



## Empowering minds: An e-book blending contextual teaching learning with plant tissue exploration to boost argumentation and cognitive skills

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ARTICLE INFO	ABSTRACT
<p><b>Article history</b> Received: 03 February 2024 Revised: 28 September 2024 Accepted: 03 October 2024</p> <p><b>Keywords:</b> Argumentation Skills Cognitive Contextual Teaching and Learning (CTL) E-Books Teaching Materials</p>	<p>This research was motivated by obstacles in implementing biology learning which resulted in the lack of training in argumentation skills and low cognitive learning outcomes. The current teaching materials does not yet support these skills optimally. The aim of this research is to develop an e-book blending contextual teaching learning that is feasible, practical and effective to boost high school student's argumentation and cognitive skills. A research and development method was used using the ADDIE (Analyze, Design, Development, Implementation, Evaluation) development model. The subjects of this research were 34 high school students in Sleman, Yogyakarta in limited trials and 62 students in field trials. The type of research used in the field test was quasi-experimental with a pretest-post-test control group design. Class XI MIPA 1 was used as the control class and class XII MIPA 2 as the experimental class. Data collection instruments used included product assessment questionnaires by experts, biology teachers and students, argumentation skills and cognitive learning outcomes test instruments. Data analysis used the paired sample t-test, independent sample t-test and n-gain score test. The research results show that e-books is suitable for use in learning according to material experts and media experts, e-books is practical for use in learning according to teacher and student assessments, and e-books is effective for improving students' argumentation skills and learning outcomes. The conclusion in this research is that e-books blending contextual teaching and learning are feasible, practical and effective to use to boost students' argumentation and cognitive skills.</p>

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## INTRODUCTION

The increasingly rapid development of technology in the era of globalization also influences the learning strategies used by educators during the learning process. Based on this, it is a big challenge for educators to utilize technology in the learning process to prepare students who have certain knowledge and skills. However, in reality, the use of technology to develop teaching materials is still not used optimally, especially in biology lessons. Most teachers have not used technology as a learning medium (Fitriyanti et al., 2021) (Budiarti et al., 2023).

Based on interviews with biology teacher at high school in Sleman, Yogyakarta, Indonesia on March 14, 2023 it was found that the current learning process does not use digital-based teaching materials, there are difficulties for students to understand bioprocess and tissue material, the questions used in daily tests only have 10% of the questions with HOTS type and some students have not met the minimum completeness criteria on material that they find difficult to understand. Based on this description, students' cognitive and 21<sup>st</sup>-century skills still need to be improved. This is in accordance with previous research that the problem in biology learning is that innovative learning strategies and methods have not been implemented, there is a mismatch in understanding the concepts and types of evaluation tests used by teachers and students have difficulty understanding biology material (Paraniti & Arjaya, 2021).

Apart from using interview results, researchers distributed a questionnaire on student needs at high school in Sleman. The results showed that as many as 46% of students stated that it was difficult to understand the structure and function of plant tissue. This difficulty is due to the material being extensive, but there is no use of strategies and interesting teaching materials to make it easier for students to understand the material. Based on research conducted by Natasya & Mellisa (2023) students have difficulty understanding the material on the structure and function of plant tissue. In this material, students experience misconceptions and do not understand the concept because the material on the structure and function of plant tissue is broad (Sundari et al, 2018). Based on this, the development of teaching materials in this study was carried out on the material on the structure and function of plant tissue.

As many as 97% of students like digital-based teaching materials that can be operated using smartphones. According to research by Alperi (2019), media that is appropriate for 21<sup>st</sup> century skills and liked by students is computer-based media. One type of digital-based teaching material is an e-book. With an electronic basis, books can be combined with pictures, video and audio which can increase students' interest in learning so that there will be an increase in cognitive learning outcomes. Apart from that, by using e-books, material that is usually memorized can become easier to understand because it is assisted by the use of other media.

Based on research conducted by Putra & Lisdiana (2017), by developing an interactive e-book on mutation material, valid teaching material results were obtained to increase students' understanding of concepts. Apart from making it easier for students to understand the material, e-books can be used anytime and anywhere so students can read and study them again. In addition, research by Patranita et al (2022) states that digital teaching material supplements are products that are practical for students to use in learning activities. Apart from that, the latest information presented in teaching materials makes invisible sensory material more concrete so that it can help students understand the material. In line with previous research, Suprpto et al (2019) stated that improving learning outcomes by using interactive e-books is quite effective. Animation-based interactive e-books have a positive influence, including students becoming more interested in learning, increasing independence and self-confidence, developing creativity and increasing motivation in solving problems. Research conducted by (Rosyidah & Rahayu, 2022) developing an e-book based on contextual teaching and learning on plant growth and development material produced valid teaching materials for improving creative thinking skills. In this study, the development of e-books was blending contextual teaching and learning with a focus on contextual-based material so that it can make it easier for students to understand the structure and function of plant tissue.

Based on the results of the student needs questionnaire and interviews with biology teachers conducted by researchers, the 21<sup>st</sup>-century skills that still need to be improved at high school in Sleman are argumentation skills. Difficulty in understanding the material makes students have difficulty in expressing their opinions. One of the factors that causes students to have low argumentation skills is students' understanding of the material (Hardini & Alberida, 2022). In addition, the learning process

has not been focused on measuring argumentation skills, teachers only observe the argumentation skills of several students during presentations without any follow-up. Research by Devi et al (2018) revealed that students' argumentation skills are included in the low level category, this is caused by several factors such as students' prior knowledge and opportunities to argue.

