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Development of e-Booklets making nata de pina as a learning resource for Biology Technology Innovation material in the Merdeka Phase E curriculum in high school

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Abstract: Research Development of e-Booklet Making Nata De Pina Research-Based Research as a Learning Source of Biological Technology Innovation Material in the Merdeka Phase E Curriculum in High School aims to analyze the influence of the concentration of sprouts extract on the quality of thickness and weight of nata de pina, as well as analyzing the validity, feasibility, and readability of E-Booklet Making Nata De Pina Developed. The development research design uses the Addie model, which consists of 5 stages, namely analysis, design, development, implementation and evaluation. In this study the implementation stage was not implemented. The results of this study were the provision of sprouts in the process of making nata de pina had a significant effect on the thickness of thickness and weight of nata de pina. The best results of the five treatments for the concentration of sprouts extract tested are trial in the K4 treatment with a concentration of sprouts of 100 ml for 500ml of media. The e-Booklet of making Nata de Pina is considered very valid with the acquisition of material validation scores of 90.90% and the validation score of media experts of 93.53%. The e-Booklet making Nata de Pina was declared very feasible with the acquisition of the teacher response score of 96.66% and the student response was 89.52%. As well as the results of the e-Booklet readability test making Nata de Pina is considered high with the acquisition of the Rumpang test score of 98.38%.

Keywords: Biotechnology; E-booklet; Learning Resources; Nata de Pina

Introduction

Biology learning is a part of science that contains facts, laws and principles from the results of the scientific process (Agnafia, 2019). According to (Jayawardana, 2017) Biology learning has the potential to be a forum for improving high-level thinking skills, developing scientific attitudes and basic skills. The biology learning process is not just a transfer of knowledge using the lecture method from teacher to student, but rather the process of constructing knowledge in everyday life is taught through experiments oriented towards the scientific process. In order to realize optimal biology learning, teachers must be able to develop appropriate learning tools and the use of learning resources must be included in them (Abdulrahaman et al., 2020). Learning resources in the learning process have an absolute position, complex material can be presented in a concise and systematic form through the use of learning resources.

Learning resources are all sources or sets of materials created intentionally or unintentionally so that students can learn individually or in groups with the aim of increasing effectiveness and increasing the

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efficiency of learning objectives. Learning resources are able to support the learning process and expand the presentation of material that is not explained in the book. Therefore, teachers as facilitators in the learning process must be able to choose learning resources that are effective and efficient in achieving learning goals (Puspita et al., 2017).

Implementation of the Independent Curriculum requires schools to implement project-based learning. Senior High Schools have an allocation for project assignments of 30%. Project obligations must be carried out with careful planning and implementation so that students are able to increase their independence, critical thinking skills and collaboration skills. Students are given contextual learning experiences so that they can be trained in solving problems using scientific methods. Students must be able to find problems, formulate hypotheses, design experiments, conduct experiments, analyze data, draw conclusions and communicate experimental results. Indirectly, this activity can bring out creativity and sharpen students' reasoning (Wahyudi et al., 2018). To support the learning process, contextual learning resources are needed that are able to increase students' understanding and process skills that make learning more meaningful.

Based on the results of an interview with one of the biology teachers at SMA Negeri 1 Randudongkal in February 2023, information was obtained that the learning resources used in the innovation material learning process were still in the form of Student Worksheets (LKS) and textbooks that were less contextual. In the biology learning process, the teacher has carried out practical activities on biological technology innovation material in the form of making tempeh and tape. This experiment is very common, some students even said that experiments on making tempe and tape had already been carried out when they were at junior high school level, so the students did not get new experiences. One innovation that can be implemented to support the implementation of the Independent Curriculum through project-based learning is by utilizing honey pineapple peel waste to make nata de pina.

