in research because it serves to obtain theoretical foundations, identify research gaps (*Research gap*), and compare the results of the research with previous studies. Today, various digital platforms can be used to quickly and efficiently access scientific literature. Google Scholar is very helpful for quick searches of scientific literature, but researchers need to understand its limitations and use other sources to obtain more comprehensive information (Hoseth, 2011). Scientific article searches can also be conducted via Google. Google Search facilitates rapid access to information across various disciplines, though it may reduce long-term information retention (Fisher et al., 2022). How to find articles through Google Search is presented in Figure 2.

Figure 2 presents the steps for searching the literature using Google Search. The search process begins by entering the desired keyword, for example*, "pdf+indigenous knowledge"* (A), so that the search results display more articles or scientific documents in PDF format. To obtain more up-to-date references, the researcher can select *Tools> Custom Range* and specify the desired publication year range, for example, 2020–2025, to obtain articles published in the last five years (B). This technique can help researchers identify relevant literature sources more quickly and efficiently over time (C).

However, the effectiveness of Google Search depends on the selection of appropriate keywords and search strategies. Because search results are ranked using Google's algorithms, not all retrieved documents necessarily represent the most scientifically rigorous evidence. Therefore, researchers should critically evaluate the credibility of each source and, whenever possible, complement Google Search with specialised academic databases such as Google Scholar, Scopus, or Web of Science. Nevertheless, for exploratory searches and the identification of recent publications, Google Search remains a practical tool for supporting biology research.

3.3.2 Referral Management

Good reference management is an important part of writing scientific papers to maintain citation accuracy and academic integrity. Various reference management software, such as Mendeley, can help researchers store, organise, and manage library resources systematically. Mendeley also supports the addition of notes to scientific documents and collaboration among users in reference management (Jain et al., 2023). In addition, Mendeley has proven effective in supporting long-term learning and academic collaboration, although there are still some technical obstacles to its use (Banat, 2021). Using Mendeley also helps students manage citations more accurately and reduces academic errors in scholarly writing (Kale, 2023). Therefore, using reference management software can improve writing efficiency and make it easier to compile citations and bibliographies consistently. Beyond improving writing efficiency, reference management software contributes to research quality by reducing citation errors, maintaining consistency in bibliographic formatting, and supporting academic integrity. Nevertheless, automatically imported metadata are not always accurate; therefore, manual verification remains necessary before citations are incorporated into scientific manuscripts. The use of Mendeley Desktop is presented in Figure 3.

