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SiBaAI App and Verbal-linguistic Intelligence: Lecturers' Perspectives to Support Disabled Students in Scientific Writing

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Abstract

SiBaAI is AI-based reading application which is designed to support students' academic needs. This app provides materials that are relevant to scientific writing, such as writing structure, language rules, and idea development techniques. This app facilitates users to understand references more effectively and efficiently by integrating AI technology. Furthermore, SiBaAI facilitates students in organizing ideas and improving their quality of argumentation in scientific writing. This application was AI-based tool designed to support the verbal-linguistic intelligence of disabled students in scientific writing. Utilizing mixed methods sequential explanatory design, quantitative data was collected from 105 lecturers using Likert-scale questionnaire. The qualitative data was obtained from in-depth interview. The analysis was focused on four aspects, namely application usefulness and relevance, application usability, the effectiveness of application in supporting scientific writing, and application compliance with inclusive education. Quantitative results showed high perceptions across all dimensions. This indicated positive evaluation which was homogeneous and stable. Qualitative findings revealed that lecturers perceived SiBaAI app as cognitive scaffolding which was effective in structuring, explaining concepts, and overcoming linguistic barriers. Data integration demonstrated that SiBaAI app connected pedagogical and technological aspects of inclusive education. It utilized AI (Artificial Intelligence) as collaborative learning tools. This study contributed to the use of AI in inclusive higher education by highlighting the lecturers' perspectives and providing empirical evidences to design AI-based application which empowered disabled students in scientific writing.

Keywords: Artificial Intelligence, Disabled Students, Scientific Writing, SiBaAI App, Verbal-linguistic Intelligence.

Introduction

Inclusive education for disabled students becomes an important global issue (1, 2). It receives more attention in recent decades (3, 4). Various national and international policies including Sustainable Development Goals (5) have encouraged countries to increase equal access for disabled students (6-8).

One crucial aspect of inclusive education is to ensure equal access to educational resources (9). This aspect requires various technological resources (10). Technology plays important role in creating inclusive learning environment (11) in which disabled students can access learning materials, participate in class discussion, and complete academic assignments (12). Several skills can be easily mastered by non-disabled students, but those are difficult for disabled students, including scientific writing skill (13). These limitations are influenced by various factors (14). A lack of adaptive pedagogical support causes disabled students to miss important steps in achieving scientific writing skill (15). They have difficulties in their verbal-linguistics intelligence (16). On the other hand, verbal-linguistic intelligence has important academic role, especially in scientific writing (17). It refers to the capacity to communicate (18). Verbal-linguistic intelligence is needed in scientific writing (19). However, most disabled students have difficulties in it. This indicates that facilities for disabled students are inadequate. Digital technology of Artificial Intelligence (AI) provides solutions to

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overcome difficulties of disabled students in scientific writing (20, 21). AI-based learning materials provide adaptive and interactive features (22). Magic features of AI can be presented into learning materials, such as enhanced digital dialogues (23), automatic grammar checking, text prediction, and proposed vocabularies (24). It can be said that SiBaAI app is able to support disabled students. In the material feature, disabled students are able to study the stages of scientific writing, including
(a) problem analysis,
(b) analysis of writing ideas,
(c) detail sub-chapters of writing,
(d) comparing references,
(e) combining ideas and references,
(f) proofreading,
(g) creating writing, and
(h) displaying the writing results.
Furthermore, disabled students can utilize AI assistance to be connected to the application.
SiBaAI application is designed for mobile learning. Its system consists of user interface, database server, and AI service that are connected using internet. AI integration process proceeds according to the following sequence: (a) the user submits a query or text through 'Ask AI' feature, (b) the application encrypts the data and forwards it to the server; (c) the server processes the request using an AI model and generates a response; (d) the response is sent back and displayed to the user. The entire process takes less than two seconds depending on network quality.
This application system is designed to support disabled students in academic writing. The instructions module offers user guidance. The materials module delivers learning content on the IMRaD structure, scientific articles, and eight writing stages. The Ask AI module serves as the core feature. The evaluation module assesses students' writing, generates automated scores, and provides immediate feedback. The developer module presents information on the development team, application version, and support contact options. All these functionalities are integrated through a mobile application architecture connected to AI model. Its homepage can be viewed in Figure 1.

Figure 1: Homepage of SiBaAI App (Translate: Main Menu, Instructions, Materials, Ask AI, Evaluation, Developers)

A recent study discusses Generative AI (GAI), such as ChatGPT, Gemini, and Claude, used to evaluate responses for disabled students (25). Results show AI gives more optimistic responses and lower frustration levels, indicating a gap: lack of lecturers' perspectives on integrating AI into scientific writing materials for disabled students. Previous research shows that disabled students perceive AI as effective for scientific writing (26), but lecturers' perspectives on improving verbal-linguistic intelligence are not discussed. Another study introduces AccessiLearnAI, an AI-based platform to increase disabled students' learning accessibility (27). These previous studies create a research gap, presented in Figure 2.

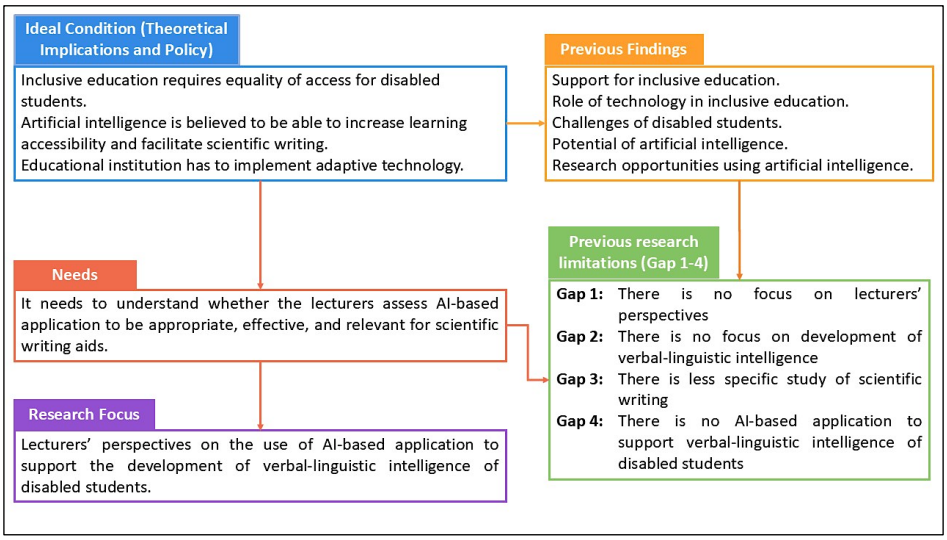

Figure 2: Research Gap

In Figure 2, this study investigates lecturers' perspectives on SiBaAI app to support verbal-linguistic intelligence of disabled students in scientific writing.

Verbal-linguistic Intelligence

Verbal intelligence is the ability to understand, process, and use language effectively (28). Meaning is understood when linked to the speaker and social context (29), and also depends on vocabulary choice. Vocabulary is a main component of verbal-linguistic intelligence (30), playing a role in verbal fluency and executive function control (31). Verbal-linguistic intelligence is supported by cognitive processes; verbal short-term memory facilitates language transitions within sentences (32). Proper understanding of language elements is crucial because meanings can be lost when tone, accent, or nuances are not addressed (33). In this study, verbal-linguistic intelligence is operationalized through a developed application's 'Ask AI' feature, which enhances writing coherence and fosters intelligence development in scientific writing.

