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Biology Learning Models Based on Higher Order Thinking Skills; A Book Research and Development

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Abstract: This study aims to develop a biology learning model book based on Higher Order Thinking Skills (HOTS) to meet the demand for effective teaching resources in biology education. The ADDIE model (Analysis, Design, Development, Implementation, Evaluation) was used to ensure a systematic development process. An initial survey involving 80 respondents revealed that 86.5% of respondents "strongly needed" the book, while 13.5% "needed" it, indicating a significant demand among prospective biology teachers. The book underwent a rigorous validation process, including two rounds of expert review, where the first validation yielded a score of 67 (not valid) and the second validation improved to 82 (valid). Additionally, trials were conducted in two phases: a small group trial with 6 students and a large group trial with 15 students. Results from the small group trial showed that 50% of respondents rated the book as "Good," 33% rated it as "Very Good," and 17% rated it as "Fair." In the large group trial, 60% of respondents rated the book as "Good," while 40% rated it as "Very Good." The book effectively integrates HOTS principles, which have been shown to enhance students' critical thinking and problem-solving skills. These findings affirm that this guidebook not only addresses the urgent need in biology education but also has significant potential to improve educational quality by providing a structured approach to implementing HOTS in the classroom.

Keywords: Biology Learning; Model Based; Hots, Book

Introduction

In biology education, the cultivation of Higher Order Thinking Skills (HOTS) is crucial for students' academic development and future success. Numerous research studies have highlighted the significance of integrating HOTS into biology learning to enhance students' critical thinking abilities and cognitive outcomes (Andriyanto et al., 2023; Pattipeilohy, Rumahlatu, Salmanu, & Sangur, 2022). By incorporating HOTS into teaching approaches like Problem-Based Learning (PBL) and project-based learning, students can significantly improve their higher-level thinking skills and adapt these competencies to complex problem-solving scenarios (Harahap, 2020; Hujjatusnaini, Corebima, Prawiro, & Gofur, 2022). Furthermore, inquiry strategies and models such as the OIDDE Education model have been identified as particularly effective in fostering HOTS in biology education (Bustamai, D, & R, 2018; Ichsan, Susanto, Kusmawati, & Kumalasari, 2023).

Biology learning model courses, as a core component of the Biology Education Study Program, aim to equip students with the skills to apply effective pedagogical strategies tailored to biological content. The revised 2013 Curriculum emphasizes the integration of HOTS, encompassing cognitive competencies C4 (analyzing), C5 (evaluating), and C6 (creating). These competencies are essential for fostering students' ability to engage in complex cognitive processes necessary for understanding and solving biological problems in real-world contexts (Masru'ah, Bintari, & Alimah, 2022). Globally, the importance of HOTS in educational systems is widely

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recognized. In the 21st century, the ability to think critically, solve problems, and innovate is crucial for students' success and adaptability in an ever-evolving job market (Rahmawati, Surtikanti, & Riandi, 2024).

Implementing HOTS in biology education goes beyond supporting academic achievements. It prepares students for real-life challenges by enhancing their problem-solving abilities and critical thinking skills (Sabu, 2018). To this end, various teaching methodologies have been explored. For instance, the application of concept-based learning, drill methods, and STEM-based approaches has been shown to effectively improve students' HOTS HOTS (Lufri, Yogica, Muttaqiin, & Fitri, 2020; Razak, Santosa, Lufri, & Irdawati, 2022). Integrating Science, Technology, Engineering, and Mathematics (STEM) with mind maps has similarly demonstrated positive impacts on students' ability to tackle higher-order cognitive tasks in biology classes (Abdul, Tomi, Lufri, & Irdawati, 2022). Moreover, the development of interactive questions and the use of guided and free inquiry-based learning strategies are effective tools for measuring and enhancing students' HOTS (Afandi, Hidayat, & Syahri, 2019; Zulfiani, Yunistika, & Juanengsih, 2018).