Pemalang Regency is the largest honey pineapple producer in Central Java with a productivity of 18,960 tons/ha. Some of the honey pineapple produced is processed into processed products such as jam, dodol, sweets and pineapple chips. This production activity produces pineapple skin waste reaching 5.12 tons of total production and the honey pineapple skin waste has not been processed properly so it has the potential to cause new problems for the environment (Nurhayati, 2013). Making nata de pina from pineapple skin waste can be used as a learning innovation in biological technology innovation material, therefore it is necessary to have a guidebook on techniques for making nata de pina as a learning resource that is able to increase understanding of biology through contextual learning packaged in an attractive appearance.

The above problems can be overcome through the development of e-booklets as a learning resource for biological technology innovation material. This e-booklet learning resource contains a brief description of biological technology innovation material accompanied by pictures and videos to make it easier for students to understand the concept of biological technology innovation material. The e-booklet developed also presents additional material in the form of techniques for making nata de pina to improve students' process skills. Making nata de pina was chosen as an experimental innovation because of the problem of pineapple peel waste which has not been managed properly and has the potential to cause new problems for the environment. According to Atmojo as quoted by (Handayani & Sutanto, 2016) This pineapple waste is rich in water content of ± 87%, carbohydrates of 10.54%, crude fiber of 1.70%, protein of 0.70%, ash of 0.50%, and fat of 0.02%.

In making nata de pina there are factors that play an important role in the successful production process, one of which is the presence of a nitrogen source. The nitrogen source commonly used in the nata making process is an inorganic nitrogen source such as ZA (ammonium sulfate) which is quite dangerous if consumed and has the potential for metal contamination so the use of ZA is limited (A. I. Fitri et al., 2022). Therefore, it is necessary to have an organic nitrogen source that is safe for consumption as a substitute for inorganic nitrogen sources. Sprouts were chosen as an alternative ingredient to replace ZA (ammonium sulfate) which is beneficial for body health and contains good nutrients and protein ranging from 20.5-21% so it is suitable for the growth of Acetobacter xylinum bacteria (Arifiani et al., 2015). The addition of sprout extract to the nata making process had an influence on the thickness, smell, color, nutrition and texture of the nata.

The presentation of learning resources for nata de pina making techniques in the form of e-booklets is considered practical and easier for students to understand because the material is presented in a more concise form compared to textbooks which have too broad a scope. According to (Nursamsu et al., 2023), With e-booklets, the teaching and learning process becomes easier, teachers can send e-booklets to students which can be accessed online via devices or laptops. E-booklets also use more communicative language and are equipped with supporting images and interesting

videos to make it easier for students to understand the information and provide a more real impression of learning (Amanullah, 2020). Apart from that, the e-booklet developed from research results is considered to have a more valid presentation of material content compared to the results of literature studies alone. Therefore, the development of an e-booklet on making nata de pina based on research is thought to be able to help students understand technological innovation material. This research aims to analyze the effect of sprout extract concentration on the quality of thickness and weight of nata de pina, as well as analyzing the validity, feasibility and readability of the nata de pina making e-booklet that was developed.

Method

The approach used in this research is Research and Development (R&D). This research is devoted to developing an e-booklet as a supplement to research-based learning resources that are relevant to biological technology innovation material in high school. The research design uses the ADDIE model. The analysis stage in developing the e-booklet consists of analyzing learning resource needs using a questionnaire and analyzing material needs by conducting experimental research on the effect of sprout extract on the quality, weight and thickness of nata de pina, which consists of 5 levels of sprout extract concentration, namely, K0 (0 mL/ L); K1 (25 mL/L); K2 (50 mL/L); K3 (75 mL/L); and K4 (100 mL/L). Design stage by designing an e-booklet using the Canva application and presenting it online using Publuu.com software. The development stage of the e-booklet product is based on the results of the design by carrying out validity tests by media experts and material experts, practicality tests by teachers and students of class X MIPA 2 and booklet by students.