Disabled Students

Disabled students face systemic barriers and social pressures at university. They often isolate themselves and seek equal recognition (34). One factor is treatment that positions them solely as special education participants (35). Disability is often seen as a personal issue where learning barriers are directly attributed to these limitations (36). Access to physical environments and communication systems is crucial for their verbal participation (37). Disabled students often rely on personal assistance and individual relationships to fully engage in learning (38). Supportive space is essential for academic security and confidence (39). Verbal-linguistic intelligence is crucial for accessing and understanding scientific articles.

Scientific Articles

Scientific article presents research findings. In the digital era, the number of published articles has increased significantly (40). Articles in databases enable the identification of trends and patterns (41). However, the rapid growth of publications makes it difficult for researchers to identify and select relevant articles (42). Therefore, a more structured approach to searching and screening scientific articles is needed, both manually and with technology (43). Furthermore, scientific texts use complex language (44). In this context, the ability to select and evaluate information is a

critical strategy that supports research report preparation and improves references (45).

Methodology

Research Design

This study utilized mixed methods sequential explanatory design. This research design was mixed methods that began with collecting and analyzing quantitative data, continued with qualitative approach aimed to clarify and interpret the results of quantitative data (46). This model was used to investigate lecturers' perspective in quantitative data and qualitative interviews. The reason for using this model was that this study aimed not only to obtain a numerical overview of lecturers' perspectives regarding the use of SiBaAI app in learning and scientific writing, but also to gain a deeper understanding of their experiences, views, and responses to the implementation of this technology. The initial phase was conducted through quantitative data collection to identify the level of acceptance, perceptions, and assessments of lecturers toward the application. In addition, these quantitative findings were further explored through qualitative interviews to obtain more comprehensive explanation regarding the reasons, user experiences, obstacles, and needs of lecturers in utilizing SiBaAI app. Therefore, the combination of both types of data enabled researchers to achieve in-depth understanding of the phenomenon under study. This study did not employ a convergent design because the quantitative and qualitative data were not collected simultaneously, but rather sequentially and complementarily. This study also did not use exploratory mixed methods because it did not begin with qualitative data exploration to develop research instruments or concepts, but instead focused on evaluating SiBaAI app.

Sample and Data Collection

Research samples were 105 lecturers who were teaching scientific writing or supervising academic assignments for disabled students. Quantitative data was collected by sharing questionnaire in which the participants had fulfilled the consent form. Lecturers' responses can be collected using questionnaire (47). The questionnaire was distributed online using the instruments which could be viewed in Table 1.

Table 1: Instruments of Lecturers' Perspectives

Question Aspects and Indicators	Likert Scale 1–5
Application Usefulness and Relevance	
SiBaAI App is relevant to the needs of disabled students in scientific writing.	
The features are appropriate with the stages of scientific writing.	
SiBaAI App improves verbal-linguistic intelligence of disabled students.	
SiBaAI App is effective teaching media.	
Application Usability	
The interface can be easily understood by disabled students.	
The instructions are clear and unambiguous.	
Disabled students are easy to access the AI features.	
The navigation menu is simple and user-friendly.	
The Effectiveness of Application in Supporting Scientific Writing	
The scientific writing materials are quite comprehensive.	
The AI features facilitate disabled students in understanding the concept of scientific writing.	
The AI features facilitate disabled students in developing the structure of scientific writing.	
Application facilitates disabled students in overcoming verbal-linguistic barriers.	
Application Compliance with Inclusive Education	
The application addresses the accessibility needs of disabled students.	
The application can be integrated into inclusive classroom learning.	
The application facilitates autonomous learning for disabled students.	

Note: The first column contains questionnaire items grouped by aspect. The Likert scale ranges from 1 (Strongly Disagree) to 5 (Strongly Agree).

Qualitative data was collected using in-depth interview. From a total of 105 lecturers who completed the quantitative questionnaire, 15 lecturers were selected to participate in interview during the qualitative phase. The criteria for selecting interview participants were:

(a) the lecturer had used the SiBaAI app for at least one academic semester;

(b) the lecturer had experience supervising disabled students in scientific writing;
(c) the lecturer came from different study programs to obtain varied perspectives; and
(d) the lecturer provided written consent to be interviewed.

Participants were selected using purposive sampling to ensure that they had relevant knowledge and experience related to the focus of study. Interviews were conducted individually based on participants' preferences. The duration of each interview ranged from 45 to 75 minutes, with an average duration of 60 minutes per participant. All interviews were recorded (with participant consent) and transcribed verbatim for analysis purposes. Its instrument could be viewed in Table 2.

Table 2: Instrument of In-depth Interview for Lecturers

Aspects, Question Indicators, and Probes
Application Usefulness and Relevance
What do you think about the relevance of SiBaAI app to the needs of disabled students in scientific writing?
Probe: Examples of use; most relevant features; most assisted group of disabled students.
To what extent do the app features align with the stages of scientific writing in your class?
Probe: Features that support each stage; inappropriate areas.
Based on your observation, how does this app support the development of disabled students' verbal-linguistic intelligence?
Probe: Examples of improvement; changes in students' ways to write.
Can SiBaAI be effective as companion teaching materials?
Probe: The most effective time; how it facilitates learning process.
Application Usability
How user-friendly is SiBaAI app for disabled students?
Probe: Icons, colors, texts; disabled students' responses.
How clear are the instructions for using application?
Probe: Easy/difficult parts; assistance needed.
How easy is it to access AI features?
Probe: Usage instructions; technical challenges.
Is the navigation of application simple and student-friendly?
Probe: Confusing menu; needed improvements.
The Effectiveness of Application in Supporting Scientific Writing
Is the scientific writing material in the application comprehensive to fulfill learning needs?
Probe: Missing materials; most helpful materials.
How do AI features facilitate disabled students to understand scientific writing concept? **Probe:** Examples of concept; accuracy of AI assistance.
Does AI help disabled students to construct the structure of scientific writing? **Probe:** Most helpful parts of writing; structure quality.
To what extent does the application overcome disabled students' verbal-linguistic barriers? **Probe:** Types of barriers; changes after using the application.
Application Compliance with Inclusive Education
How does the application address the accessibility needs of disabled students?
Probe: Device compatibility; most assisted group.
Can the application be integrated into inclusive classroom learning
Probe: Examples of classroom implementation; additional strategies.
To what extent does the application facilitate autonomous learning for disabled students? **Probe:** Independence levels; independent-revision ability.

Note: Aspects = main evaluation dimensions, Question Indicators = semi-structured interview questions, Probes = optional follow-up prompts to gather deeper lecturers' responses.

The instruments described were lecturer perspective questionnaire (quantitative) and in-depth interview guideline (qualitative). These instruments were developed based on review of related literature. The development process began

with the construction of a joint blueprint encompassing four main aspects:

(a) usefulness and relevance of the application;
(b) usability of the application;
(c) effectiveness of the application in supporting scientific writing; and
(d) alignment of the application with the principles of inclusive education.

These four aspects were operationalized into 15 indicators that were identical for both instruments. Each indicator corresponded to an item in the questionnaire and one main question (grand tour question) in the interview guideline. No existing instrument was fully adapted from previous studies because research on AI-based applications for disabled students in the context of scientific writing was limited. However, several indicators in both instruments drew upon established theoretical frameworks such as, the accessibility aspect referred to Universal Design for Learning (UDL), the indicators of scientific writing referred to the IMRaD structure, and the indicators of usability referred to Nielsen's theory. Therefore, both instruments represented new developments tailored to the specific context of this study, and they were developed to ensure that quantitative and qualitative data could complement each other.

The content validity of both questionnaire and interview guideline was established through a four-step procedure. First, instrument blueprint comprising four aspects and 15 indicators was developed based on a literature review of inclusive education, verbal-linguistic intelligence, and AI in learning. Second, the instruments were reviewed by three experts (two in language education and one in measurement and evaluation). Third, the experts assessed the alignment of each item with its corresponding indicator and aspect, and provided feedback on wording, clarity, and content appropriateness. Fourth, based on the expert assessment, all items were declared content to be valid and suitable after following minor revisions to two questionnaire items to enhance clarity.

