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Development of Basics and Learning Process Biology Textbooks Based on the Industrial Revolution 4.0

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Abstract: This research aims to develop a basic textbook and biology learning process based on the industrial revolution 4.0. The research method uses R&D with the ADDIE model (analysis, design, development, implementation and evaluation). The research results show that the need for basic textbooks and a biology learning process based on revolution 4.0 is very high. The design of this book uses A5 size paper, with a table of contents including: learning in the era of the industrial revolution 4.0, biology learning methods, teaching skills, learning media, current biology learning models and teaching aids. At the development stage, the book Basics and Biology Learning Process Based on the Industrial Revolution 4.0 was declared feasible by the validator. At the implementation stage, this book received a good rating (82.25) in small group trials and good (84.3) in large group trials. Conclusion, basic books and the biology learning process are in the appropriate category according to the validator's assessment and the good category according to the lecturer's and student's assessment.

Keywords: Biology; Development; Education; Industrial revolution 4.0; Textbook

Introduction

Preparing prospective teachers is a real thing that must be done today as an effort to deal with change. In the current era (industry 4.0), teachers are required to have digital literacy knowledge and be able to apply 21st century learning (Uspayanti, 2021). Industrial revolution 4.0 with characteristics based on big data, digital and technology (Sadikin & Hakim, 2019b). So, it's not just about teaching, but more than that, and of course this can be formed in higher education. In the era of Industrial Revolution 4.0, technology based on big data and artificial intelligence has changed the way of learning and teaching. This requires prospective teachers not only to have basic knowledge in digital learning, but also the ability to design teaching methods that are flexible and adaptive to technological changes. The novelty of this effort also lies in the integration of digital literacy as a core element in the prospective teacher education curriculum. Without strong digital literacy skills, prospective teachers may struggle to meet the needs of a generation of digital native learners.

Education for prospective teachers should be able to produce quality graduates. Graduates who are able to become leaders, have an entrepreneurial spirit, have emotional intelligence, have good digital literacy, are able to communicate, think globally, are able to work together and are able to solve problems (Wibawa, 2018). Of course, it needs to be realized by every element of higher education, so that these efforts are successful (Choli, 2020).

Efforts to prepare these prospective teachers are also made by Jambi University, including in the biology education study programme. Here students are prepared to become competent prospective teachers, including by attending Basics and Learning Process Biology lectures. Through this course, students are expected to have the ability to prepare lessons, manage

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classes, develop media, and evaluate learning. Of course, such abilities are needed in real conditions when becoming a teacher (Sadikin & Siburian, 2019).

In order to produce competent graduates, efforts are needed to achieve meaning full learning. Such learning will be able to hone students' soft and hard skills (Ruswan et al., 2024). Efforts that can be made are to prepare sufficient learning resources, for example textbooks for basics and learning process biology lectures. A needs analysis has been conducted and the result is that the book is needed.

Based on a survey of 270 respondents, it was found that 86.5% really needed it and 13.5% said they needed it and 0% said they did not need textbooks. This confirms that students as prospective biology teachers need textbooks to prepare them as teachers in the 4.0 era. The textbooks of Basics and Learning Process Biology are designed to present something new about teacher teaching skills. Books can also provide benefits for teachers to help them deliver content in class (Baburkin, et al., 2016).

Based on Kepmendiknas No: 36/D/O/2001, "Teaching books are guides for a course made by experts and according to the rules of textbooks and officially published and disseminated". Textbooks are a collection of topics that are made regularly by presenting the completeness of the abilities students are expected to have. Textbooks are needed by teachers to explain lessons, which can ensure that lesson objectives can be achieved (Suwarni, 2015). Textbooks are one of the important components in learning, to facilitate the delivery of lessons as a whole (Irawati & Saifuddin, 2018). Textbooks can help improve the teaching skills of prospective biology teacher students (Sadikin & Hakim, 2019a).

Meanwhile, Biology learning is a process of interaction between teachers, students and teaching materials to acquire knowledge, skills, attitudes and values as well as responsibility to the environment, society, nation and country who are faithful and pious. Biology lessons are related to how to find out and understand about nature systematically, so that learning biology is not only for mastery of knowledge but also a process of discovery, so students are required to be able to think critically and creatively (Sari & Khair, 2022). Meanwhile, we know that critical thinking skills and creative thinking can affect student learning outcomes (Sumarni & Kadarwati, 2020).

Based on that, the development of a text-book on the basics and learning of biology processes based on industry 4.0 capabilities was carried out. It is hoped that this book can accommodate the learning needs of students, so that they can prepare themselves as teachers in the future.

Method

This research is a type of research & development (R & D). Development research is a research method used to make a product, and test it to determine its feasibility (Winarni, 2021). This research uses the ADDIE models; Analysis, Design, Development, Implementation, and Evaluation (Figure 1).