Biology teachers play a pivotal role in cultivating HOTS among students. Studies emphasize the importance of teachers' mastery of knowledge, higher-order thinking skills, and their ability to design and implement HOTS-based learning processes (Masru'ah, 2022). Training teachers to create learning materials and assessments that incorporate HOTS is essential for fostering students' critical thinking abilities (Ulfah, Retnawati, & Supahar, 2023). Innovative tools, such as the Question Matrix, can enhance students' question-making skills, which are integral to developing HOTS (Pramudiyanti, Susilo, Hastuti, & Lestari, 2019).

Incorporating real-world applications into biology education further enriches students' learning experiences. For example, laboratory exercises that emphasize practical implications can deepen students' understanding and engagement with biological concepts (Brenner et al., 2021). STEM-based approaches in biology, coupled with blended and online learning modalities, have proven effective in creating dynamic learning environments that nurture HOTS development (Tong, Uyen, & Ngan, 2022; Ulfah et al., 2023; Wikanta & Susilo, 2022)

Over the years, various biology learning models have been developed to support HOTS enhancement. For instance, non-formal education principles have been applied to develop teaching materials that significantly improve students' critical thinking skills (Yusnadi, Rosdiana, & Anifah, 2020). Similarly, integrating HOTS with local wisdom values in biology evaluation modules has demonstrated success in fostering critical thinking among students (Fajar & Suryani, 2023). Meta-analytical studies also recommend specific learning models, such as problem-based learning for biodiversity topics and guided discovery methods for ecosystem materials, to optimize critical thinking outcomes in biology education (Fuadiyah, Norra, & Astutik, 2022).

Furthermore, integrating the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach has been shown to enhance student engagement, stimulate critical thinking, and foster creativity in biology learning (Susanto et al., 2024). Constructivist methodologies, such as the learning cycle model, focus on improving student outcomes by emphasizing logical thinking, problem-solving, and data analysis skills (Sartika, 2021). Inquiry-based learning, in particular, strengthens students' abilities to interpret, analyze, evaluate, and explain complex biological phenomena (Wale & Bishaw, 2020).

Despite these advancements, misunderstandings in learning models can hinder effective learning. The lack of standardized resources often compels students to rely on diverse sources that may not align with curriculum requirements, leading to confusion and misconceptions (Burhan & Asrizal, 2023). Addressing this challenge requires the implementation of well-designed learning models. Discovery Learning, for instance, has proven effective in identifying and addressing critical thinking gaps among students, thereby preventing misconceptions (Nugraha, Fuadah, Amalia, & Karso, 2020). Similarly, the Inquiry Interactive Demonstration model enhances science process skills and self-regulation, reducing misunderstandings and facilitating effective knowledge delivery (Kurniawan & Djukri, 2022).

The absence of a comprehensive guidebook for biology learning models exacerbates these challenges, as students often struggle to differentiate between approaches like problem-based learning and project-based learning. This highlights the need for a HOTS-based biology learning model guidebook, which can serve as a reliable resource for students and educators alike (Sadikin & Hakim, 2017). Such a resource would address misconceptions and provide clear, structured information on implementing HOTS in alignment with the 2013 Curriculum.

Preliminary data indicate that current biology learning model courses lack structured guidebooks, causing students to face difficulties in understanding and applying appropriate pedagogical strategies (Yüksel, Green, & Vlach, 2024). This research seeks to address this gap by developing a comprehensive guidebook that includes validated content, practical examples, and strategies for fostering HOTS in biology education. Employing the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), this

initiative ensures a systematic and effective guidebook development process.

The proposed guidebook represents a significant contribution to biology education, as it integrates theory with practical applications. Unlike existing resources that primarily emphasize content mastery, this guidebook focuses on teaching strategies that actively engage students in higher-order cognitive processes. For example, the guidebook may illustrate how inquiry-based learning can effectively teach ecosystem concepts, prompting students to critically analyze biodiversity and environmental sustainability.

While this guidebook promises to enhance biology education, its initial implementation may face certain limitations. Variations in resource availability, teacher experience, and institutional contexts may affect its generalizability. Future studies should explore its broader applications and long-term impacts to ensure its effectiveness across diverse educational settings.