The Implementation stage in this research was not carried out. The evaluation stage in this research is an interpretation of the results of validity, practicality and readability as a reference in improving e-booklet products. Data collection instruments used expert validation questionnaire sheets, teacher and student response sheets, and rumpag test question sheets for students. The data analysis technique for the effect of sprout extract on the quality of nata de pina was carried out using a one-way ANOVA test. Expert validation analysis with the following formula.

$$P = \frac{f}{N} X\ 100\% \quad (1)$$

Information:
P = Percentage of eligibility
F = Total score obtained
N = Number of criteria scores
The validity results obtained are interpreted into the assessment criteria as follows.

Table 1. Criteria for Validation of E-booklets by Experts

Percentage range (%)	Criteria
0 ≤ p ≤ 25	Very invalid
25 < p ≤ 50	Not valid
50 < p ≤ 75	Fairly valid
75 < p ≤ 100	Very valid

Analysis of teacher and student responses using the following formula.

$$P = \frac{f}{N} X\ 100\% \quad (2)$$

Information:
P = Percentage of responses
F = Total score obtained
N = Number of criteria scores

The response values obtained are interpreted into the assessment criteria as follows :

Table 2. Criteria for E-booklet Response Results by Teachers and Students

Percentage range (%)	Criteria
0 ≤ p ≤ 25	Not really worth it
25 < p ≤ 50	Not worth it
50 < p ≤ 75	Decent enough
75 < p ≤ 100	Very worthy

Analysis of e-booklet readability tests by students uses the following formula.

$$\text{Score} = \frac{\text{Number of correct answers}}{\text{Number of words removed}} X\ 100\% \quad (3)$$

The values obtained are interpreted into the following assessment criteria.

Table 3. Criteria for Overlapping Test Results by Students

Score (%)	Criteria
Test scores > 60	Tall
Skor tes 40 - 60	Currently
Skor tes < 40	Low

Result and Discussion

The results of the research presented in this chapter include four things, namely: The effect of the concentration of sprout extract on the quality of nata de pina, the results of the validation of the e-booklet on techniques for making nata de pina, the results of the practicality of the e-booklet on techniques for making

nata de pina, the results of the readability of the e-booklet on techniques making nata de pina.

Effect of Sprout Extract Concentration on the Quality of Nata de Pina

The results of research conducted regarding the effect of the concentration of green bean sprout extract on the quality, thickness and weight of nata de pina consisting of five treatments are as follows.

Table 4. Data on Nata de Pina Thickness Results

Treatment	Repetition Thickness (mm)					Average
	I	II	III	IV	V	
K0	2.50	2.20	2.10	2.10	2.00	2.18
K1	4.90	4.70	4.00	5.00	2.40	4.20
K2	7.00	5.90	4.40	7.90	7.40	6.52
K3	8.20	6.20	5.20	9.10	8.70	7.48
K4	8.90	7.50	7.80	11.30	10.30	9.16

Table 5. Results of one way ANOVA Test for Nata depina Thickness ANOVA mark

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	151.18	4	37.79	21.83	.000
Within Groups	34.61	20	1.73		
Total	185.79	24			

Table 6. Data on Nata de Pina Weight Results

Treatment	Test Weight (gr)					Average
	I	II	III	IV	V	
K0	225	235	203	205	204	214.40
K1	259	244	240	266	237	249.20
K2	285	257	254	291	284	274.20
K3	302	271	269	309	306	291.40
K4	305	288	289	343	331	311.20

Table 7. One-Way ANOVA Test Results for Nata de Pina Weight ANOVA of values

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	28393.04	4	7098.26	21.10	.000
Within Groups	6726.80	20	336.34		
Total	35119.84	24			

Based on the results of research that has been carried out, it shows that the administration of sprout extract with different concentrations has a significant influence on the quality, thickness and weight of nata de pina. This is in line with opinion (Mutmainnah & Renhoat, 2022) which states that adding sprout extract to the media as a nitrogen source can have a real influence on the characteristics of nata. Research conducted by (Akmal et al., 2020) also stated that the addition of green bean sprout extract as an alternative source of nitrogen had a significant effect on the thickness of nata de coco. Sprout extract has complex nutritional content so it can support the development of Acetobacter xylinum. The best results from the five green bean sprout extract concentration treatments that were tested were in treatment K4 with a green bean sprout extract concentration of 100 ml with an average thickness of nata de pina produced of 9.16 mm and an average weight of nata de pina. The result was 311.20 gr.