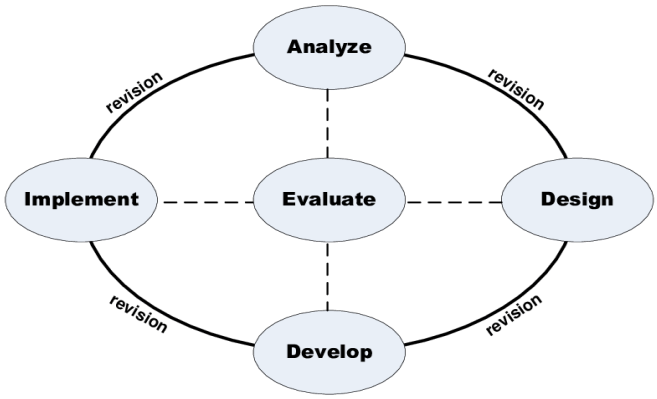

Figure 1. ADDIE model's (Branch, 2009)

Validity and feasibility tests were carried out to measure the quality of the products produced. Product validation by experts, analyzed using formulas and converted using the validity criteria in table 1.

Table 1. Validity Criteria (Sugiyono, 2015)

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

Then, feasibility is carried out through a book trial to students. Trial in stages, from small groups to large groups. The trial results have been calculated and adjusted according to the eligibility criteria in table 2.

Table 2. Feasibility Criteria (Arikunto, 2015)

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

This research was carried out in 3 stages of ADDIE, namely analysis, design and development.

Analysis Phase

A needs survey has been carried out with the results stating that 78% of respondents need this book.

This book is needed for several reasons, including for lecture purposes, to broaden your knowledge as a prospective biology teacher, to prepare yourself with current developments, and as a learning and reading resource.

Content analysis was also carried out to pay attention to the interests of learning in the era of the industrial revolution 4.0. The findings of Jatmiko et al. (2023), state that there are several competencies needed by teachers in this era, including mastery of language, technology, the ability to teach effectively, and the skill of combining theory with practice.

Design Phase

This book is designed carefully and follows the rules of the textbook. Each section is considered to be in accordance with existing needs and conditions. Computing software is also used to simplify the book design process. Figure 2 shows the designed book cover.

Figure 2. Book cover

Development Phase

The book was designed using a review of several literatures. The priority is to provide teachers with 21st century skills and science process skills. Because this is the hallmark of biology education. An example of a book is shown in Picture 2. Then, the textbook draft is validated by experts. A book is said to be valid if its content, presentation, graphical and language aspects have been assessed (Andini et al., 2021). Validation was carried out twice and the results can be seen in figure 3.

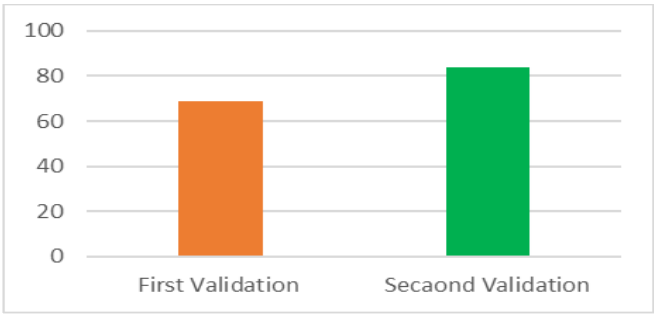

Figure 3. Result of expert validation

Based on Figure 3, there are significant changes from the expert validation results. The first validation resulted in a less valid book with a score of 69. And experts have also provided suggestions for improving the draft textbook. as for the suggestions given, namely Improve the font used, proportionality of images and tables, complete the book content, and add author biography. After revision, a second validation was conducted with the result of "valid" and the draft can be tested.

Validation is not only about numbers to know whether it is valid or not, but also considering input and suggestions from experts. Experts suggest several improvements to improve the book. Among them, improving the presentation of images, because the use of images clearly and precisely will affect student motivation (Rodi et al., 2023). Then, font and grammar adjustments are also made. Because good teaching materials should be written using good language (Zahwa & Syafi'i, 2022). The expert also agrees that this textbook can influence student motivation. There are factors that affect student motivation, and the teacher's ability to present books as learning media will also accompany them (Sari & Ratu, 2021).

The trial was carried out using two methods, namely small groups and large groups. Product trials were carried out in small groups with 6 students and in large groups with 15 students. The results showed good progress (Table 3).

Table 3. Result of Small Group and Large Group Test

Test Phase	Average	Category
Small Group	82.25	Good
Large Group	84.3	Good

Students proactively respond to the use of books. In general, they gave a positive response to the use of this textbook. Through these textbooks students can learn independently, get new information, and make learning easier. This is in accordance with the opinion of Haryani et al. (2022) which explains that textbooks can also help students add insight independently. Then, they also said that this book also presents learning that is in accordance with learning in the 21st century. We also know that developing learning according to current conditions (21st century) is something that is highly recommended (Mukminin et al., 2020).

Various feedbacks from previous tests are considered for improvement. In the end there is confidence that the book is ready to be used in the real class. Because the use of textbooks in learning can affect student learning outcomes (Wahyuni et al., 2022). In addition, textbooks equipped with practice questions can also improve student learning outcomes (Adri, 2020). The integration of internet technology is also

considered, because it is an important part to try in learning in the 4.0 era (Yanti et al., 2021).

Conclusion

Based on this study, it was concluded that the textbooks developed were feasible to use. It is based on expert judgement with valid results and also on tests (small group and large group). It would be nice if this textbook could also be developed in electronic form, to help students prepare themselves as teachers.

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Author Contributions
Conceptualization, A.S, J.S. Developing Product; A.S, J.S. Analyzing Data, M.Y, D.A.E.P.S.; Drafting Article, A.S, M.Y, D.A.E.P.S.

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Conflicts of Interest
The authors declare no conflict of interest.

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