A pilot study was then conducted with 30 lecturers who shared similar characteristics to the main sample but were not included in it. The pilot study aimed to identify ambiguous wording, item comprehension difficulties, and completion time. Results showed that all questionnaire items were well understood, no double-barreled items were present, and completion time ranged from 5 to 7 minutes. For the interview guideline, the main questions were easily understood by interviewers, and the provided probe questions effectively facilitated deeper exploration.

Reliability was measured using Cronbach's Alpha. Based on pilot data from 30 participants, the overall Cronbach's Alpha for all 15 items was 0.89, exceeding the acceptable threshold of 0.70. The reliability values for each aspect were: usefulness and relevance = 0.85; usability = 0.87; effectiveness in supporting scientific writing = 0.88; and alignment with inclusive education = 0.86. All aspects values also exceeded 0.70. In other words, the questionnaire was declared reliable and consistent for measuring lecturers' perspectives of SiBaAI app.

For the qualitative instrument, statistical reliability testing was not performed due to its qualitative nature. Therefore, consistency was maintained through the use of main questions aligned with the questionnaire indicators and through interviewer training to ensure consistent interview procedures across all participants.

Qualitative Data Coding Procedures

The qualitative data coding followed a systematic procedure to ensure the validity and reliability of the analysis. First, the coding process was carried out by two researchers independently (inter-coder). Each researcher read all interview transcripts from the 15 lecturers repeatedly to understand the overall context, and identified meaning units relevant to the four aspects of the study. Second, an inter-coder reliability test was conducted to measure the level of agreement between the researchers. The measurement was performed by comparing the coding results. The agreement coefficient was calculated using the percentage agreement formula as showed in Equation [1]:

$$\text{Percentage agreement} = \frac{\text{Number of agreed codes}}{\text{Total number of codes}} \times 100\% \qquad [1]$$

The test results showed an agreement level of 89% in excellent category (a value of ≥ 80% was considered acceptable). All coding disagreements (11%) were discussed by the researchers until a consensus was reached. During these discussions, each disagreement was traced back to the

interview transcript to ensure the most accurate interpretation. Third, triangulation was conducted using two approaches. Source triangulation was performed by comparing interview data from lecturers. When similar themes emerged from multiple sources, those themes were considered more credible. Method triangulation was performed by comparing qualitative findings from interviews with quantitative data from questionnaire to determine whether the interview findings supported, strengthened, or contradicted the quantitative findings.

Fourth, the entire data was systematically processed. Interview transcripts were printed on paper. These were cut and pasted based on the identified meaning units. These cut pieces were attached to worksheets labeled according to codes and themes. Furthermore, pieces sharing the same code were grouped together to identify patterns of findings. This process was followed by the creation of a thematic matrix containing direct quotations from lecturers' statements for each aspect. Fifth, member checking was conducted to confirm interview summary findings with 5 of 15 interviewed lecturers to ensure that the researchers' interpretations aligned with the lecturers' intended meanings. The selected lecturers were those who provided diverse statements. The results indicated that all lecturers agreed with the summaries prepared. It could be said that coding procedure was characterized by systematic processes, inter-coder agreement (89%), source and method triangulation, and member checking.

Analyzing of Data

Data analysis technique in quantitative phase of this study was conducted to investigate lecturers' perspectives on SiBaAI app to support verbal-linguistic intelligence of disabled students in scientific writing. Quantitative data was obtained from questionnaire which implemented Likert scale 1 – 5 that had four main aspects, namely application usefulness and relevance, application usability, the effectiveness of application in supporting scientific writing, and application compliance with inclusive education.

The data from questionnaire was processed using coding by providing scores based on Likert scale, i.e. 1(strongly disagree), 2(disagree), 3(quite agree), 4(agree), and 5(strongly agree). Moreover, it was calculated to obtain students' total and mean scores for each indicator. Mean score described the level of respondents' perspectives on each aspect.

To examine lecturers' perspectives, descriptive analysis consisting of minimum, maximum, mean, and standard deviation was conducted. This aimed to provide descriptions of lecturers' perspectives on SiBaAI app. The mean score was categorized as very low [1.00–1.80], low [1.81–2.60], sufficient [2.61–3.40], high [3.41–4.20], or very high [4.21–5.00]. In addition, standard deviation (SD) was used to determine the consistency of respondents' responses with the criteria of very homogeneous [SD < 0.50], quite homogeneous [0.50–1.00] and high variation [1.00]. This category was used to strengthen the interpretation of mean score in each indicator.

To determine the strongest and weakest aspects of application, the mean scores of all aspects were compared. This identified effective and inappropriate elements of the app based on lecturers' perspectives. Furthermore, it could identify the correlations between variables. This analysis technique provides comprehensive descriptions about lecturers' perspectives on the use of SiBaAI app in inclusive education to enhance verbal-linguistic intelligence of disabled students.

Qualitative data analysis of this study was conducted by interviewing the lecturers. This was said as thematic analysis that consisted of data reduction, data presentation, and drawing conclusion/verification (48).

In data reduction stage, interview results were transcribed to identify the relevant information, such as lecturers' experiences using SiBaAI, their assessments of application features, their barriers, and their perspectives on its contribution to enhance verbal-linguistic intelligence of disabled students.

In data presentation stage, coding was grouped into several themes, namely application usefulness and relevance, application usability, the effectiveness of application in supporting scientific writing, and application compliance with inclusive education. The data was presented in form of table, matrix, or narrative summary to determine the correlations between themes. In verification stage, the researchers concluded the analysis results by comparing raw data and finding the relationship between respondents' statements and themes.

The mixed methods integration was consisted of connecting, merging, and embedding techniques.

Connecting technique utilized quantitative results to guide the interview exploration. In qualitative stage, the analysis results were compared to quantitative results. This integration was said as merging technique. Each quantitative finding was compared with interview transcripts to determine congruence or contradiction data. This process helped to understand the perspectives emerging. The last stage of integration was embedding technique. It was conducted by incorporating qualitative quotations into final interpretation to strengthen the quantitative data.

Results

Lecturers' perspectives; on SiBaAI app and verbal-linguistic intelligence to support disabled students in scientific writing; are categorized into four types, namely application usefulness and relevance, application usability, the effectiveness of application in supporting scientific writing, and application compliance with inclusive education. Those categories can be described as follows:

The Usefulness and Relevance of AI-based App (SiBaAI App)

The lecturers' perspectives in the usefulness and relevance of SiBaAI App to support verbal-linguistic intelligence of disabled students in scientific writing can be viewed in Table 3.

Table 3: Lecturers' Perspectives in the Application Usefulness and Relevance

Aspect of Application Usefulness and Relevance	$\bar{x}$	SD	Interpretation of Variability
Q1	3.96	0.80	High, sufficient variability
Q2	4.07	0.79	High approaching very high, low variability
Q3	3.98	0.86	High, highest variability
Q4	4.02	0.78	High approaching very high, low variability
μ Aspect	**4.01**	**0.81**	**High, sufficient variability**

Note: $\bar{x}$ = mean; SD = standard deviation. Variability interpretation criteria: low (SD<0.80), sufficient (0.80≤SD≤0.85), high (SD>0.85); High approaching very high = mean >4.00 with low variability (SD<0.80).

Based on analysis results, the aspect of application usefulness and relevance obtains the μ score of 4.01. It is high category in which the application is said to be relevant and useful for users. The mean score of each question item (Q1 – Q4) is 3.96 – 4.07. This indicates the consistent positive assessment of application which is suitability to learning need and able to support academic process. The value of standard deviation is 0.81. This indicates homogeneous responses on the aspect of application usefulness and relevance.