This can be interpreted as saying that the nitrogen requirement for the growth of Acetobacter xylinum bacteria is well met at a concentration of 100 ml of sprout extract for 500 ml of media. The existence of a nitrogen source is very necessary for Acetobacter xylinum bacteria in the cellulose biosynthesis process (Ghozali et al., 2021). Nitrogen sources play a role in protein synthesis and enzyme production by Acetobacter xylinum bacteria which are used to polymerase glucose into cellulose or fiber chains (Ningsih et al., 2021). If the availability of nitrogen in the media is appropriate, it will be able to stimulate optimal cellulose bond formation. On the other hand, if there is a lack of a nitrogen source in the media for making nata de pina, it can cause Acetobacter xylinum bacteria to experience nutritional deficiencies which can inhibit the formation of cellulose and produce nata that is thin and easily decays. Providing an appropriate nitrogen source will produce white nata, a hard and dense texture and increase the fiber content in nata. Nitrogen concentration to the fermentation media can have an influence on the formation of the number of polysaccharides, the more nitrogen sources provided, the greater the number of polysaccharides produced.

Validity of the Nata de Pina Making E-booklet

The validity of the e-booklet for making nata de pina consists of material expert validation and media expert validation which are presented in the following table.

Table 8. Material Expert Validation Results

Feasibility aspect	Percentage (%)
Fill	90.90
Presentation	90
Contextual assessment	88.57
Average percentage	89.82
Criteria	Very valid

Validation of the e-booklet material for making nata de pina that has been developed is carried out by material expert lecturers who aim to assess the suitability of the material concepts presented in the e-

booklet so that it can be declared valid for use. The results of the e-booklet assessment for making nata de pina which was carried out by material expert validators obtained a score of 89.82% in the very valid category. Assessment of material validation that has been carried out refers to three aspects, namely content suitability, presentation suitability and contextual assessment. The first assessment aspect, namely the suitability of the content, received a percentage score of 90.90% with a very valid category. This is because the material presented in the e-booklet is complete and refers to the learning outcomes of biological technology innovation material in the independent curriculum phase E, which includes understanding biology and process skills.

The suitability of the content of the material which refers to the students' learning achievement targets. Apart from that, in the e-booklet on making nata de pina, facts and data are presented that are in accordance with real conditions and interesting examples and illustrative images are provided according to the students' development. Library sources are used in presenting material in e-booklets within the last 10 years so that the material presented is up to date or up to date in accordance with current scientific developments. One of the criteria for up-to-dateness in textbooks is indicated by the use of libraries no more than the last 10 years. The second assessment aspect is the feasibility aspect of presentation which received a score of 90% in the very valid category. This is because the material presented in the e-booklet on making nata de pina is structured consistently and systematically starting from understanding biological technology innovation, conventional biotechnology and modern biotechnology, and the process of making nata de pina.

Through a systematic presentation of material, students can easily understand the concept of biological technology innovation material in a coherent manner from simple concepts to more complex concepts. This is in line with research conducted by (Rahayu & Mertha, 2017) explains that teaching materials that are systematically designed can have a big influence on the process of managing information and the development of a person's thinking, making it easier to capture information (Rahmatih et al., 2017) also said that a systematic and consistent presentation of material concepts makes it easier for students to understand the material. Apart from that, the presentation of the e-booklet on making nata de pina is interactive and participatory so that students can be directly involved with the learning resources or materials used (Khamidah et al., 2019) in his research, it was stated that the use of interactive teaching materials in the learning process can increase students' attractiveness and visualization can increase students' understanding of the material presented.