Figure 3.
Use of Mendeley Desktop for reference management

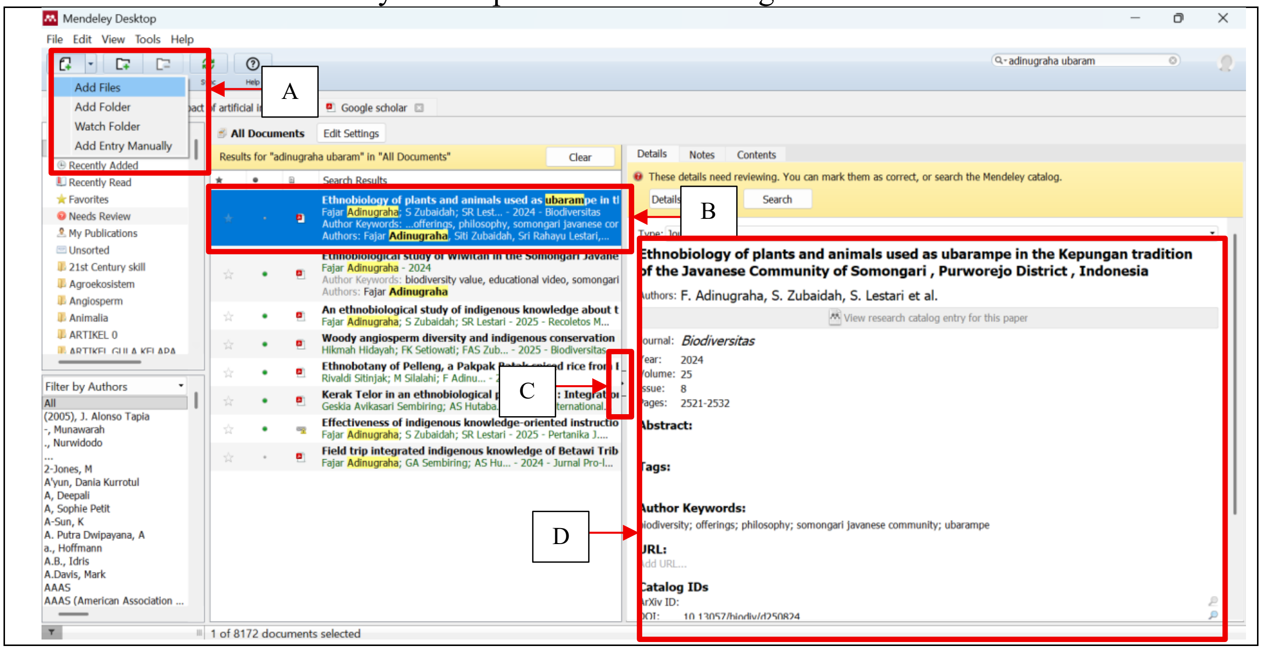


Figure 4.
How to use Mendeley in Microsoft Word

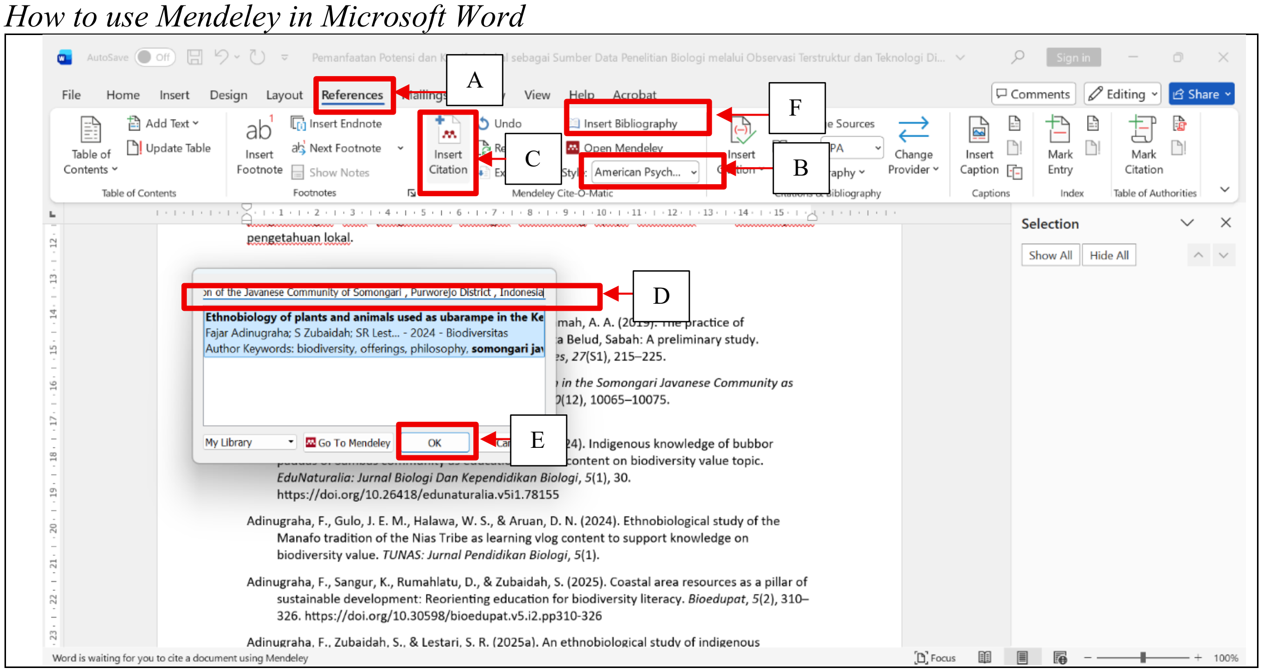


Figure 3 shows Mendeley Desktop, which can be used to manage scientific references systematically. The first step is to add the downloaded article in PDF format via the

Add Files (A) menu. Before adding a document, it is recommended to create a folder or collection first so that references can be grouped by research topic. After the article has been successfully added, the user can open the document by clicking or double-clicking the article title in the reference list (B). The article's bibliographic information can be displayed via a small triangle icon (C), with the article's metadata appearing in the information panel (D). Such metadata needs to be checked and, if necessary, edited manually, as Mendeley is not always able to read the document information accurately. Information that needs to be verified includes the document type, article title, author's name, journal name, year of publication, volume, issue, page, DOI, and other bibliographic data. Correcting metadata accurately is very important because it affects citation accuracy and the automatic compilation of bibliographies. The use of Mendeley in MS Word is presented in Figure 4.