Results of interview with lecturers related to the use of SiBaAI app strengthen quantitative data. In the first question, most lecturers say that this application helps students with physical disability to find ideas. The revealed probe based on interview result is that the application is less optimal for blind students due to limited compatibility with screen reader. This result is integrated with quantitative data in which its score is 3.96. It belongs to high category.

In the second question, most lecturers argue that they are used to teach IMRaD method in scientific writing. The application has the same template of learning materials. Therefore, the disabled students are not confused. The revealed probe based on interview result is that AI feature and menu of scientific writing stages are the most appropriate one. This result is integrated with quantitative data in which its score is 4.07 (approaching very high category) and it has low variability (SD= 0.79).

In the third question, most lecturers explain that students' academic vocabularies are improved because the application provides synonyms and formal sentences. One of them says that it is suitable for understanding the concept. However, it needs more assistance to create long and coherent writing. The revealed probe based on interview result is that students' vocabularies and grammar can be increased. However, it needs development of argumentation and coherence. This result is integrated with quantitative data in which its mean score is 3.98. It belongs to high category.

In the fourth question, most lecturers say that they ask students to utilize SiBaAI app to make draft of literature review. The revealed probe based on interview result is that this app is most effectively used in the preparation and initial revision stages. This result is integrated with quantitative data in

which its score is 4.02 (approaching very high) and has low variability (SD=0.78). It can be said that SiBaAI app is effective as companion teaching material.

Results of interview strengthen quantitative findings in which the lecturers have positive perspectives on the usefulness and relevance of SiBaAI app. This application is appropriate as companion teaching material and relevant to stages of scientific writing. In addition, varied perspectives of supporting verbal-linguistic intelligence can be understood as a reflection of complex linguistic intelligence of disabled students. These findings show that SiBaAI app fulfills the aspect of application usefulness and relevance which needs to be developed.

However, challenges emerged from the interviews. Lecturers noted that the AI feature was less than optimal for blind students due to compatibility issues with screen reader. A lecturer said, "Blind students still have difficulty accessing the Ask AI feature because the screen reader does not work well on several menus." This revealed that accessibility for visual disabilities needs further enhancement. The themes which integrate quantitative and qualitative data in the aspect of application usefulness and relevance can be viewed in Figure 3.

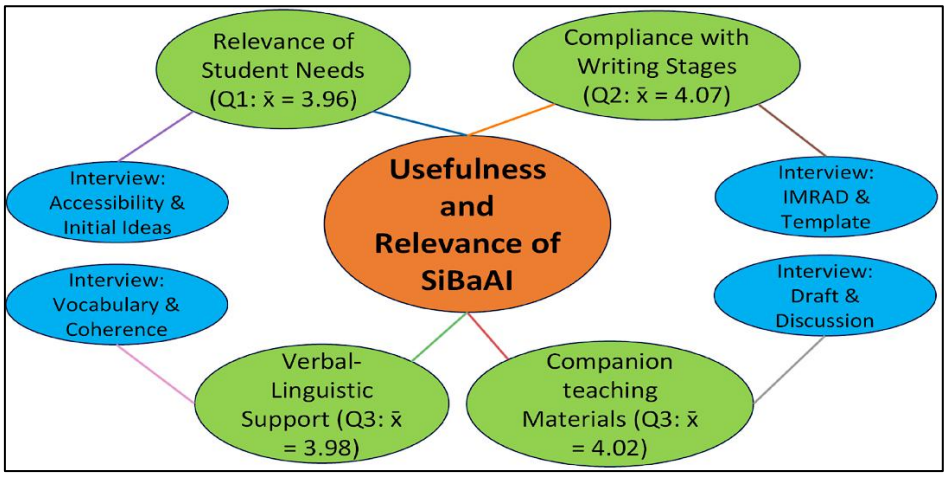

Figure 3: Themes of Integrating Quantitative and Qualitative Data in the Aspect of Application Usefulness and Relevance

Table 4: Lecturers' Perspectives in the Aspect of Application Usability

Application Usability	x̄	SD	Interpretation of Variability
Q5	4.04	0.79	High (approaching very high), sufficient-normal variability
Q6	3.90	0.77	High, low-normal variability
Q7	3.99	0.83	High, highest variability
Q8	3.97	0.79	High, sufficient-normal variability
μ Aspect	**3.97**	**0.79**	**High, sufficient-normal variability**

Note: x̄ = mean; SD = standard deviation. Variability interpretation criteria: low (SD<0.80), sufficient (0.80≤SD≤0.85), high (SD>0.85); High approaching very high = mean >4.00 with low variability (SD<0.80).

Application Usability (SiBaAI App)

Lecturers' perspectives; in the aspect of application usability (SiBaAI app) to support verbal-linguistic intelligence of disabled students in scientific writing; can be viewed in Table 4.

Lecturers' perspectives in the aspect of application usability are high category in which its mean score is 3.97. It shows that this app can be used easily by disabled students. The interface is said to be user-friendly (x̄ = 4.04). The navigation menu is simple (x̄ = 3.97). The access to AI feature is easy (x̄ = 3.99). The usage instruction obtains the lowest score (x̄ = 3.90). However, it is in high category. The value of standard deviation is homogeneous (SD = 0.50–1.00). This indicates that lecturers' perspectives are almost the same. It can be concluded that the app has good usability to support inclusive learning for disabled students.

Results of interview with lecturers about the usability of SiBaAI app strengthen the quantitative data. In the fifth question, most lecturers appreciate the app design which is cognitively undemanding. The color contrast, large font size, and structured layout make disabled students to adapt well. The icon 'Ask AI' facilitates them to use

it. The revealed probe based on interview result is that SiBaAI app is easy to be used. This result is integrated with quantitative data in which the score is 4.04. This is the highest score in which the positive feedbacks are about its visual design.

In the sixth question, most lecturers say that the text instructions are clear. Lecturers only need one mentoring session. Moreover, the students can explore it. The revealed probe based on interview result is that the instructions are good and it can add more visual guidance or short videos. This result is integrated with quantitative data in which the score is 3.90 (high category).

In the seventh question, most lecturers argue that AI features can be easily accessed. Students are able to 'ask' AI when have difficulties to find ideas. The revealed probe based on interview result is that the menu 'ask AI' has simple process. Therefore, lecturers and students are familiar with chatbots. The only obstacle is lag or timeout when the network is weak. This result is integrated with quantitative data in which the score is 3.99 (high category) and it has the highest variability (SD = 0.83).

In the eighth question, most lecturers answer that the app menu is well structured, starting from topic, outline, draft, and revision. The revealed probe based on interview result is that shortcut or bookmark is needed for frequently used features. However, its navigation is said to be user-friendly. This result is integrated with quantitative data in which the score is 3.97.

Results of interview provide good result on application usability. Based on lecturers' opinions, SiBaAI app is a good tool which is easy to be used and facilitates inclusive learning. This finding reveals that the app creates positive experience for users in inclusive learning process. It can be said that usability aspect is great foundation to develop SiBaAI app in the future.

Technical limitations concerning network stability are also reported. Several lecturers state that the AI feature suffered from response delays or timeout connection when the internet connection is poor. A lecturer states, "In regions with unstable internet signals, students frequently complain that the AI does not respond promptly." This finding suggests that the effectiveness of SiBaAI app is based on the availability of sufficient network. The integration between quantitative and qualitative data that connects results of questionnaire and interview on the usability aspect of SiBaAI app can be viewed in Figure 4.