The third assessment aspect is contextual assessment which received a score of 88.82% in the very valid category. This is because the material presented in the nata de pina making e-booklet is linked to students' real-world situations in everyday life. Based on research conducted by (Coman et al., 2020), it is stated that a learning resource that is structured contextually by highlighting local problems and potential is considered suitable to be used as additional teaching material. Learning materials that are linked to real life conditions can create more meaningful learning. Students are able to build concepts and find connections between the knowledge gained in class and its application in real life. Designing contextual booklets based on environmental problems around students which are considered capable of providing real and applicable learning experiences. In their research also explains that the use of contextual teaching materials in the learning process requires students to construct knowledge in real life so that students understand what they learn by applying it to real conditions.

Table 9. Media Expert Validation Results

Feasibility aspect	Percentage (%)
Graphics	88.88
Language	98.18
Average percentage	93.53
Criteria	Very valid

Validation of the e-booklet media for making nata de pina was carried out by media expert lecturers who aimed to assess the appearance of the e-booklet media so that it could be declared valid for use. The results of the e-booklet assessment for making nata de pina carried out by media expert validators obtained a score of 93.53% in the very valid category. The assessment of material validation that has been carried out refers to two aspects, namely graphic suitability and linguistic suitability. The first assessment aspect is graphic feasibility which received a score of 88.88% in the very valid category. This is because the nata de pina making e-booklet that has been developed has an appropriate size, namely A4, an attractive cover design and content layout design. Choosing harmonious colors, letters and layout can increase attractiveness for students. The quality of the images and illustrations presented in the nata de pina making e-booklet can be observed well and clearly.

In the nata de pina making stage, the images presented are images resulting from personal documentation of research results. This aims to represent the explanation that will be conveyed to students. The presentation of these images can make it

easier for students to understand the meaning of the explanation. This is in line with the opinion expressed by (Bus et al., 2015) stated that the use of images in e-booklets is used to clarify the information that will be conveyed to students. The presentation of images or illustrations in e-booklets is also able to increase students' attractiveness, the presentation of images in a learning medium is able to increase interest in reading because it helps students to imagine so that they can strengthen their memory. The second assessment aspect, namely linguistic appropriateness, received a very valid category with a score of 98.18%. This is because the material in the nata de pina making e-booklet is described in communicative and easy to understand language. Apart from that, accuracy in the choice of language, sentence structure, and style of conveying information that is appropriate to the intellectual and emotional development of students means that conveying information in e-booklets can be easily accepted. That a learning resource is considered to meet grammatical competence if the information presented can be logically communicated to the reader so that it can be accepted according to the student's stage of cognitive development. Apart from that, Majid expressed a similar opinion in research (Marzuki et al., 2023) explains that the appropriateness of the language of a learning resource is categorized as good if the writing uses simple, easy to understand language and uses commonly used terms.

Feasibility of Making Nata de Pina E-booklet

The feasibility of the nata de pina making e-booklet was obtained based on the results of the teacher response test and student response test to the nata de pina making e-booklet which is presented in the following table.

Table 10. Recapitulation of Teacher Response Results

Assessment Indicators	Percentage (%)
Interest	100
Material	100
Language	86.66
Helpfulness	100
Average percentage	96.66
Criteria	Very worthy

The results of the biology teacher's response at SMA Negeri 1 Randudongkal to the nata de pina making e-booklet obtained a percentage score of 96.66% in the very appropriate category. The assessment of teacher responses to the data de pina e-booklet that has been developed refers to four aspects, namely: interest, material, language, and helpfulness. The first aspect, namely interest, received a score of 100% in the very worthy category. This is because the appearance of the e-booklet is designed to be very attractive and colorful so that it can increase students' enthusiasm in learning biological technology innovation material. As stated in research conducted by (Hanifah et al., 2020) explained that an attractive e-booklet design can arouse curiosity in students and make it easier to understand the material presented in the learning process. Research conducted (Amalia et al., 2020) also stated that the use of colors and illustrations in e-booklets can stimulate interest and enthusiasm for learning in students and provide high levels of understanding in students.