Argumentation skills are one of the important skills learned by students as a form of communication to express opinions through scientific arguments (Anita et al, 2019). Students' ability to argue shows students' understanding of a material or problem. According to Noroozi et al (2020) that argumentation skills are high-level skills that students need as preparation for the world of work. This skill also helps students to make decisions and solve problems.

One effort to improve students' argumentation skills is by using a contextual teaching and learning (CTL) approach. However, contextual-based learning has not been implemented optimally by teachers and the teaching materials used in schools still have little emphasis on contextual-based learning, so there is a need to develop teaching materials that present material contextually. CTL is an approach that links learning material with students' daily lives, making it easier for students to understand the material. Based on research conducted by Mayasari (2022), it is stated that the CTL approach has a significant effect on improving students' argumentative writing, in that students are able to express reasons, facts, or evidence for an opinion or problem-solving idea in written form. According to Zaini et al (2020), the CTL approach is related to the concept of constructivism. Learning is not just memorizing but constructing knowledge from experience and interaction. CTL helps students become more active during learning because the material is linked to student experiences.

Apart from being able to improve understanding of concepts and argumentation skills, the CTL approach can also be used to look at students' mathematical communication skills Arifin (2016), improve students' critical thinking skills Taofek & Agustini (2020), and improve other skills. Based on this, improving students' argumentation skills and cognitive learning outcomes can be done by developing e-books blending CTL. The general description of a blending CTL is an e-book that presents material related to the student's daily life or environment as an emphasis on the contextual concepts of the material. This e-book also facilitates CTL approach activities such as presenting scientific articles, assignments, observations and reflections.

This development hoped can help students understand the structure and function of plant tissues material through presenting that is interesting, systematic and contextually based. For this reason, is research aims to develop an e-book blending contextual teaching learning with plant tissue exploration that is feasible, practical and effective in boosting high school students' argumentation and cognitive skills.

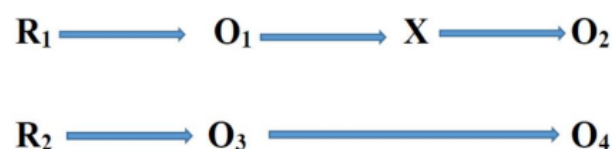
## METHODS

### Development Style

The type of research in this development is research and development by Borg and Gall (Gustiani, 2019). In this study, teaching materials were developed in the form of an e-book blending contextual teaching and learning (CTL) with plant tissue exploration. E-book development uses the ADDIE (Analyze, Design, Development, Implementation, Evaluation) model developed by Dick et al (2005).

### Product Trial Design

A limited trial of the e-book was carried out on biology teachers and students at high school in Sleman, Yogyakarta. Class XII MIPA 1 was used for test instrument trials and class XII MIPA 2 for e-book trials. Meanwhile, field trials were carried out in two XI classes, namely XI MIPA 1 as the control class and XI MIPA 2 as the experimental class. The research design used in testing e-books blending CTL is a pretest-post-test control group design. Figure 1 shows the pretest-post-test control group design.



**Figure 1.** Pre-test and Post-test Control Group Design (Akpalu et al., 2018).

Figure 1 shows the experimental group ( $R_1$ ), control group ( $R_2$ ), pretest in the experimental group ( $O_1$ ), pretest in the control group ( $O_3$ ), learning using an e-book blending contextual teaching and learning ( $X$ ), post-test in the experimental group ( $O_2$ ), and post-test in the control group ( $O_4$ ) (Sugiono, 2018)

### Instrument

The instruments in this research include questionnaires, observation sheets, interview sheets and test instruments in the form of choice questions and descriptions to measure students' argumentation and cognitive skills. The test instrument has gone through a validation stage by experts and limited testing on students before being used in field trials. The results of the validation of the choice question instrument are presented in Table 1, the validity of the descriptive question instrument is presented in Table 2 and the results of the reliability of the question instrument are presented in Table 3.

**Table 1.**  
Validity of Choice Question Instruments

Item	Correlation	Result
Question 1	Pearson Correlation	0,469**
	Sig. (2-tailed)	0,005
	N	34
Question 5	Pearson Correlation	0,666**
	Sig. (2-tailed)	0,000
	N	34
Question 12	Pearson Correlation	0,547**
	Sig. (2-tailed)	0,001
	N	34
Question 13	Pearson Correlation	0,547**
	Sig. (2-tailed)	0,001
	N	34
Question 16	Pearson Correlation	0,513**
	Sig. (2-tailed)	0,002
	N	34

Based on Table 1, it can be seen that out of 18 choice questions, only 5 questions are valid. Questions are said to be valid if the sig value is  $<0.05$ . These results represent the material on the structure and function of plant tissue, including plant organs, plant tissue and tissue culture.