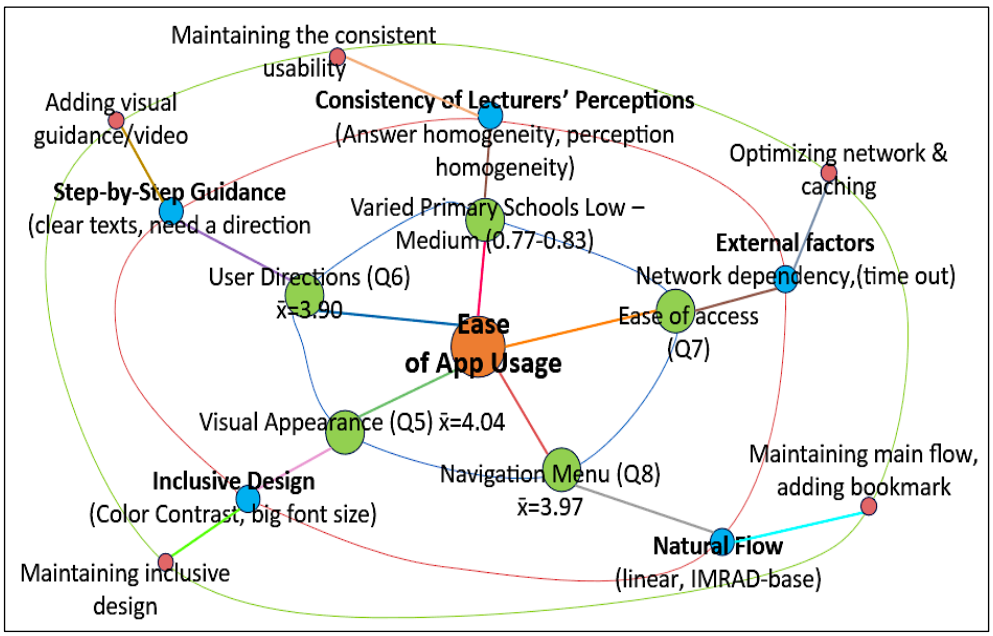

Figure 4: The Integration between Quantitative and Qualitative Data in Application Usability

Table 5: Lecturers' Perspectives in the Aspect of Application Effectiveness to Support Scientific Writing

Application Effectiveness in Supporting Scientific Writing	$\bar{x}$	SD	Interpretation of Variability
Q9	3.96	0.81	High, sufficient variability
Q10	4.01	0.83	High, sufficient variability
Q11	3.92	0.82	High approaching very high, highest variability
Q12	3.98	0.81	High, sufficient variability
μ Aspect	**3.97**	**0.82**	**High, sufficient variability**

Note: $\bar{x}$ = mean; SD = standard deviation. Variability interpretation criteria: low (SD<0.80), sufficient (0.80≤SD≤0.85), high (SD>0.85); High approaching very high = mean >4.00 with low variability (SD<0.80).

The Effectiveness of SiBaAI App in Supporting Scientific Writing

Lecturers' perspectives; in the aspect of its effectiveness to support verbal-linguistic intelligence of disabled students in scientific writing; can be viewed in Table 5.

Lecturers' perspectives in the aspect of application effectiveness to support scientific writing have good category. The mean score of each indicator is 3.41 – 4.20. The value of μ aspect is 3.97. This indicates that learning materials in the app are quite comprehensive (Q9), AI features facilitate students to understand the concept of scientific writing (Q10), and the app supports to develop the structure of scientific writing (Q11). Furthermore, the app can overcome students' verbal-linguistic barriers (Q12). The value of standard deviation (SD) is 0.50 – 1.00. This indicates that lecturers' answers are homogeneous. So, the app is effective to support scientific writing of disabled students.

Results of interview with lecturers about the application effectiveness strengthen the quantitative data. In the ninth question, most lecturers respond that the learning materials in the app are helpful in scientific writing. The revealed probe based on interview result is that the materials support to produce scientific articles. However, this app has not accommodated automatic translation system. This result is integrated with quantitative data in which the score is 3.96 (high category).

In the tenth question, most lecturers answer that students raise questions about scientific writing and AI is able to provide simple explanation about it. The revealed probe based on interview result is that paraphrasing, chapter systematics, and citation techniques have high level of accuracy for basic concepts. This result is integrated with quantitative data in which the score is 4.01 (approaching very high). This indicates that AI makes the concepts to be clear with the value of standard deviation is 0.83.

In the eleventh question, most lecturers say that 'Ask AI' feature is very good. Students simply input a topic and immediately receive a logical framework. This saves time for brainstorming. The revealed probe based on interview result is that introduction part and chapter outlines are logically structured. This result is integrated with quantitative data in which the score is 3.92 (high category).

In the twelfth question, most lecturers say that 'Ask AI' feature reduces students' burden. They are able to express ideas, so their verbal-linguistic intelligences are developed. The revealed probe based on interview result is that student's self-confidence is increased, editing time is reduced, and draft quality is improved well. This result is integrated with quantitative data in which the score is 3.98 with sufficient variability (SD=0.81).

Results of interview support quantitative findings. Based on lecturers' opinions, SiBaAI app is effective (μ=3.97) to make disabled students to be more confident and independent in scientific writing process. This integration shows that the app is effective in technical writing knowledge, academic logical structure, and individual linguistic barrier. Those become appropriate combination for inclusive education.

Moreover, lecturers highlight the application's limitations in managing extended and complex writing. A lecturer states, "This application is very helpful for short paragraphs and basic concepts, but for lengthy writing requiring coherent argumentation across chapters, the AI remains suboptimal." This indicates that SiBaAI app is more effective for early-stage writing (initial scaffolding) than for producing complex manuscripts. The integration between quantitative and qualitative data that connects results of questionnaire and interview on the aspect of app effectiveness can be viewed in Figure 5.

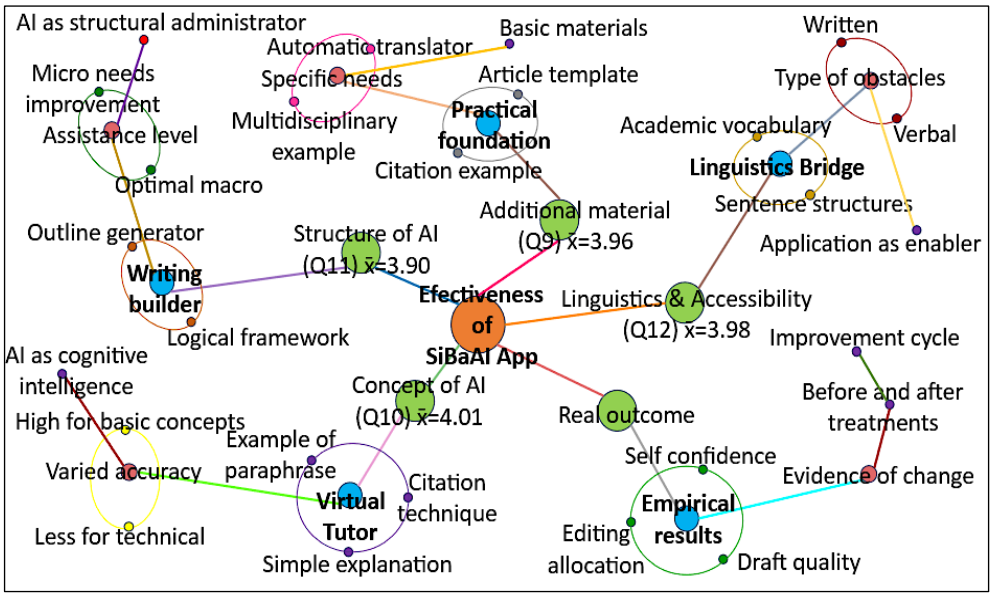

Figure 5: Integration between Quantitative and Qualitative Data in the Aspect of App Effectiveness

Table 6: Application Compliance with Inclusive Education Principle

Application Compliance with Inclusive Education Principles	x̄	SD	Interpretation of Variability
Q13	3.96	0.80	High, sufficient variability
Q14	4.08	0.77	High approaching very high, lowest variability
Q15	4.05	0.83	High approaching very high, highest variability
μ Aspect	**3.97**	**0.82**	**High, sufficient variability**

Note: x̄ = mean; SD = standard deviation. Variability interpretation criteria: low (SD<0.80), sufficient (0.80≤SD≤0.85), high (SD>0.85); High approaching very high = mean >4.00 with low variability (SD<0.80).