Apart from that, the presence of illustrations, pictures and videos makes learning less boring and can increase student motivation and is able to support students in mastering material concepts. The presentation of pictures and illustrations is more interesting and makes it easier for students to understand a concept or fact. The second aspect is that the material is in the very worthy category with a score of 100%. This is based on a complete and coherent presentation of material starting from an explanation regarding the definition of biological technology innovation, conventional biotechnology and modern biotechnology, and is complemented by making nata de pina. The material is also presented concisely so that it is easy for students to understand clearly.

As in research conducted by (Aprilia et al., 2023) believes that the concise and systematic presentation of e-booklets is effective in increasing students' knowledge. In addition, the material presented is contextual based on the results of conventional biotechnology research and several examples of biotechnology products that students can encounter in everyday life. According to the opinion of (E. A. Fitri et al., 2023) in his research stated that booklets that are contextual or based on everyday life are able to provide meaningful understanding and are able to provide students with real learning experiences (Wahyuni et al., 2023), in his research also stated that the contextual learning process was able to motivate students to link the knowledge they acquired in the classroom with its implementation in real life.

The third assessment aspect is in terms of language which received a score of 86.66% in the very decent category. This is because in general the language used is clear and easy to understand. Based on the opinion expressed by the biology teacher, there are words that are quite foreign when read by students, for example the words "surrogate mother". It would be better if an additional word was given as "surrogate mother" so that it is easier for students to understand and does not cause misinterpretation. The presentation of data and facts in e-booklets is packaged in simple language so that the material to be presented can be easily accepted by

students. Apart from that, in research conducted by (Fu'aida et al., 2024) also explained that the use of words that are in accordance with writing rules, communicative language and appropriate to the cognitive level of students, can easily convey the content of the material well to students.

The fourth aspect is related to assistance which received a score of 100% in the very appropriate category. This e-booklet on making nata de pina is considered to be able to help students understand the material. Apart from that, this e-booklet is also practical to use and easy to carry anywhere and anytime without requiring expensive costs. Media in electronic or digital form is considered more practical to use, because it is easier to carry and can be accessed via gadgets, does not become obsolete easily, and is easier to distribute. This was also explained in research conducted by (Susilo & Dewi, 2023) that electronic e-booklets can be practically and easily used by students anywhere and at any time. Teachers also feel that this e-booklet is helpful in delivering the material and teachers want this e-booklet to be used in the process of learning biological technology innovation material.

Table 11. Recapitulation of Student Response Results

Question	Score	Persentage (%)	Criteria
The appearance of this e-booklet is attractive	303	90.44	Very worthy
This e-booklet makes students more enthusiastic about studying biology	291	86.86	Very worthy
The existence of this e-booklet makes studying biology not boring	296	88.35	Very worthy
This e-booklet supports students to master biological technology innovation material	294	87.76	Very worthy
The existence of illustrations can provide motivation to study the material	380	91.94	Very worthy
The material presented is complete	304	90.74	Very worthy
The delivery of material in the e-booklet is related to everyday life	290	86.56	Very worthy
The material is presented coherently, systematically and consistently	303	90.44	Very worthy
The material presented in this e-booklet is easy to understand	298	88.95	Very worthy
The sentences and paragraphs used in the e-booklet are clear and easy to understand	301	89.85	Very worthy
The language used is simple and easy to understand	306	91.34	Very worthy
The letters used are simple and easy to read	305	91.04	Very worthy
This e-Booklet helps students understand the material	298	88.95	Very worthy
This e-Booklet is practical, easy to use, easy to carry, and doesn't have to be expensive	308	91.94	Very worthy
Students feel helped and have the desire to use e-booklets	294	87.76	Very worthy
Average percentage			
Criteria	89.52		Very worthy