**Table 2.**  
Validity of Descriptive Question Instruments

Item	Correlation	Result
Question 1	Pearson Correlation	0,407*
	Sig. (2-tailed)	0,017
	N	34
Question 4	Pearson Correlation	0,501*
	Sig. (2-tailed)	0,003
	N	34
Question 6	Pearson Correlation	0,524**
	Sig. (2-tailed)	0,001
	N	34
Question 7	Pearson Correlation	0,584**
	Sig. (2-tailed)	0,000
	N	34
Question 8	Pearson Correlation	0,728**
	Sig. (2-tailed)	0,000
	N	34
Question 9	Pearson Correlation	0,770**
	Sig. (2-tailed)	0,000
	N	34
Question 10	Pearson Correlation	0,691**
	Sig. (2-tailed)	0,000
	N	34

Based on [Table 2](#), out of 10 questions, there are 7 valid descriptive questions. This can be seen in the significance section, that the question is said to be valid if the sig value is  $<0.05$ . These results represent the material on the structure and function of plant tissue, including plant tissue, tissue culture, differences in the anatomy of dicotyledonous and monocotyledonous plants, and modification of plant organs.

**Table 3.**  
Reliability of Test Instruments

	Cronbach's Alpha	Information
Choice Question	0,646	Reliable
Descriptive Question	0,744	Reliable

Based on [Table 3](#), the choice questions obtained a Cronbach's alpha value of  $0.646 > 0.6$ , so it can be concluded that the multiple-choice questions are reliable. While in the essay questions, Cronbach's alpha value was obtained at  $0.774 > 0.6$ , so it can be concluded that the essay questions are reliable.

### Data Analysis Technique

The data analysis technique used is qualitative data analysis and quantitative data. Qualitative data analysis was obtained based on suggestions and input from material experts, media experts, teachers and students. Quantitative analysis was carried out using SPSS version 26.0 software which included preliminary analysis, product development data analysis, prerequisite tests, analysis of improving argumentation skills and student cognitive learning outcomes.

Preliminary analysis uses tests of validity, reliability, distinguishing power and level of difficulty of the questions. Product development data analysis was carried out to determine the feasibility and practicality of an e-book blending CTL. The product assessment questionnaire used a Likert scale, the results of which were then categorized according to the validation score assessment criteria referring to the criteria by Riduwan (2015).

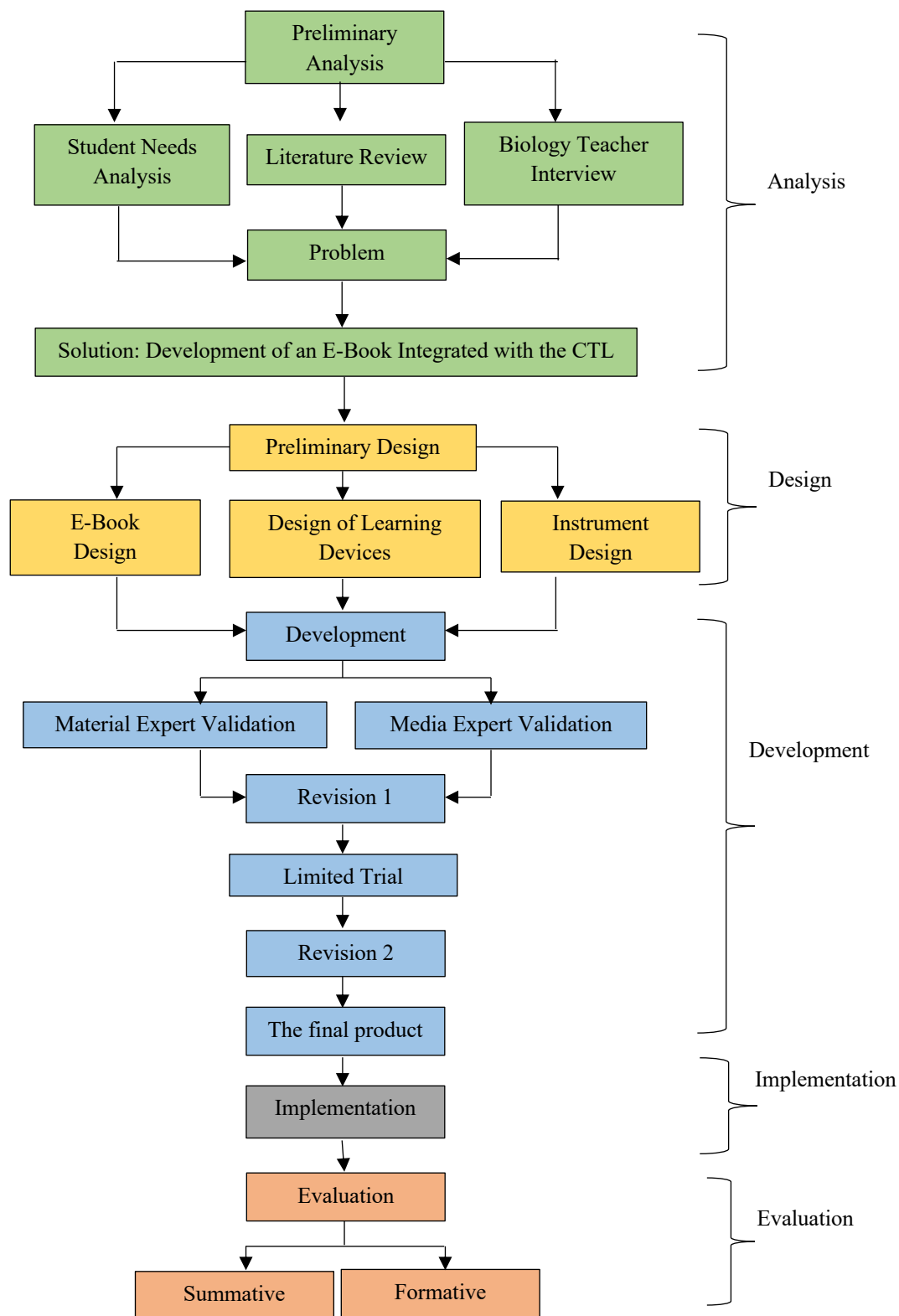
The prerequisite tests used are normality and homogeneity tests, while the analysis of improving argumentation skills and cognitive learning outcomes uses the paired sample t-test, independent sample t-test and n-gain score test. The interpretation category of n-gain effectiveness refers to the category by Hake (1998).