Application Compliance with Inclusive Education Principles

Lecturers' perspectives; in the aspect of application compliance to support verbal-linguistic intelligence of disabled students in scientific writing; can be viewed in Table 6.

Lecturers' perspectives in the aspect of application compliance with inclusive education principles have good category. The mean score of each indicator is 3.41 – 4.20. The value of μ aspect is 3.97. Indicator of Q13 shows that the app has addressed accessibility needs of disabled students. Indicator of Q14 obtains highest mean score [4.08] which indicates that the app can be integrated into inclusive classroom learning. Indicator of Q15 has mean score of 4.05 which indicates that the app is effective for disabled students in autonomous learning. The value of standard deviation (SD) is 0.50–1.00. This indicates that lecturers' answers are homogeneous. So, the app is relevant to inclusive education principles and suitable for disabled students.

Results of interview with lecturers support quantitative data. In the thirteenth question, most lecturers argue that app features, fonts, and color contrast facilitate students who have low vision. The revealed probe based on interview result is that students with physical disabilities and dyslexia are much helped. However, totally blind students need additional assistance. This result is integrated with quantitative data in which the score is 3.96 (high category) with sufficient variability (SD=0.80).

In the fourteenth question, most lecturers say that they utilize SiBaAI app as collaborative platform. Disabled and non-disabled students can have a writing project with the same tool. The revealed probe is that lecturers use the app for:

(a) scaffolding,

(b) structured peer review, and

(c) mixed group projects.

This result is integrated with quantitative data in which the score is 4.08 (approaching very high) with lowest variability (SD=0.77).

In the fifteenth question, most lecturers answer that before using the application, students need intensive assistance, so they can build their draft. The revealed probe is that students with physical disabilities achieve high level of independence,

while students with severe sensory disabilities need assistance. In addition, 'Ask AI' feature helps students to revise their writing. This result is integrated with quantitative data in which the score is 4.05 (approaching very high) with highest variability (SD=0.83).

Lecturers also identify variations in the level of independence based on disability type. According to their reports, students with physical disabilities achieved high independence after using SiBaAI app, while those with severe sensory disabilities (total blindness) still required intensive support, even after using the application. A lecturer argues, "For dyslexia students, this application is very helpful. However, for blind students, they still need assistance because the text-to-speech feature is not yet fully optimal."

Results of interview support quantitative findings. Based on lecturers' opinions, SiBaAI app is appropriate for inclusive education principles (μ=3.97). The integration between quantitative and qualitative data that connects results of questionnaire and interview on the aspect of application compliance with inclusive education principles can be viewed in Figure 6.

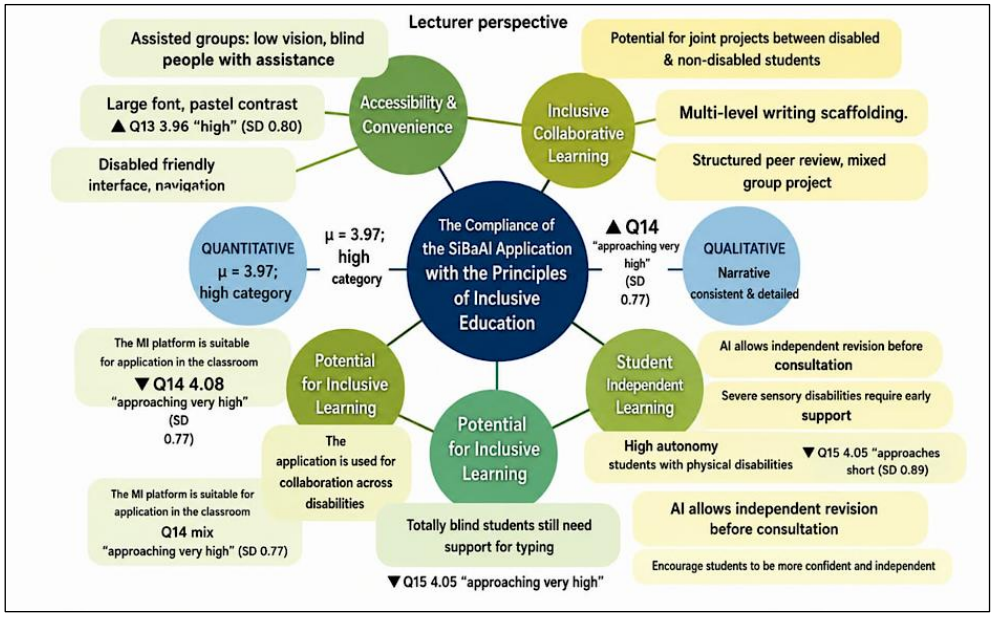

Figure 6: Integration between Quantitative and Qualitative Data in the Aspect of Application Compliance with Inclusive Education Principles

While SiBaAI is consistent with inclusive education principles, it does not replace the lecturer's pedagogical role. Before implementing SiBaAI, lecturers serve as the primary source of feedback for students, addressing grammar corrections, writing structure, and argument evaluation. SiBaAI app has shifted lecturer's role to a facilitator in spelling correction, grammar checking, and vocabulary suggestions. As a result, SiBaAI provides more time for lecturer in developing students' reasoning skills, training them to produce logical and coherent arguments, and offering guidance based on student's disability type. However, it is important to emphasize that SiBaAI does not completely replace the lecturer's role.

Lecturer plays important role in evaluating argument quality, assessing research methodology appropriateness, ensuring work originality, and providing ethical guidance on AI use to prevent academic integrity violations. Furthermore, SiBaAI has limitations for students with severe disabilities (e.g., total blindness) and for complex writing assignments. Therefore, SiBaAI is more character-rized as a catalyst for pedagogical transformation. It changes how lecturers teach by automating routine tasks but does not reduce the lecturer's role as an educator who guides, evaluates, and humanizes the learning process.

To enrich the research findings, additional analyses have conducted, including correlation tests and comparisons among the four aspects of lecturers' perspectives. Based on the mean values (μ) for each aspect presented in Tables 3, 4, 5, and 6, it was found that first aspect had the highest value (μ = 4.01), falling into the high category,

while other aspects had identical values (μ = 3.97), all within the high category. The difference in scores between first aspect and the other aspects was 0.04 points, which is numerically very small and does not alter the rating category. This indicates that the four aspects are perceived as relatively balanced by the lecturers.

The standard deviation (SD) values across the four aspects are relatively homogeneous, ranging from 0.79 to 0.82. This indicates that the variation in participants' answers is relatively similar. Statistically, this finding suggests that the four aspects share a positive and consistent relationship. It can be said that lecturers who rated one aspect highly tended to rate the other aspects highly as well. From a theoretical perspective, the strongest relationship is between first aspect and third aspect because the useful application is deemed effective in supporting scientific writing. Moreover, a strong relationship is also between second aspect and fourth aspect because an application that is easy to use is aligned with inclusive learning environments.