Figure 4 shows the steps for automatically creating citations and bibliographies in Microsoft Word using Mendeley. Before use, users need to install the Mendeley plugin in Mendeley Desktop by selecting Install MS Word Plugin from the Tools menu. After the installation process is successful, the Mendeley menu will appear on the References tab in Microsoft Word (A). Users can then select the desired citation style, such as APA, IEEE, or Chicago, via the Style (B) menu. To add a citation, click Insert Citation (C), then enter or copy the title of the article that has been saved in Mendeley (E), then select the appropriate reference and click OK. Citations will automatically appear on the manuscript according to the selected style. Furthermore, the bibliography can be automatically generated by selecting the Insert Bibliography (F) menu, so that all references cited in the document are systematically arranged according to the format used. This feature helps improve writing efficiency and minimise errors in citations and bibliography compilation.

3.3.3 Digital-Based Organism Identification

Digital technology also supports the identification of organisms through applications powered by artificial intelligence (AI). The iNaturalist application has been widely used in educational and research activities, including for project-based learning in organism identification (Niemiller et al., 2021) and species identification in museum collections (Heberling & Isaac, 2018). Meanwhile, Pl@ntNet is a plant identification app developed since 2013 and has covered more than 22,000 plant species (Xing et al., 2021). The app can identify plants based on various organs, such as flowers, leaves, fruits, and bark (Goëau et al., 2013), which really helps the field identification process. The use of Pl@ntNet has also been reported to be effective in supporting plant identification in biodiversity research in urban forests (Adinugraha, 2022). Therefore, artificial intelligence-based applications such as iNaturalist and Pl@ntNet can serve as practical alternatives for observing and identifying organisms in biological research. The iNaturalist and pl@ntnet applications are presented in Figure 5.

Figure 5 shows two widely used applications for identifying organisms digitally: iNaturalist and Pl@ntNet. Both apps use photo documentation to help users quickly and conveniently identify species. iNaturalist allows users to upload observations, obtain identification from the scientific community and artificial intelligence systems, and store location, date of observation, and field records in a single platform. In addition, iNaturalist provides data-sharing and species distribution-mapping features that support biodiversity research and conservation activities. Meanwhile, Pl@ntNet is specifically designed for plant identification based on images of various plant organs, such as leaves, flowers, fruits, stems, and bark. With these features, iNaturalist and Pl@ntNet can serve as support tools for structured observation in biological research, drawing on potential and local wisdom.

Figure 5.
Organism identification applications. A. iNaturalist; B. pl@ntnet

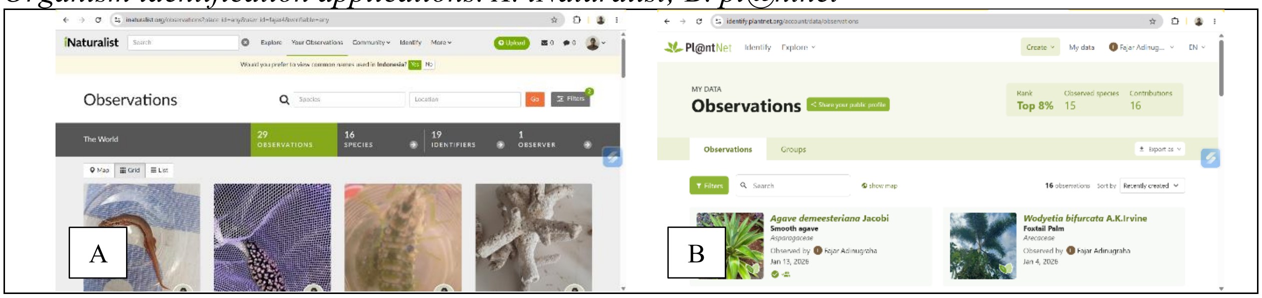
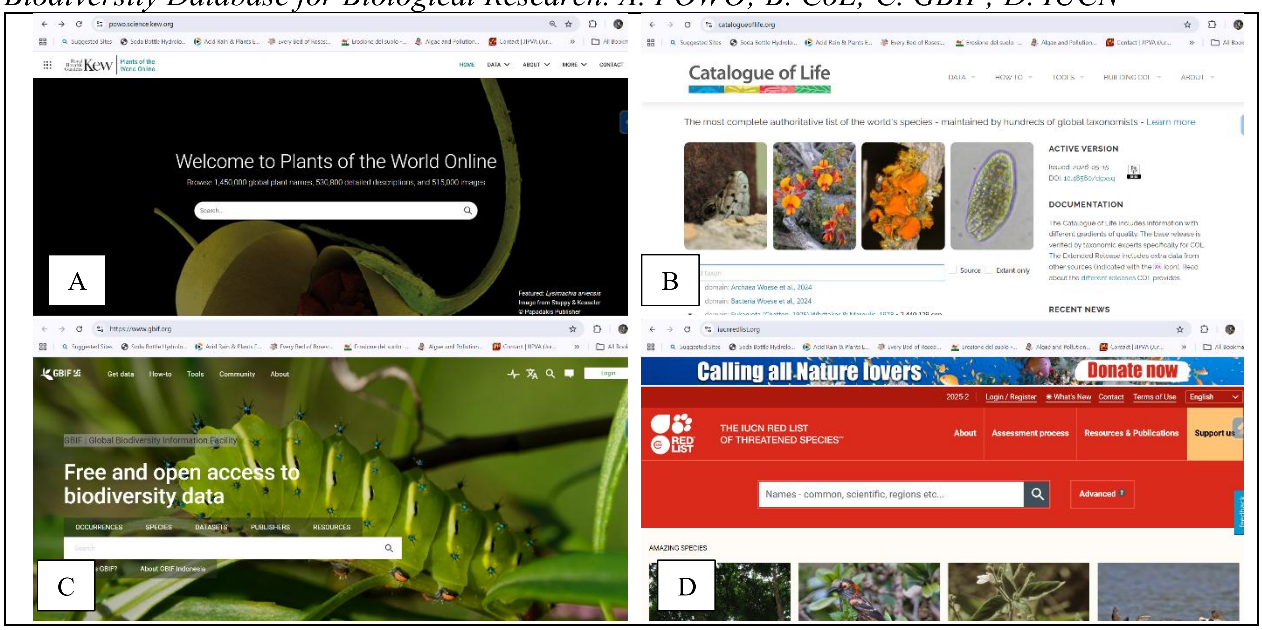