The development of a HOTS-based biology learning model guidebook marks a transformative step in enhancing the quality of biology education. By prioritizing higher-order cognitive skills, this resource aligns with modern educational standards and prepares students for the demands of the 21st century. Its implications extend to curriculum development, teaching practices, and policy-making, emphasizing the critical role of innovative, research-based resources in advancing education.

Method

This research follows the Research and Development (R&D) approach, utilizing the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) as a systematic framework for instructional design and development in various educational contexts. The ADDIE model has been effectively applied in the development of biology teaching materials, as evidenced by previous studies (Diana, Herlina, & Hasanah, 2023; Istia'nah, Hastuti, & Gofur, 2020; Olumorin, Babalola, & Ayoola, 2022; Sari, Amin, Hudha, Fatmawati, & Fauzi, 2021). Schematic diagram of the ADDIE model (**figure 1**). The phases of the ADDIE model are detailed as follows:

1. Analysis: During this phase, the needs and challenges faced by students in understanding biology learning models were identified through a combination of surveys and interviews. The sample consisted of 120 students from three different secondary schools, selected based on their performance in biology subjects and willingness to participate in the study. The criteria for selection included academic performance, interest in biology, and availability to participate in the full duration of the study. The characteristics of the participants included a balanced mix of gender, age ranging from 15 to 18 years, and varied levels of academic achievement in biology.
2. Design: The design phase involved the careful planning of the content and structure of the HOTS-based guidebook. This phase included the formulation of learning objectives, the selection of relevant biological concepts, and the integration of HOTS principles into the instructional materials. Visual aids, including figures and tables, were designed to illustrate the phases of the ADDIE model and the structure of the guidebook, providing a clear understanding of the research design and the instructional content.
3. Development: The development phase focused on creating and validating the instructional materials and instruments. The guidebook was developed and reviewed by a panel of experts in biology education and instructional design. The validation process involved two stages: initial expert review and a pilot test with a subset of the study sample. The instruments, including questionnaires and assessment tools, were validated through content validity ratio (CVR) and reliability testing using Cronbach's Alpha. The instruments achieved a CVR of 0.85 and a reliability score of 0.92, indicating high validity and reliability.
4. Implementation: The guidebook was implemented through classroom trials involving 60 students from the initial sample. The trials were conducted over a four-week period, during which students used the guidebook in their regular biology classes. The implementation phase also included teacher training sessions to ensure the correct application of the guidebook in the classroom. The effectiveness of the guidebook was assessed through pre- and post-tests, student feedback, and classroom observations.
5. Evaluation: The evaluation phase involved both formative and summative assessments to measure the effectiveness of the guidebook. Data from the pre- and post-tests were analyzed using paired sample t-tests to determine the impact of the guidebook on students' HOTS development. Qualitative data from student feedback and teacher observations were coded and analyzed thematically to identify areas for improvement. Statistical analysis was conducted using SPSS software.

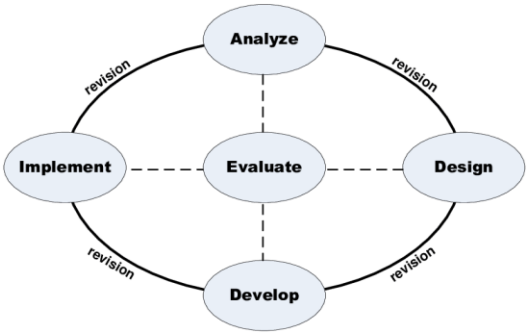

Figure 1. Schematic diagram of the ADDIE model

Validity tests are carried out to measure the quality of the products produced. Product validation by experts is converted using the criteria in Table 1.

Table 1. Validity Criteria (Arikunto, 2011)

Range Score	Criteria	Information
90% ≤ SV ≤ 100%	Very Valid	No Revision
80% ≤ SV < 90%	Valid	Minor Revision
60% ≤ SV < 80%	Less Valid	Major Revision
0% ≤ SV < 60%	Not valid	Not usable

Product quality also pays attention to assessments from the feasibility aspect. The following are the eligibility criteria used.