It can be concluded that there is no substantive difference among the four aspects. All aspects are high rating category, meaning that the SiBaAI app is perceived positively. This consistency in assessment strengthens the conclusion that the SiBaAI app has good quality and is acceptable to lecturers as a supportive tool for scientific writing for disabled students. The summary of inter-aspect relationship and comparative analysis can be viewed in Table 7.

Table 7: Summary of Inter-Aspect Relationship and Comparative Analysis

Aspect	Mean (μ)	SD	Category	Rank	Interpretation
Usefulness and relevance	4.01	0.81	High	1st	Positively evaluated, slightly superior
Usability	3.97	0.79	High	2nd	Positively evaluated, balanced with third and fourth aspects
Effectiveness in supporting scientific writing	3.97	0.82	High	2nd	Positively evaluated, balanced with second and fourth aspects
Compliance with inclusive education	3.97	0.82	High	2nd	Positively evaluated, balanced with second and third aspects

Note: $\bar{x}$ = mean; SD = standard deviation. Variability interpretation criteria: low (SD<0.80), sufficient (0.80≤SD≤0.85), high (SD>0.85); High approaching very high = mean >4.00 with low variability (SD<0.80).

Based on Table 7, it can be concluded that SiBaAI app is evaluated positively overall by the lecturers, with no aspect being significantly weak or significantly superior.

Discussion

In line with inclusive education emphasized in SDGs and international education policy (6, 7), this study shows that lecturers provide positive perspectives on SiBaAI app which consist of four aspects, namely application usefulness and relevance, application usability, the effectiveness of application in supporting scientific writing, and application compliance with inclusive education. These findings emphasize that AI can be strategic pedagogical instrument in creating academic access and equity for disabled students.

Application Usefulness and Relevance in Supporting Verbal-linguistic Intelligence of Disabled Students

Based on lecturers' opinion, SiBaAI app is relevant for disabled students in scientific writing. Inclusive education requires contextual and relevant learning resources (9). Integration of quantitative and qualitative data shows that SiBaAI app is suitable with IMRaD structure, AI features support development of academic vocabulary, and this app reduces cognitive load of disabled students. Generative AI facilitates disabled students in scientific writing, especially in formulating ideas and text structures (26).

However, lecturers' perspectives in Q3 indicate that verbal-linguistic intelligence is multi-dimensional.

The app can develop vocabulary and grammar, but it needs improvement in supporting argument coherence. This finding reveals that AI is effective for initial scaffolding, but lecturer's pedagogical role cannot be removed (49). Generative AI significantly improves quality of students' academic writing, especially in the aspects of linguistic precision, structural, and argumentative coherences (50). Furthermore, recent study explains that students utilize generative AI as linguistic support and academic task management (51). They also say that AI integration needs

pedagogical adjustment in which scaffolding is used in the initial phase of scientific writing. Lecturer makes sure that AI enhances the development of students' academic reasoning and independent thinking (52). Therefore, SiBaAI app is integrated into scientific writing to increase academic reasoning and autonomous learning of disabled students.

Application Usability as Foundation of Technology Inclusivity

Usability is a primary prerequisite for inclusivity of educational technology. Inclusive technology is designed with universal design for learning (11). Results of interview with lecturers show that visual design, navigation, and representative icons in SiBaAI app reduce cognitive load of students with physical disability and dyslexia. This indicates that usability is related to technical convenience and cognitive justice in learning process.

Different perspective emphasizes that the success of AI in inclusive education is also influenced by network stability. This provides critical contribution to the discourse on AI that ignores contextual factors in its implementation (12). Moreover, integration of generative AI into higher education level increases digital literacy, critical thinking skill, and students' participation (53). However, pedagogical guidance is still needed to overcome ethical issues and ensure equal participation. In addition, pedagogical instructions and institutional policies are crucial to ensure generative AI can be optimally utilized (54). Various challenges in implementing generative AI at Indonesia are available infrastructure, educator capabilities, and digital disparities (55).

The Effectiveness of SiBaAI App in Supporting Scientific Writing Process

The effectiveness of SiBaAI app in supporting scientific writing shows that this app can be substantive pedagogical tool. The lecturers observe the improvement of students' self-confidences, draft quality, and revision process. Artificial Intelligence tends to provide more supportive feedbacks, so it reduces academic anxiety of disabled students (25). This study shows the effectiveness of AI is the combination of logical academic structure and linguistic support. Variability in Q11 reveals that AI is the most effective tool for scaffolding. Students utilize generative AI to produce ideas and improve grammar in academic writing (56). Moreover, digital literacy which integrates ethical discussion and AI assessment helps students to use technology and support preservation of academic integrity (57). Using AI without pedagogical instructions can decrease critical thinking skill, so learning strategy is needed to strengthen digital literacy in utilizing AI (58).

Application Compliance with Inclusive Education

The aspect of application compliance with inclusive education obtains the highest score in Q14. This indicates that SiBaAI app can be integrated into learning environment where disabled and non-disabled students in it. In line with this, AI has great potential in creating inclusive and collaborative learning environments (27). This study shows that lecturer has a role to integrate AI successfully using scaffolding, structured peer review, and mixed group projects. In Q15, the independence of disabled students is contextual, depending on its type and level. It can be said that inclusivity is dynamic process which requires technology combination, pedagogical support, and institutional policy. The use of AI in collaborative learning improves equal participation between disabled and non-disabled students (59). Moreover, AI can be a support system non-judgmental that enhances self-confidence of disabled students (60). Students' learning independence in AI-assisted environment is gradual and influenced by mentoring context (61).

The research findings explain that AI facilitates students in composing scientific writing more effectively and systematically (62). Other findings indicate that AI-based applications can improve academic writing skills through automated feedback (63). Furthermore, AI technology helps students to develop ideas, improve writing structure, and enhance academic quality efficiently (64). These previous studies demonstrate that AI supports more adaptive and inclusive writing instruction. This is in line with the findings of this study, in which SiBaAI app can support students with physical disabilities in writing scientific articles.

Assistive technology enhances writing skills of disabled students through digital correction features and guided support (65). Moreover, inclusive digital learning environments enable disabled students to develop academic writing

skills independently (66). In addition, inclusive educational technology helps disabled students to understand the structure and process of scientific writing (67). Previous studies support the findings of this study which show that disabled students are greatly assisted in writing scientific articles using SiBaAI app.

However, several challenges and limitations are identified during implementation of SiBaAI app. First, the effectiveness of AI feature depends heavily on internet connection. In remote areas, response delays and timeout errors present significant obstacles, consistent with research on the digital divide in Indonesia (55). Second, the application remains suboptimal for students with severe visual impairments (total blindness) due to limited screen reader compatibility, suggesting that Universal Design for Learning (UDL) principles have not been fully realized. Third, SiBaAI app functions best in early-stage writing (e.g., idea generation, outlining, and grammar correction) but is less effective for lengthy writing. This supports the assertion that using AI without pedagogical guidance may diminish critical thinking skills (58). Fourth, different levels of student independence indicate that one-size-fits-all approach is inadequate for accommodating the diverse needs of disabled students. Therefore, the use of SiBaAI requires lecturer support tailored to student's disability profile.

This study expands the use of AI in inclusive education by including lecturers' perspectives that are rarely discussed in international literature. The findings show that SiBaAI app supports verbal-linguistic intelligence of disabled students. Based on policy perspective, this study implies the need of development standard for AI in inclusive education that emphasizes on technology, pedagogical suitability, accessibility, lecturers' readiness. This discussion confirms that SiBaAI app is positively perceived by lecturers as relevant and effective technology that aligns with inclusive education principles. This strengthens the argument that AI has great potential to fill the gap regarding to verbal-linguistic intelligence of disabled students in scientific writing.