Figure 6.
Biodiversity Database for Biological Research. A. POWO; B. CoL; C. GBIF; D. IUCN



The educational value of AI-based identification applications extends beyond species recognition. Immediate access to taxonomic information encourages users to compare morphological characteristics, verify scientific names, and explore ecological information. Consequently, these applications may contribute to improving biodiversity literacy, particularly species recognition and awareness of local biodiversity. However, AI-generated identifications should be regarded as preliminary results because prediction accuracy depends on image quality, taxonomic coverage, and database completeness. Therefore, verification using authoritative biodiversity databases remains necessary.

3.3.4 Biodiversity Database for Biological Research

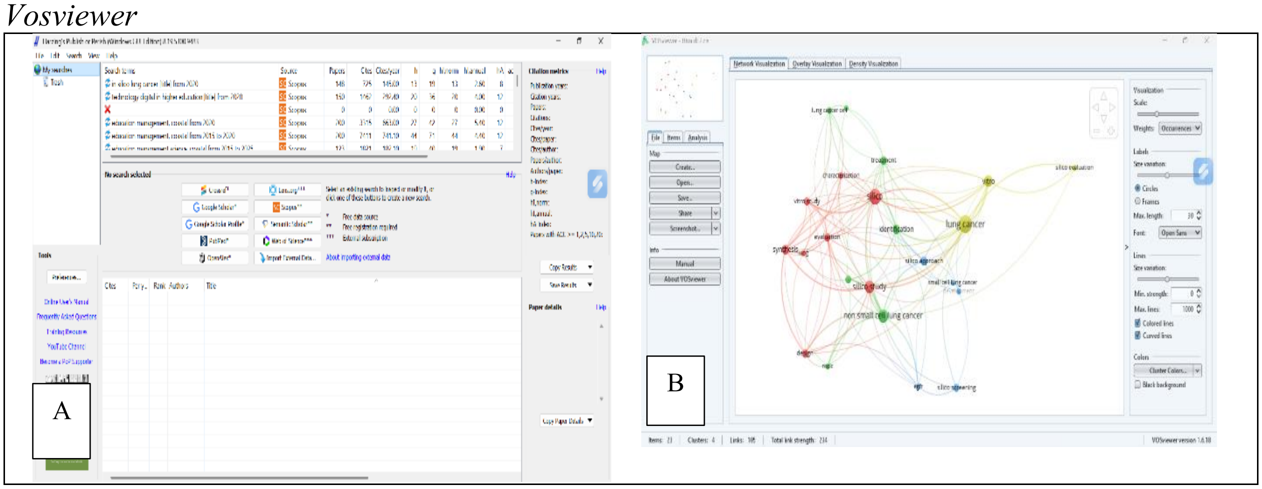
In addition to identification applications, various global biodiversity databases can be used to verify and enrich the information from observations. Plants of the World Online (POWO) (Figure 6.A) is a plant database that provides information on valid scientific names, taxonomic classifications, synonyms, and species distribution, making it very useful in plant identification (POWO, 2026). For other groups of animals and organisms, the Catalogue of Life (CoL) (Figure 6.B) can be used as a source of taxonomic information that includes millions of species from different groups of organisms (COL, 2026). Meanwhile, the Global Biodiversity Information Facility (GBIF) (Figure 6.C) provides biodiversity and species distribution data from various regions of the world that can be used in biodiversity, biogeography, and conservation research (GBIF, 2026). In addition to knowing the identity and distribution of species, researchers can use the IUCN Red List (Figure 6.D) to obtain information on a species's conservation status and threat level (IUCN Red List, 2026). Using multiple biodiversity databases together provides complementary information. For example, Pl@ntNet may assist in preliminary identification, whereas POWO or Catalogue of Life can verify accepted scientific names. GBIF provides species occurrence records, while the IUCN Red List supplies conservation status information. Integrating these resources enables researchers to produce biological data that are more reliable and scientifically defensible. The use of these databases allows researchers to obtain more accurate, comprehensive, and up-to-date biodiversity information, thereby supporting biological research grounded in potential and local wisdom in greater depth.