The results of the responses of students from SMA Negeri 1 Randudongkal to the e-booklet on making nata de pina obtained a percentage score of 89.52% in the very decent category. This is because the nata de pina making e-booklet has been developed in accordance with what students expect and is suitable for use as a learning resource in the process of learning biological technology innovation material. Students as e-booklet users need to be involved in providing responses to the nata de pina making e-booklet that has been developed. As explained in research conducted by (Hamzah & Mentari, 2017) stated that apart from the feasibility level test carried out by expert validators, students also need to carry out feasibility tests regarding the learning tools that have been developed, reviewed from the user aspect. This student response questionnaire contains 15 questions, the first highest score with a total of 91.94% which is classified as very appropriate is in question number 5 regarding the use of illustrations in the nata de pina making e-booklet which is able to increase students' motivation in studying the material.

Students think that the use of illustrations is considered more interesting compared to full text reading material. This is in line with research conducted by (Rahmanida & Hidayatullah, 2023) e-booklets will be more interesting if they present lots of diverse visual

illustrations (Okiningrum & Handayani, 2023). In his research, he also argued that presenting illustrations in teaching media will attract students' interest in studying the material well. A score percentage of 91.94% was also obtained in question number 14 regarding the use of e-booklets which are practical, easy to access and carry without expensive costs. Students think that presenting teaching materials in digital or electronic form makes it easier to use, students just need to open the gadget without having to carry books with a fairly heavy mass. This is in line with research carried out by (Kristina et al., 2023) said that teaching materials in digital form are considered more practical to use and can be carried easily anywhere and allow students to learn independently.

Obtaining the second highest score with a total of 91.34% related to the use of language that is as simple and easy to understand in question number 11 received a very decent category. The third largest percentage in terms of the use of simple and easy to read letters in item number 12 received a score of 91.04% in the very decent category. Students think that the choice of language and letters presented in the e-booklet is easy to read and understand well, the language used is not complicated and the meaning is easy to grasp. According to (Paramita et al., 2019) explained that when developing booklet media it is necessary to pay attention to the choice of good and appropriate language to make it easier to convey the contents of the media well and clearly (Sarip et al., 2022) In his research, he also emphasized that the implication of e-booklets in the learning process is that it makes it easier for students to read and understand the content of the material. Therefore, e-booklets must be presented using letters that are easy to read and use language that is easy for students to understand.

The fourth highest score was obtained for item number 6, namely 90.74% with a very decent category on questions related to completeness of the material. Students are of the opinion that the material presented in the e-booklet is also complete and arranged systematically which includes: the cocept of biological technology innovation; conventional biotechnology and modern biotechnology; the process of making nata de pina. (Cahyani & Jati, 2023) in his research, he explained that teaching materials must have characteristics that include material content in accordance with learning outcomes that are arranged in a coherent and varied manner and contain complete and in-depth information according to students' needs.

The fifth highest score in items number 1 and 8 is related to the attractive appearance of the e-booklet and systematic presentation with a score of 90.44% in the very decent category. Students think that the color combination presented in the nata de pina making e-booklet is very interesting and realistic and the pages can be turned like using a book. According to (Suryanda et al., 2019) said that when developing learning resource supplements you must pay attention to color structures, images and attractive layouts. (Darling-Hammond et al., 2020) also said that the development of teaching supplements must be structured in a coherent manner to make it easier for students to understand the material as a whole, so that the role of teaching supplements in supporting the learning process can be achieved optimally.