Novelty of this study is the integration of lecturers' perspectives, verbal-linguistic intelligence, and using AI for disabled students in scientific writing. This study is different from previous studies in which focus on disabled students' perceptions without specific pedagogical context. This study explores lecturers' perspectives as the main actor. It utilizes SiBaAI app as linguistic and academic scaffolding, and relates to verbal-linguistic intelligence in scientific writing. Therefore, this study presents a new perspective of AI and inclusive education, especially in academic writing. The novelty of this study can be viewed in Figure 7.

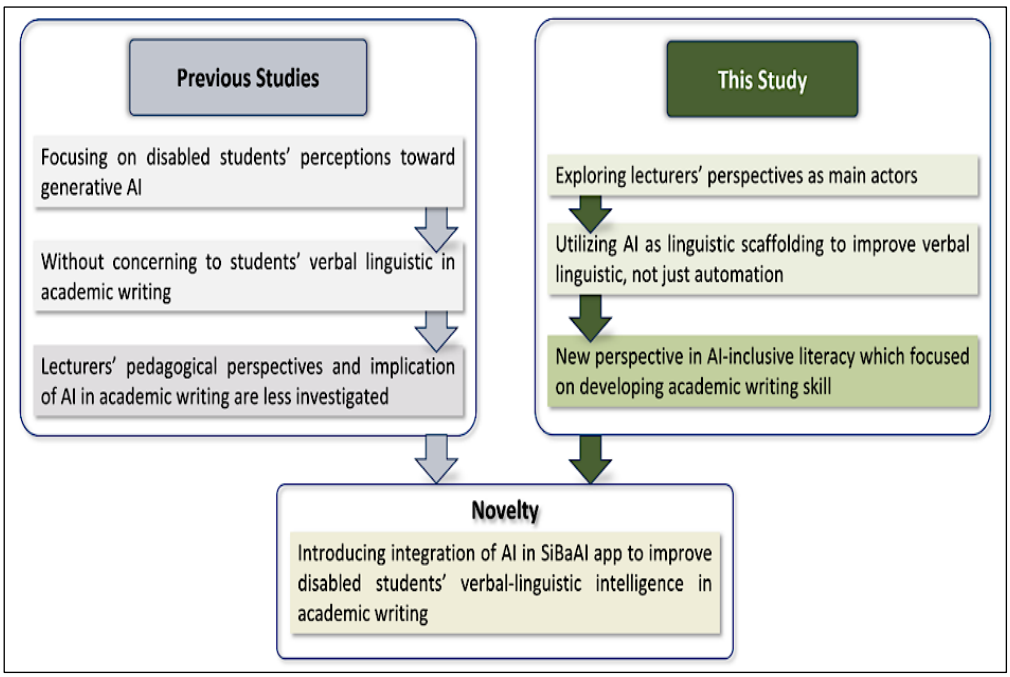

Figure 7: Novelty of Study

Conclusion

The conclusion of this study is that SiBaAI app is positively perceived by lecturers in supporting verbal-linguistic intelligence of disabled students in scientific writing. The four aspects of application usefulness and relevance, application usability, the effectiveness of application in supporting scientific writing, and application compliance with inclusive education obtain high categories. This indicates that the application fulfills technical standard and relevant to the needs of inclusive education. However, the implementation of SiBaAI has technical challenges, including reliance on internet stability and limited accessibility for students with severe visual impairments. Furthermore, its effectiveness is confined to the early stages of writing and is suboptimal for complex writing. Therefore, generalization of present findings has to be approached with caution, especially in contexts with limited digital infrastructure or different disability types that are not represented in this study.

Findings of this study confirm that AI-based technology is effective for disabled students in cognitive and linguistic scaffolding. The strength of SiBaAI app lies in its ability to combine three critical dimensions. They are conceptual understanding through adaptive AI explanations, systematic development of scientific writing structures, and linguistic support to overcome verbal barriers. This study also identifies that the effectiveness of application is contextual. AI can be assistive tool in the initial and intermediate stages. Lecturer's role is crucial to assist academic reasoning and adjust to specific disability profiles.

Findings of this study can be a basis of future research to explore the strategy to integrate AI into educational curriculum and involve stakeholders' perspectives (lecturers, technology developers, and students) to create holistic evaluation in inclusive education. This study provides a new approach related to inclusive AI pedagogy that emphasizes three principles, i.e. universal design, technology integration, and strengthening lecturer as actor of meaningful learning experiences. This approach is relevant to inclusive education and can be adapted in various educational levels that are oriented towards justice and equal access.

Based on finding and discussion, there are recommendations addressed to

(a) developers of educational technology to develop AI features for disabled students,
(b) higher education institutions to adopt a framework for integrating AI into curriculum in which lecturers' capabilities to use adaptive scaffolding tools are developed,
(c) future researchers to conduct longitudinal study in examining the long-term impact of using similar application on verbal-linguistic intelligence and academic success of disabled students, and
(d) lecturers and educational practitioners to integrate SiBaAI app with reflective pedagogical strategy, such as blended scaffolding which combines AI and human assistance, as well as the implementation of inclusive-collaborative learning using digital platform.

There are several limitations of this study. The sample is restricted to 105 lecturers from selected universities in Indonesia, so the findings cannot be generalized to the entire population of Indonesian lecturers or to different educational contexts. All quantitative data are collected via self-administered questionnaires which may introduce social desirability bias. This study employs a cross-sectional design, measuring lecturer perspectives at a single time point. Therefore, it cannot capture changes in perspectives over time or the long-term effects of SiBaAI on teaching practices and the scientific writing skills of disabled students.

In addition, this study is focused on the lecturers' perspectives without involving the perspectives of disabled students as the primary users of SiBaAI app. In fact, students' perceptions may differ from those of the lecturers. Therefore, the findings of this study represent only the lecturers' point of view and may not necessarily reflect the direct experiences of disabled students. Readers and future researchers have to interpret the findings of this study cautiously to avoid overgeneralization beyond the context of this study.

Abbreviations

AI: Artificial Intelligence, SD: Standard Deviation, SiBaAI: Artificial Intelligence-based Reading Application, Q1: Question 1, Qn: Question n.

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Author Contributions

Cahyo Hasanudin: Conceptualization, Methodology, Investigation, Writing-Original Draft, Project Administration, Ayu Fitrianingsih: Statistical Analysis, Formal Analysis, Searching Reference Resources, Writing–Review and Editing, Visualization, Data Curation, Ida Zulaeha: Methodology, Investigation, Data Analysis/Interpretation, Supervision, Aida Azizah: Data Collection, Validation, Critical Revision Of Manuscript, Drafting Manuscript, Aji Krisna Bayu: Data Curation, Formal Analysis, Admin, Project Administration.

Conflict of Interest

The authors have no conflicts of interest to declare.

Data Availability

Research data is neatly stored in research files. If requested by relevant parties, researchers can present it.

Declaration of Artificial Intelligence (AI) Assistance

Authors used the AI tool ChatGPT (OpenAI, version GPT-4) to assist in the visualization and thematic synthesis of this study, specifically in designing thematic networks integrating quantitative and qualitative data based on descriptive statistical analysis and interview findings. The use of AI was limited to graphical representation and conceptual organization of relationships between themes, while all data analysis, interpretation of results, conclusion drawing, and manuscript writing were carried out independently by the authors. After using this AI tool, we conducted critical review, verification of accuracy, and thorough editing of all output. For the preparation of Figures 3, 4, 5, and 6, the authors used ChatGPT (OpenAI) to generate the initial draft layout and content structure. All AI-generated drafts were subsequently revised, updated, and finalized using Microsoft PowerPoint. All authors are fully responsible for the content, originality, and academic integrity of this published work.

Ethics Approval

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