### Development Procedure

There are three problem formulations in the development that were carried out, namely knowing the feasibility, practicality and effectiveness of e-books blending contextual teaching and learning to boost students' argumentation and cognitive skills. The feasibility of e-books is seen from the results of expert validation, the practicality of e-books is seen from teacher and student assessments, and effectiveness is seen from implementation results. The detailed development procedure is presented in [Figure 2](#).

### Argumentation Skill Level

The argumentation model in this research refers to the Toulmin argumentation model which has elements of claim, datum, warrant, backing, qualifiers, and rebuttal (Haro et al., 2022) (Cankaya & Aydogan, 2022). However, for analysis of argumentation levels, it refers to previous research by (Riwayani et al., 2019) (Karlina & Alberida, 2021) which is presented in table 4.



**Figure 2.** Development Procedure



**Table 4.**  
Indicators of Argumentation Skills

No.	Criteria	Level
1.	Argumentation consists of arguments in the form of a simple claim with an opposing claim (counter claim) or in the form of a claim with a claim	1
2.	Argumentation consists of arguments in the form of a simple claim with an opposing claim (counter claim) accompanied by data, guarantees or backing but does not contain a rebuttal.	2
3.	Argumentation consists of arguments in the form of simple claims with opposing claims accompanied by data, guarantees or support with occasional weak rebuttals	3
4.	Argumentation consists of arguments in the form of claims with one rebuttal that can be identified clearly and precisely, one argument can contain several claims or counter claims	4
5.	Argumentation consists of broad arguments (extended, but still related to the subject matter) with more than one clear rebuttal	5

## RESULTS AND DISCUSSION

Based on research that has been carried out by developing an e-book blending contextual teaching and learning (CTL) with plant tissue exploration, it was found that the e-book is feasible, practical and effective for improving students' argumentation skills and cognitive learning outcomes. The blending E-Book with CTL approach emphasizes contextually based learning material. These activities are expressed in the form of scientific journals, assignments, observations and reflections.

### 1. Feasibility of an E-Book Integrated with the CTL Approach

The feasibility of an e-book blending CTL is obtained from the results of assessments by experts, presented in table 5 for media experts and in table 6 for material experts.

**Table 5.**  
Media Expert Validation Results

No.	Aspect	Percentage	Category
1.	E-Book Presentation	96%	Very Valid
2.	Software engineering	80%	Valid
3.	Ease and flexibility of access	100%	Very Valid
	<b>Mean</b>	<b>92%</b>	<b>Very Valid</b>

Based on [Table 5](#), the results of the validation of e-book blending CTL by media experts fall into the very valid category. These results show that e-books are suitable for use as teaching materials from the media assessment. The presentation aspect has a very valid category, these results show that the e-book has a systematic arrangement, is blended with the CTL, the illustrations used are representative, have an evaluation that is in accordance with the abilities studied and the layout quality is good. The software engineering aspect describes the operation of all e-book contents that is smooth, easy to access and in accordance with developments in science and technology. The final aspect, namely, ease and flexibility of access, illustrates that e-books can be used anytime and anywhere as long as there is an internet network, they can control student learning success and make learning more effective. So overall, based on expert validation, the blending e-book with the CTL is suitable for use to improve students' argumentation and cognitive skills. This is in accordance with research conducted by Putra (2023) that e-books that are suitable for use can be seen from the presentation of the e-book including the quality of images, videos and e-book layout.

**Table 6.**  
Material Expert Validation Results

No.	Aspect	Percentage	Category
1.	Appropriateness and accuracy of the material	90%	Very Valid
2.	Presentation of material	96%	Very Valid
3.	Suitability material and CTL components	90%	Very Valid
4.	Argumentation skills	100%	Very Valid
5.	Cognitive learning outcomes	90%	Very Valid
6.	Language	90%	Very Valid
	<b>Mean</b>	<b>93%</b>	<b>Very Valid</b>

Based on [Table 6](#), the results of the validation of e-book blending CTL by material experts are obtained in the very valid category. This shows that e-books blending with the CTL are suitable for use as material from a material aspect. The feasibility and accuracy aspects of the material illustrate that in the material presented there is integration between the material and CTL components, there is accuracy in providing examples and concepts of the material, suitability of the material with KI and KD, suitability for learning objectives and accuracy of the material so that it does not give rise to double meanings or misconceptions. The aspect of material presentation illustrates that the material in the e-book is arranged systematically, the quality of the concept maps and illustrations is good, the presentation of writing is appropriate, and the presentation of learning instructions is clear so that it is easy for students to understand.