The sixth highest score was 89.85% in the very appropriate category in item number 10 regarding the preparation of sentences and paragraphs that are easy to understand. Item number 13 has the seventh highest score of 88.95% regarding the ease of students understanding the material in the e-booklet. Students think that composing simple and communicative sentences makes it easier for students to understand the material presented in the e-booklet. Developing learning media you should pay attention to sentence structure so that the content of the media can be conveyed well and clearly to students. (Fitriani et al., 2023) in his research also emphasized that it is necessary to pay attention to the structure of sentences and paragraphs in developing teaching supplements, the sentences used are simple and the number of sentences in a paragraph is not too long with the aim of making it easy for students to understand.

The eighth highest score was 88.35% on question number 3. Students thought that the e-booklet made studying biology less boring because it was packaged in an interesting form. The ninth highest score was for items number 4 and 15. Students felt helped by the use of e-booklets and support in mastering biological technology innovation material with a score of 87.76% in the very appropriate category. Students through the use of e-booklets also feel more enthusiastic about studying biology as in point number 2 as the tenth highest with a score of 86.86% in the very decent category.

The nata de pina making e-booklet is prepared with an attractive design, varied, complete and systematic presentation of the material, as well as the presentation of illustrations in the form of pictures and videos can help students master the biological technology innovation material well. The learning process becomes more enjoyable so that it does not cause boredom in students and is able to increase students' enthusiasm in carrying out the learning process. Apart from that, the material presented in the e-booklet is also related to everyday life, as in question number 7, the score was 86.56% in the very decent category. This facilitates students in providing real learning experiences so that

students are able to connect knowledge acquired through daily life in the surrounding environment.

Readability of the Nata de Pina Making E-booklet

The readability of the nata de pina making e-booklet was obtained from the results of cross-sectional tests carried out by students and is presented in the following table.

Table 12. Overlapping Test Results

Average Percentage (%)		Number of Values	Percentage %	Criteria
	Correct	Wrong		
Average	65.92	1.08	98.38	Tall
Percentage	98.38	1.61	98.38	

The results of the cross-sectional test carried out by students to measure the readability level of the e-booklet that had been developed obtained an average correct answer score of 98.38% and an average incorrect answer of 1.61%. According to (Dwivedi et al., 2023) a cross-sectional test carried out to determine the readability level of a developed teaching material is very necessary, this is considered to be able to help researchers identify parts that need to be improved and clarify information in the teaching material. The overall average percentage result of the gap test with a score of 98.38% is in the high category, meaning that the nata de pina making e-booklet that has been developed can be read well by students. The results of the cross-sectional tests that have been carried out mean that students answered incorrectly on foreign terms such as: Rhizopus oryzae, Somatic cell nuclear transfer, and Acetobacter xylinum. Students experience difficulty in reading these foreign terms which causes students to answer questions incorrectly in the gap tests that have been carried out. This is in line with research conducted by (Nurhasikin et al., 2019) that foreign terms for students who are not used to reading foreign terms can cause difficulties in understanding the information.

Conclusion

Based on the results and discussion of research on the development of an e-booklet for making nata de pina that has been carried out, it can be concluded that the administration of sprout extract in the process of making nata de pina has a significant influence on the quality, weight and thickness of nata de pina. The best results from the five sprout extract concentration treatments that were tested were in treatment K4 with a sprout extract concentration of 100 ml for 500 ml of media. The nata de pina e-booklet was considered very valid with a material validation score of 90.90% and a media expert validation score of 93.53%. The nata de pina e-booklet was declared very feasible with a teacher response score of 96.66% and a student response of 89.52%. And the results of the e-booklet readability test were considered high with a gap test score of 98.38%.

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Author Contributions

Conceptualization, H. U.; methodology, H. U and E. S. R; software, H. U; validation, E. S. R; formal analysis, H. U; investigation, H. U; resources, H. U; data curation, H. U; writing—original draft preparation, H. U.; writing—review and editing, H. U and E. S. R; visualization, H. U; supervision, H. U and E. S. R; project administration, H. U and E. S. R; funding acquisition, H. U and E. S. R. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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