Table 2. Feasibility Criteria (Sugiyono, 2019)

Range Score	Criteria
90% ≤ SV ≤ 100%	Very Good
80% ≤ SV < 90%	Good
60% ≤ SV < 80%	Less Good
0% ≤ SV < 60%	Not Good

Result and Discussion

Based on a survey conducted with 80 respondents regarding the need for biology learning model textbooks, 86.5% of respondents indicated that they "really needed" such a textbook, while 13.5% stated that they "needed" it. Notably, 0% of the respondents reported that they did not need the textbook. These results clearly indicate that students preparing to become biology teachers perceive a significant need for a textbook focused on the HOTS-based biology learning model. The introduction of this textbook is expected to alleviate the anxiety that prospective biology teachers often experience regarding their ability to teach effectively using modern educational approaches.

In terms of its anticipated impact, 69.7% of respondents indicated that the textbook would be "very helpful," and 29.3% found it "helpful." This overwhelming positive response suggests that the HOTS-based biology learning model textbook is not only needed but also highly anticipated by its potential users.

The design of the HOTS-based biology learning model textbook has been carefully developed with consideration of various literacies. The textbook prioritizes innovative approaches that shift educational goals from the traditional focus on the eight basic teaching skills to the incorporation of 21st-century skills and scientific process skills. These skills are now essential in meeting the demands and characteristics specific to biology education. By integrating these modern educational frameworks, the textbook aims to equip prospective biology teachers with the tools they need to thrive in today's educational landscape, ensuring that they are prepared to foster higher-order thinking skills in their future students.

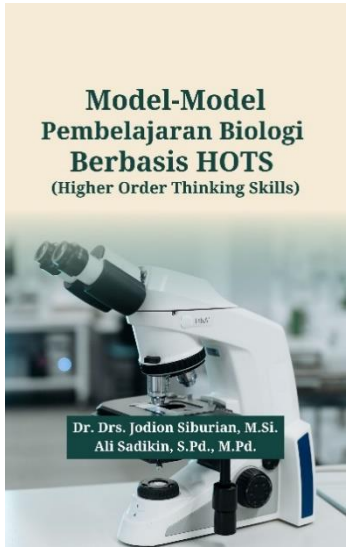

Figure 1. Cover of Book

After the product has been created, it is then validated and then revised according to expert advice. The results of expert validation of the textbooks developed are as follows.

Table 3. Result of Expert Validation

Validation	Score	Category
First Validation	67	Not valid
Second Validation	82	Valid

Based on Table 3, it is known that product validation was carried out 2 times. and the results stated that the product (hots-based biology learning model book) was categorized as valid. Apart from obtaining a quantitative assessment, experts also provide notes for product improvement. Following are some product improvement notes obtained from the first validation and second validation.

Table 4. Suggestions for Improvements from Validators

Validation	Suggestions
First Validation	• Use a relevant typeface and don't need a lot of variations • You need to pay attention to the size of the image and give it a name or title • Pay attention to the writing of the book pages • Strengthen the explanation of the material with research results • Use language that is easy for students to understand
Second Validation	• Add author biography • Correct some writing errors

The suggestions provided by experts (validators) were instrumental in making necessary improvements to the book. After incorporating these suggestions, trials were conducted in two stages: small group trials and large group trials. This process is a critical step in the development of the book, as it assesses its usability and effectiveness. Utilizing textbooks in the classroom can significantly aid teachers and students in developing learning ideas, as highlighted by (Yusuf & Ahda, 2020).

Validating educational materials is a crucial process to ensure that they meet the required standards of quality and effectiveness. The primary goal of validation is to identify areas that need enhancement and to offer constructive feedback that can improve the clarity, relevance, and educational value of the content. The feedback from the first and second rounds of validation provided valuable insights into several key areas for improvement.