The aspect of suitability of the material with the CTL component illustrates that there is relevance between the material and the CTL approach, namely that the presentation of the material can increase students' curiosity which is aroused through questions. Apart from that, students can find for themselves the knowledge they want to know through discovery activities, not by memorizing. The material presented also supports all components of the CTL approach, such as presenting examples taken from the surrounding environment, events that occur in daily life and relating the material to students' experiences. The feasibility of aspects of argumentation skills and students' cognitive learning outcomes illustrates that the material presented supports improving students' argumentation skills and cognitive learning outcomes. The language aspect illustrates that e-books have language that complies with writing rules, is clear and easy to understand. These results are in accordance with research by Pratanita (2022) that e-books that are suitable for use can be seen from the aspects of material, presentation and language. In addition, it can be seen from the suitability of the CTL components (Rosyidah, 2022).

## 2. Practicality of an E-Book Integrated with the CTL Approach

The practicality of the e-book blending CTL was obtained based on the results of assessments by teachers and students. Assessments by biology teachers are presented in [table 7](#), while assessments by students are presented in [table 8](#).

**Table 7.**

Assessment Results by Teachers

No.	Aspect	Percentage	Category
1.	Material aspect	90%	Very good
2.	Language aspect	80%	Good
3.	Media Aspect	89%	Very good
4.	Learning Aspects	80%	Good
<b>Mean</b>		<b>85%</b>	<b>Very Good</b>

Based on [result 7](#), it was found that the teacher's assessment was in the very good category. This shows that e-books blending CTL can be used as teaching materials during the learning process based on the biology teacher's assessment. These results are in accordance with Rosyidah (2022) that e-books have a very valid category based on validation by teachers, thus showing that e-books are practical to use.

**Table 8.**

Results of Student Responses to the E-Book Integrated with the CTL Approach

No.	Aspect	Percentage	Category
1.	Presentation of material	88%	Very good
2.	Ease of operation	91%	Very good
3.	Attractive appearance	87%	Very good
<b>Mean</b>		<b>87%</b>	<b>Very good</b>

Based on [Table 8](#), it shows that students' assessment of the e-book blending CTL approach is in the very good category. These results show that the e-book blending CTL has a systematic, attractive presentation and is easy to operate so that it can be used well by students. These results are in accordance with Suprpto (2019) that e-books received a positive response from students during field



tests.

### 3. Effectiveness of an E-Book Integrated with the CTL Approach Argumentation Skills

Argumentation skills are one of the high-level skills that students should master, so these skills must be trained during the learning process using appropriate strategies, one of which is using e-books blending CTL.

The emphasis on a contextual approach to the natural environment in the learning process makes learning activities livelier and more meaningful because students experience the events being studied themselves (Chotimah, 2018). The contextual approach not only helps students to understand material concepts through experience and relationships with the environment but can improve students' argumentation skills. Blending the CTL approach with e-books can help train students' argumentation skills. According to Sari et al (2019) their literature review, it was found that the use of e-books is very beneficial for students, e-books can improve students' 21<sup>st</sup>-century skills such as critical thinking skills, creativity, collaboration and communication. To determine the effectiveness of the blending CTL, a hypothesis test was carried out with the following stages:

#### 1) Descriptive Analysis

Descriptive analysis of the research data shows that there was an increase in the average argumentation skills in both control class and experimental class students as presented in Table 9.

**Table 9.**  
Descriptive Analysis of Argumentation Skills

Class	Data	Score Min.	Score Max.	Mean
Control	Pre-test	0.00	49.00	21.58
	Post-test	41.00	90.00	66.45
Experiment	Pre-test	0.00	38.00	20.61
	Post-test	49.00	98.00	77.00

Based on Table 9, it can be seen that the increase in argumentation skills was 44.87 in the control class and 56,39 in the experimental class. The difference in increase is 8.52, which shows that there is an influence of the use of different teaching materials. These results show that the experimental class has a higher average value of argumentation skills than the control class.

#### 2) Paired Sample t-test

The paired sample t-test was used to determine the increase in students' argumentation skills in both the control and experimental classes. Following are the results of the paired sample t-test which can be seen in Table 10.

**Table 10.**  
Results of the Paired Sample T-Test of Argumentation Skills

Class	Data	Mean	Test results (Sig. 2-tailed)	Information
Control	Pre-test	21.58	0.000 (P <0,05)	Significant
	Post-test	66.45		
Experiment	Pre-test	20.61	0.000 (P <0,05)	Significant
	Post-test	77.00		

Based on Table 10, the results obtained in both the control class and the experimental class show a significant difference between argumentation skills in the pretest and post-test data. This means that in both the control class and the experimental class, argumentation skills before and after learning experienced a significant increase on average.

#### 3) Independent Sample t-Test

Hypothesis testing was carried out using an independent sample t-test which aims to determine the effectiveness of the e-book blending CTL. The independent sample t-test aims to determine whether there is a difference in the average argumentation skills between the control class and the experimental

class. The results of the independent sample t-test can be seen in [table 11](#).

**Table 11.**  
Independent Sample T-Test Results of Argumentation Skills

	Data	Mean	Test results (Sig. 2-tailed)	Information
Post-test	Control	66.45	0.001 ( $P < 0,05$ )	Significant
	Experiment	77.00		

[Table 11](#) shows that the post-test scores for argumentation skills for the control class and the experimental class are significantly different. This shows that there is a significant difference in argumentation skills between the control class and the experimental class. These results mean that the use of e-books blending CTL is effective in improving students' argumentation skills.