3.3.5 Literature and Bibliometric Analysis for Research Gap Identification

Before conducting research, researchers need to understand the development of a topic and identify research gaps (*research gap*s) that remain to be studied. The development of digital technology allows the process to be carried out more systematically through bibliometric analysis (Kasera & Nandan, 2026). One of the widely used software tools is Publish or Perish (PoP) (Figure 7.A), which searches and collects publication metadata from various scientific sources, such as Google Scholar, Crossref, Scopus, and Dimensions (Harzing, 2016). The publication data obtained can then be further analysed using VOSviewer (Figure 7.B) to visualise the relationships among keywords, authors, institutions, and publications as a network map.

Through this analysis, researchers can identify topics that have been extensively researched, find themes that are still rarely studied, and determine more relevant research directions (Kirby, 2023; Vosviewer, 2026). Therefore, the use of Publish or Perish and VOSviewer can help build a stronger research framework and support the development of biological research based on potential and local wisdom. Bibliometric analysis does not only identify publication trends but also assists researchers in objectively identifying underexplored topics and potential research gaps. Consequently, bibliometric tools contribute to improving research planning by supporting evidence-based topic selection rather than relying solely on researchers' subjective judgement.

Figure 7.
Literature and Bibliometric Analysis for Research Gap Identification. A. Publish or Perish; B. Vosviewer



3.4 Preparation of Scientific Papers Based on Local Potential and Indigenous Knowledge

The results of observations on local potential and indigenous knowledge can be developed into systematic scientific works suitable for publication. Writing scientific papers serves to document, communicate, and disseminate research results to the scientific community. Therefore, data obtained through structured observation must be processed and presented according to the rules of scientific writing to produce valid, objective, and easy-to-understand information (Kumar, 2023; McKechnie, 2006).

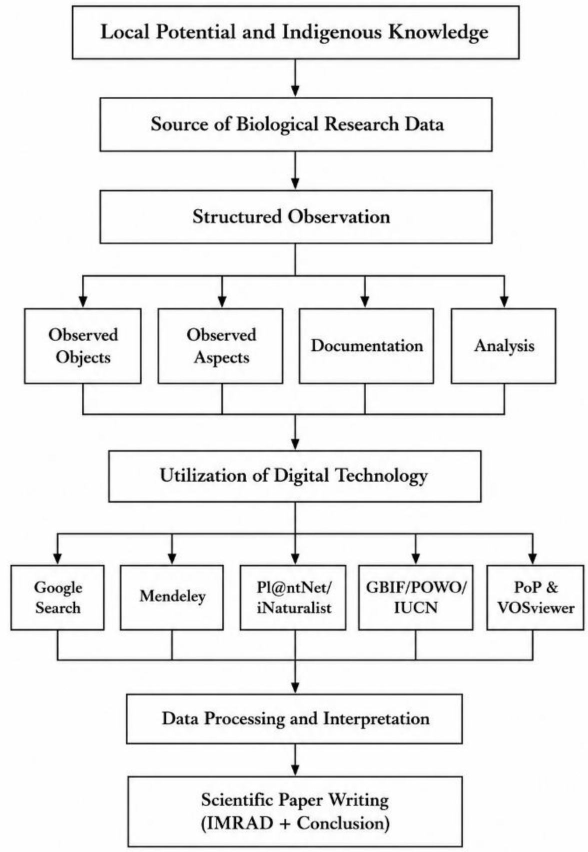
In the preparation of scientific papers, the most commonly used structure is IMRaD (Introduction, Methods, Results, and Discussion) (Shankar & Arun, 2022; UVU Writing Centre, 2025), which typically ends with a Conclusion section (Williams-Camus, 2025). The sections Introduction explain the background and objectives of the research, Methods describe the research procedures used, Results present the research findings, and Discussion interprets and discusses the results. Next, the Conclusion summarize key findings and research implications. This structure helps to present scientific papers in a systematic, logical, and easy-to-understand manner for readers (Teodosiu, 2019).