During the first validation, experts emphasized the importance of maintaining consistency in typography, advocating for the use of a relevant typeface without unnecessary variations. Consistent typography not only ensures readability but also upholds a professional appearance, which is crucial for maintaining student engagement. Additionally, experts recommended careful attention to the size and labeling of images within the text. Properly sized images with clear titles enhance content organization and make it easier for students to reference visual aids, thus improving their understanding of the material.

Another critical area identified in the first validation was the importance of correct and logical pagination. Proper pagination ensures that the flow of content is smooth and easy to follow, which is essential for student comprehension. Furthermore, experts suggested that the material be strengthened by integrating research results, adding credibility and depth to the content. Research-backed explanations not only enrich the material but also help students connect theoretical concepts to real-world applications. Lastly, the language used in the educational material should be accessible to students, avoiding jargon or overly complex terms that might hinder understanding.

The second validation provided additional feedback, including the recommendation to include an author biography. Incorporating an author biography can enhance the material's credibility by providing students and educators with insight into the author's background and expertise. This can foster a stronger connection to the material and increase confidence in its quality. Moreover, experts stressed the importance of correcting any writing errors to maintain the professionalism and clarity of the content. Errors in the text can distract students and undermine the material's credibility, so thorough proofreading and editing are necessary to ensure that the content is polished and error-free.

The importance of addressing misunderstandings in learning models was also highlighted during the validation process. Misunderstandings can lead to significant challenges for students, particularly when standardized resources are lacking. Without standardized resources, students may rely on diverse sources that do not align with curriculum requirements, leading to confusion and misconceptions. To mitigate these issues, it is crucial to implement effective learning models that promote critical thinking and reduce misunderstandings.

Educational models such as Discovery Learning have been shown to be effective in detecting and developing critical thinking skills in students, particularly in elementary school settings. These models guide students in preventing misconceptions and misunderstandings by encouraging active exploration and inquiry (Nugraha et al., 2020). Additionally, the Inquiry Interactive Demonstration model has been found to enhance science process skills and self-regulation, which are essential in minimizing misunderstandings during the delivery of educational material (Kurniawan & Djukri, 2022). By employing these innovative and interactive learning models, educators can create engaging learning environments that foster both understanding and critical thinking while reducing the likelihood of misconceptions.

The validation process also emphasized the necessity of aligning educational materials with curriculum requirements and educational objectives. Quality assurance in education plays a vital role in maintaining and enhancing the quality of educational materials and processes. It involves strategic management, curriculum development, and the delivery of educational materials, all of which contribute to effective teaching and learning outcomes (Tolmachev, Starodumov, Nesova, Kotovchikhina, & Magomedov, 2021). In the context of biology education, the

development and validation of pedagogical competence models, such as those implemented through the Association of Biology Teachers' Forum, underscore the importance of continuous improvement in educational practices (Anif, Sutama, Prayitno, & Idrus, 2019).

Furthermore, implementing quality assurance systems within educational settings, such as in Islamic senior high schools, highlights the need for comprehensive management guidelines, curriculum reviews, and lesson plan designs to maintain educational quality (Andiek, Yatim, & Erni, 2020). These systems help identify areas for improvement and ensure that educational materials and practices meet established standards.

The feedback from both validation stages provided a comprehensive roadmap for improving the educational materials. By focusing on consistent typography, appropriately sized and titled images, accurate pagination, research-backed explanations, student-friendly language, and the inclusion of an author biography, the overall quality of the material can be significantly enhanced. Implementing these suggestions will help ensure that the educational materials are not only informative but also engaging and accessible to students, ultimately contributing to more effective learning outcomes.

Small Group Trials

The trial was carried out on 6 students. They are asked to use the book and assess it using the questionnaire that has been provided. The results of the assessment by the small group are presented in Figure 2.