These results show that by using the CTL approach students are able to express opinions and ideas to solve a problem found in accordance with research conducted by Mastiah et al (2020). The components in the CTL approach are able to train students' argumentation skills, such as constructivism in research conducted by Sari et al (2019) showing students' scientific argumentation skills increasing by using multi-representation-based contextual learning. This learning directs students to study material concepts directly or has a connection with real life, so that the knowledge students gain is more meaningful. Apart from that, the inquiry component enables students to discover their knowledge through various sources so that students' understanding becomes broader. In research conducted by Sandhy et al (2018), an inquiry model can improve students' argumentation skills.

In line with research conducted by Anugraheni et al (2018) those who stated that the CTL components that support claim argumentation elements are constructivism and inquiry, the constructivism component emphasizes understanding obtained from previous knowledge or experience. This knowledge is not obtained from remembering but from the process of discovery in the inquiry component. Apart from that, the reflection component helps students to organize the knowledge gained in each lesson, the questioning component helps students to explore their knowledge through questions, the modelling component helps students to form a good argument with the help of the teacher, the learning community component helps students to communicate with peers and gain additional knowledge from each friend through discussions.

Apart from using the CTL approach which can help improve students' argumentation skills, there is the main teaching material in this research, namely in the form of e-books. E-books have an influence on argumentation skills, in accordance with research by Bilqis et al (2023) which states that the use of interactive e-books can improve elementary school students' argumentative paragraph writing skills. The material in the e-book contains definitions, characteristics and examples of paragraphs. argumentation. Based on this research, it can be underlined that the e-book developed is tailored to the target skills students must achieve. Similarly, in this research, students' achievement of argumentation skills was carried out using e-books blending CTL.

#### 4) N-Gain Score

The n-gain score test was used to determine how effective the e-book blending CTL was in improving argumentation skills. The results of the N-gain score test are presented in [table 12](#).

**Table 12.**  
N-Gain Test Results for Argumentation Skill Scores

Class	Mean N-Gain Score	Score Min.	Score Max.	Category
Control	57.74	32.18	83.61	Effective enough
Experiment	71.27	45.16	96.92	Effective enough

Based on the n-gain percent score above, it shows that the average n-gain score for the experimental class is 71.27 and 57.74 for the control class, both of which are in the quite effective category. So, it can be concluded that both e-books blending CTL and scientific approaches with media in the form of power points are quite effective in improving students' argumentation skills. However, it can be seen that in the n-gain control class the resulting score is close to the less effective category, while the n-gain score in the experimental class is close to the effective category.

The overall test results above show that the e-book blending CTL is effectively used to boost students' argumentation skills as seen from the independent sample t-test that has been carried out. E-books have complete and extensive material, the blending of e-books with a contextual approach makes the presentation of material linked to the daily environment so that it is easier to understand. In addition, the components in CTL support the training of students' argumentation skills.

In addition to increasing the average argumentation skills, this research analyzed the achievement of argumentation elements and argumentation levels in both the control and experimental classes which were analyzed through students' post-test answers.

### 1) Achievement of Argumentation Elements

The observed argumentation skills have five elements, namely claim, data, warrant, backing and rebuttal. These five elements are analyzed through students' question answers. Below are presented the results of the analysis of elements of students' argumentation skills in [Table 13](#).

**Table 13.**  
Results of Element Analysis of Students' Argumentation Skills

Class	Percentage of Argumentation Skills				
	C	D	W	B	R
Control	83%	97%	21%	4%	2%
Experiment	91%	97%	45%	11%	4%

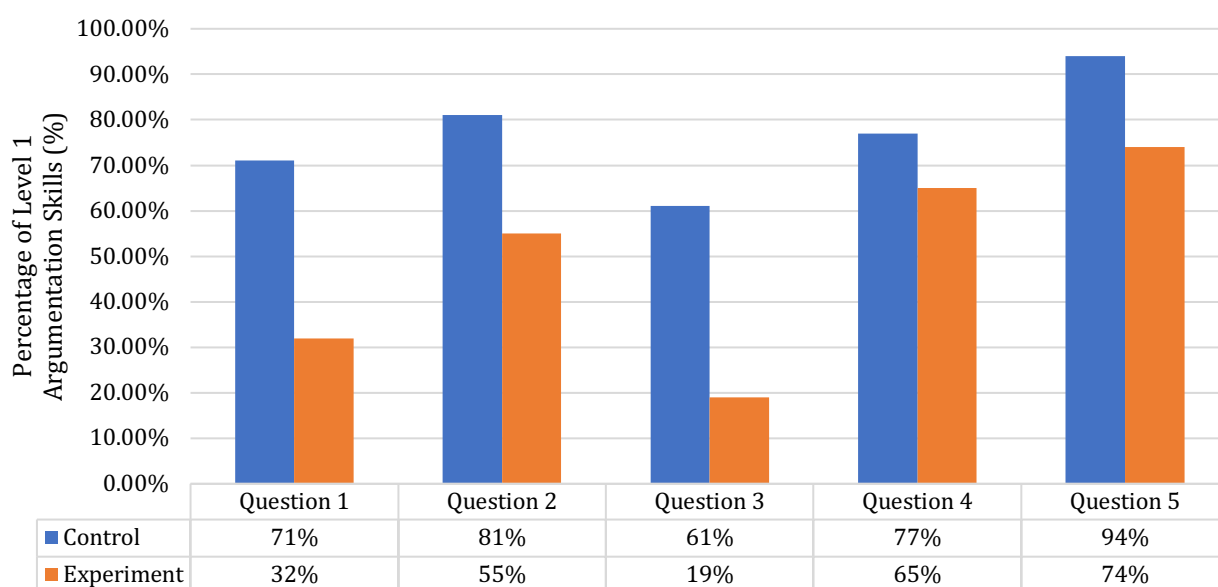
Information: C (Claim), D (Data), W (Warrant), B (Backing) dan R (Rebuttal)