In addition to following a systematic scientific writing structure, preparing papers also requires appropriate citations and references to acknowledge the source of information and avoid plagiarism. Citation management can be simplified with software such as Mendeley, which automatically generates citations and bibliographies (Banat, 2021; Jain et al., 2023). The data from the observations then need to be presented in informative tables and images so readers can easily understand them. In addition, the data must be interpreted critically by linking the research results to theories, concepts, and prior research to produce a more in-depth and meaningful discussion (Cohen et al., 2018). Based on the study described, the relationship between potential and local wisdom, structured observation, and the use of digital technology in biological research can be summarised in a conceptual framework. This framework describes the flow of data from local sources through the preparation of scientific papers to their contribution to biodiversity conservation. The conceptual framework is presented in Figure 8.

Figure 8 presents a conceptual framework for using local potential and indigenous knowledge as sources of biological research data through the integration of structured observation and digital technology. Local potential and indigenous knowledge are the main sources of research data, collected through structured observation that pays attention to the observed objects, observation aspects, documentation, and data analysis. Furthermore, the research process is supported by various digital technologies that support literature searches, reference management, organism identification, the use of biodiversity databases, and scientific literature analysis. The integration of all these stages results in more systematic, easily interpretable data for the preparation of scientific papers, while contributing to biodiversity documentation, the preservation of local knowledge, and the strengthening of conservation efforts.

Figure 8.

Conceptual framework for the use of local potential and indigenous knowledge as a source of biological research data through the integration of structured observation and digital technology



The conceptual framework proposed in this review represents the main contribution of the article because it integrates local potential, indigenous knowledge, structured observation, digital technology, and scientific writing into a single workflow. Previous studies have generally discussed these components separately, whereas this framework demonstrates their interrelationships throughout the biology research process.

By preparing high-quality scientific papers, local potential and indigenous knowledge are not only a source of research data but can also be documented and disseminated as part of scientific development. The publication of local environment-based research results is expected to increase understanding of biodiversity, strengthen conservation efforts, and support the preservation of community-owned local knowledge. However, this study is still conceptual and emphasises the use of structured observation and digital technology as approaches to biological research grounded in potential and local wisdom. Therefore, further research is needed to test the approach's application across various environmental and cultural contexts to provide stronger empirical evidence of its effectiveness in supporting research, education, and biodiversity conservation.

4. Conclusion

Local potential and indigenous knowledge can be used as valuable sources of biological research data through the application of structured observation supported by digital technology. Various digital tools, such as Google Search for literature searching, Mendeley for reference management, Pl@ntNet and iNaturalist for organism identification, as well as GBIF, Catalogue of Life (CoL), POWO, and the IUCN Red List for biodiversity data exploration, can support research activities more systematically and efficiently. In addition, Publish or Perish and VOSviewer facilitate the identification of research trends and knowledge gaps. The collected data can then be communicated through the systematic preparation of scientific papers using the IMRaD structure, supported by appropriate citations and informative data presentation. The main theoretical contribution of this review is the proposed conceptual framework that integrates local potential, indigenous knowledge, structured observation, digital technology, and scientific writing into a coherent workflow for biology research. Practically, this framework provides guidance for students, educators, and researchers in conducting context-based biology research using local resources and digital tools. This review is limited by its conceptual nature and reliance on published literature without empirical validation of the proposed framework. Therefore, future studies are recommended to implement and evaluate this framework in different educational, environmental, and cultural contexts to examine its effectiveness in improving biology research competencies, biodiversity literacy, and conservation practices.

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