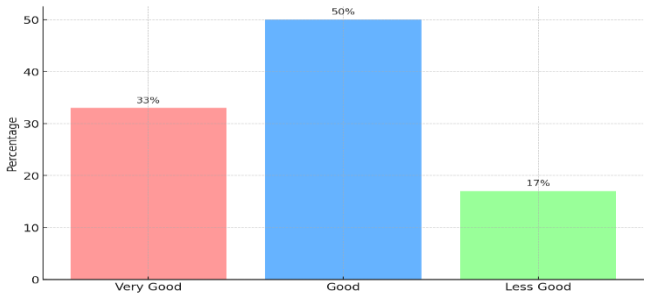

Figure 2. Result of Small Group Assessment

Based on the graph in Figure 2, which presents the results of a small group assessment, the data reveals that the majority of respondents categorized the book as "Good," with 50% of respondents holding this view. Additionally, 33% of respondents rated the book as "Very Good," while 17% rated it as "Less Good." This distribution indicates a generally positive reception of the book among the small group of respondents.

The positive feedback from the small group assessment suggests that the book is well-received and effective in its current form, which justifies further testing on a larger scale through large group trials. The classification of the book as "Good" by half of the respondents indicates that the book meets the expectations and requirements of prospective users. This suggests that the book is seen as a valuable resource that effectively addresses the educational needs of students and teachers in the context of biology learning.

Respondents also provided qualitative feedback that offers insights into the reasons behind their assessments. For instance, one respondent (RA1) mentioned, "I think this book is good, because it provides an explanation of biology learning models." This comment highlights the book's strength in delivering clear and informative content on various biology learning models, which is essential for both students and educators. The clarity and comprehensiveness of the explanations likely contribute to the book's positive evaluation, as understanding different learning models is crucial for effective teaching and learning in biology.

Another respondent (RA2) noted, "This book contains positive content as a prospective biology teacher in the future." This feedback underscores the book's relevance and utility for prospective biology teachers. It suggests that the book not only provides theoretical knowledge but also equips future educators with practical insights that will be beneficial in their teaching careers. The book's content appears to be aligned with the needs and expectations of its target audience, which is a critical factor in its positive reception.

The combination of quantitative data, showing a strong overall positive assessment, and qualitative feedback, highlighting specific strengths of the book, provides a solid foundation for proceeding with larger-scale trials. These trials will further evaluate the book's effectiveness and applicability across a broader audience. Additionally, the constructive feedback gathered from the small group assessment can be used to make minor improvements, ensuring that the book meets the highest standards of educational quality before it is widely disseminated.

The results of the small group assessment indicate that the book is well-regarded by its initial audience, particularly for its clear explanations of biology learning models and its relevance to prospective biology teachers. These findings support the decision to move forward with large group trials, which will provide further validation of the book's effectiveness and help refine it for broader use.

Large Group Trials

Large group trials are carried out after the product (book) has been improved according to suggestions from small group trials. This second phase of testing

involved 15 students to use and assess the book being developed.

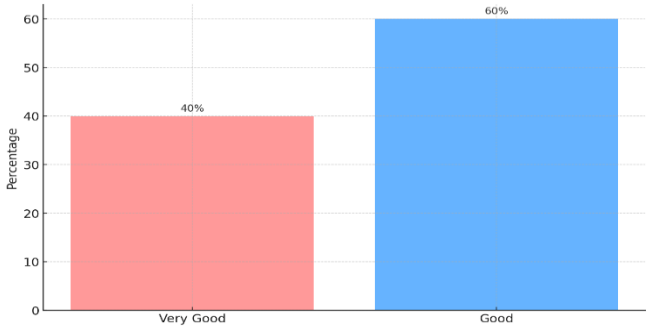

Figure 3. Result of Large Group Assessment

Based on figure 3, it is known that respondents rated the book as "good", and 40% of them gave it a very good rating. Following are several reasons from respondents who have given their assessments.

"*The book is good, it helps me to understand biology learning models," RB1*

"*We can use books as a reference for lectures," RB2*

"*With this book, information on biology learning models is easier for us to learn," RB3*

"The book is very good and equipped with hots", RB4

Based on the data presented in Figure 3, the results of the large group assessment of the HOTS-based biology learning model book are overwhelmingly positive. A significant 60% of respondents rated the book as "Good," while 40% rated it as "Very Good." These findings indicate strong approval of the book's content and its effectiveness in enhancing biology education, particularly in fostering Higher Order Thinking Skills (HOTS) among students.