[Table 13](#) shows that the experimental class has a higher percentage of each element of argumentation. These results support that the use of e-books blending CTL can train students' ability to express opinions. In line with research by Hasani (2016) which states that students who learn using the CTL approach have better argumentative writing skills than students who do not use the CTL approach. However, it should be emphasized that the backing and rebuttal sections in both the control and experimental classes have the lowest percentage compared to other elements. This is related to the level of argumentation skills possessed by students.

### 2) Achievement of Argumentation Skill Level

Toulmin argumentation skill levels have 5 level categories. The argumentation skill level describes the student's ability to write down the elements of argumentation skills. These elements include claim, data, warrant, backing, and rebuttal. The more complete the elements outlined by students in answering a question or problem, the higher the level of argumentation skills they have.

Based on the research results, it was found that students' argumentation levels in the control class and experimental class were achieved, ranging from levels 1 to 3, while levels 4 and 5 were not achieved. The achievement of students' argumentation level at level 1 can be seen in [Figure 3](#).



**Figure 3.** Percentage of Achievement of Argumentation Skills at Level 1

Figure 3 depicts level 1 argumentation skills possessed by students. Based on the graph above, it can be seen that the control class has a higher percentage of students with level 1 argumentation skills compared to the experimental class. Students with level 1 argumentation skills have the ability to express claims and data only without any other argumentative elements. Meanwhile, the achievement of level 2 argumentation skills can be seen in Figure 4.

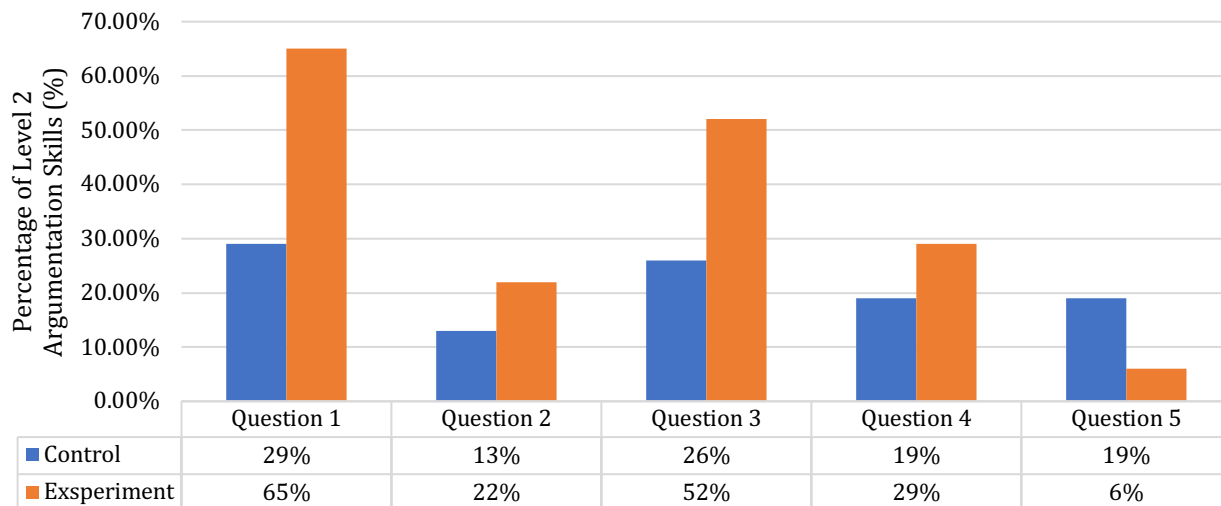


Figure 4. Percentage of Achievement of Argumentation Skills at Level 2

Based on Figure 4, it can be seen that the experimental class has students with higher level 2 argumentation skills than the control class. Students with level 2 argumentation skills are able to express claims, data and warrant/backing. Students who have achieved argumentation level 3 can be seen in Figure 5.