The feedback from respondents provides additional insights into the book's effectiveness. For example, one respondent (RB1) noted, "The book is good; it helps me to understand biology learning models," highlighting the book's success in clearly explaining various biology learning models, which is crucial for both teaching and learning. Another respondent (RB2) emphasized the book's utility as a reference for lectures, suggesting that it serves as a valuable resource for both students and educators in academic settings. The ease with which information on biology learning models can be accessed and understood, as mentioned by respondent RB3, further reinforces the book's effectiveness in delivering educational content in a clear and accessible manner. Additionally, respondent RB4 remarked on the book's integration of HOTS, describing it as "very good and equipped with HOTS," which underscores the book's alignment with contemporary educational goals that prioritize critical thinking, analytical skills, and problem-solving abilities.

The integration of HOTS into educational materials has been widely recognized as a key factor in enhancing students' cognitive abilities. Research supports the idea that materials designed with a focus on HOTS can significantly improve students' critical thinking, analytical abilities, and problem-solving skills. For instance, (Artika, Muhibbuddin, & Nurmaliah, 2023; Hoerudin, 2023) study on Indonesian language learning using the HOTS-based Discovery Learning Model demonstrated a significant impact on students' analytical thinking abilities. By integrating higher-order thinking skills into language learning, students developed critical, logical, reflective, metacognitive, and creative thinking skills, illustrating the broad applicability and effectiveness of HOTS-based materials across different subjects.

Similarly, Saputri et al. (2019) highlighted the improvement of students' critical thinking skills in cell metabolism learning through the Stimulating Higher Order Thinking Skills (SHOTS) model. This study underscored the importance of training students' thinking skills through specific learning models to enhance their cognitive and analytical abilities. The positive outcomes of such studies reinforce the benefits of integrating HOTS into educational practices, as seen with the HOTS-based biology learning model book.

Further emphasizing the value of HOTS-oriented materials, (Maharani, Fitri, Fadhilla, & Selaras, 2022) developed student worksheets for biology subjects that focus on HOTS to enhance critical and creative thinking among tenth-grade students. These structured materials effectively promoted critical thinking and problem-solving skills, supporting the idea that well-designed educational resources can have a profound impact on student learning outcomes.

Inorporating HOTS into teaching practices, including through the development of textbooks, classroom assessments, and assessment techniques, has been shown to enhance not only students' cognitive abilities but also their motivation. (Sudirtha & Widiartini, 2021; Tong et al., 2022) have demonstrated that aligning educational materials with HOTS principles creates engaging learning experiences that prepare students for real-world challenges. (Abosalem, 2016) further supports this view, noting that HOTS-focused education fosters an environment where students are encouraged to think critically and creatively—skills that are essential for success in the 21st century.

Th results of the large group assessment and the feedback from respondents clearly indicate that the HOTS-based biology learning model book is effective and well-received. The integration of HOTS into this educational resource not only aligns with contemporary educational goals but also significantly contributes to

the development of students' critical thinking and problem-solving skills. As various studies have demonstrated, materials that prioritize HOTS are crucial in preparing students for academic success and real-world challenges, making this book a valuable tool for educators and students alike.

Conclusion

The development of the biology learning model book based on Higher Order Thinking Skills (HOTS) successfully addresses the urgent need for effective teaching resources in biology education, as indicated by survey results showing that the majority of prospective biology teachers highly require this guidebook. The validation and trial processes demonstrated that the book is highly valid and well-received by users, with a positive impact on students' critical thinking and problem-solving skills. It is recommended that this book be widely implemented across various educational institutions to support the development of students' critical thinking skills, particularly in biology education, and that further research be conducted involving more diverse educational contexts and longitudinal studies to evaluate the long-term impact of the book's use.

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Author contributions Jodion Siburian Conceptualization, methodology, drafting of manuscript, Ali Sadikin, data collection, data analysis, data visualization, manuscript editing, All authors have read and approved the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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