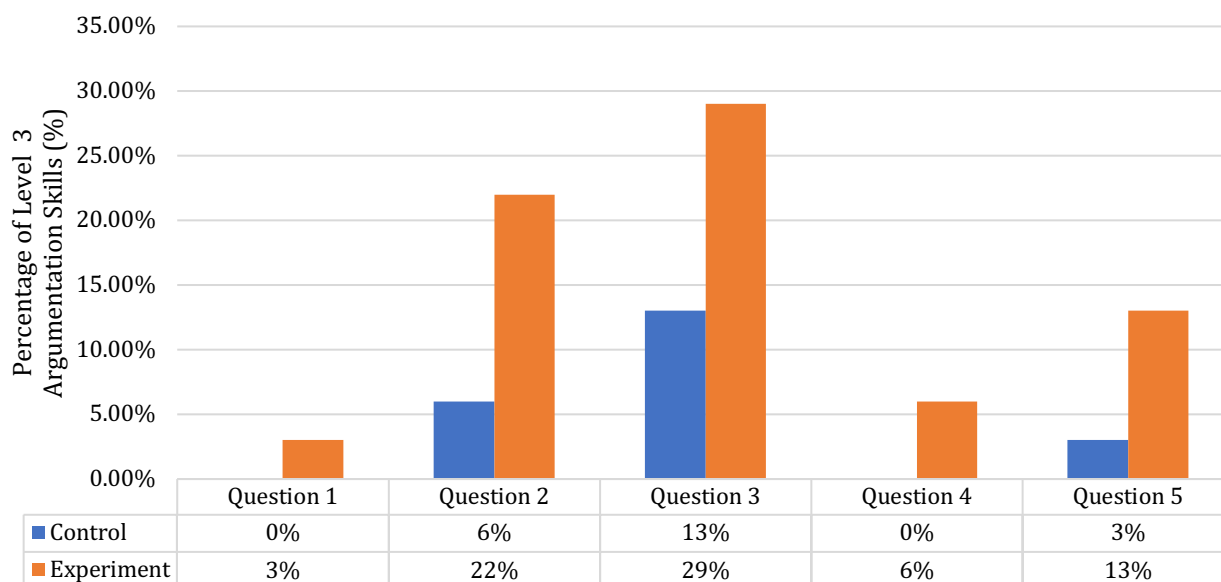


Figure 5. Percentage of Achievement of Level 3 Argumentation Skills

Based on Figure 5, it shows that at level 3 argumentation skills, the experimental class has students with these skills higher than the control class. Students who have level 3 argumentation skills can express claims and data. weak warrant/backing and rebuttal. The average students' argumentation skills are presented in Table 14.

**Table 14.**  
Average Level of Student Argumentation Skills

Class	Argumentation Skills		
	Level 1	Level 2	Level 3
Control	76,8%	17,4%	4,4%
Experiment	49%	34,8%	14,6%

Table 14 describes the average percentage of argumentation skill levels achieved by students. Based on the results of the analysis, students' argumentation skills in both the control class and the experimental class were at level 1 to level 3, while students did not reach levels 4 and 5. This is most likely due to students' focus only on the questions presented by the researcher, so that the answers contain very little rebuttal.

Based on these results, the highest argumentation skills are at level 1. However, in the control class, most of the students' argumentation skills are at level 1, while in the experimental class, some students have argumentation skills at level 1 and others are at levels 2 and 3. Analysis results This shows the influence of using e-books blending CTL. It can be seen from the results that the experimental class students have a higher average level of argumentation at levels 2 and 3 than the control class. These results are supported by research by Cetin (2014) which states that using argumentation-based teaching has an effect on students' understanding of concepts and argumentation structures. However, in their research, students with level 3 argumentation skills were able to express claims, data/warrants, backing or qualifications. Learning that supports argumentation skills in this research is the use of a contextual approach blending in e-books.

### Cognitive

Apart from being able to improve students' argumentation skills, e-books blending CTL are also used to make it easier for students to understand the material so that they can boost their cognitive learning outcomes. To determine the effectiveness of the e-book blending CTL, a hypothesis test was carried out with the following stages:

#### 1) Descriptive Analysis

The following is a descriptive analysis of the cognitive results of students in the control class and experimental class, presented in Table 15.

**Table 15.**  
Descriptive Analysis of Cognitive Results

Class	Data	Score Min.	Score Max.	Mean
Control	Pre-test	0.00	50.00	22.90
	Post-test	40.00	95.00	62.90
Experiment	Pre-test	10.00	55.00	28.06
	Post-test	50.00	95.00	75.16

Based on Table 15, it can be seen that the increase in cognition in the control class was 40.00 and in the experimental class it was 47.10. The difference in increasing cognitive is 7.1. These results show the influence of differences in teaching materials used in each class.

#### 2) Paired Sample t-test

The paired sample t-test was used to determine the increase in students' cognition. Following are the results of the paired sample t-test and are presented in Table 16.

**Table 16.**  
Paired Sample t-test Results for Cognitive Results

Class	Data	Mean	Test results (Sig. 2-tailed)	Information
Control	Pre-test	22.90	0.000 (P <0,05)	Significant
	Post-test	62.90		
Experiment	Pre-test	28.06	0.000 (P <0,05)	Significant
	Post-test	75.16		

Based on [Table 16](#), it can be concluded that both the control class and the experimental class had a significant increase in cognitive learning outcomes after the learning process. This result means that cognitive before and after learning are significantly different. To determine the effectiveness of the e-book blending CTL on cognitive, a hypothesis test was carried out.

### 3) Independent Sample T-Test

Hypothesis testing was carried out using an independent sample t-test which aims to determine whether there is a difference in the average cognitive of control and experimental class students. The results of the independent sample t-test are presented in [Table 17](#).

**Table 17.**  
Independent Sample T-Test Results of Cognitive Results

	Data	Mean	Test results (Sig. 2-tailed)	Information
Post-test	Control	62.90	0.000 (P <0,05)	Significant
	Experiment	75.16		

[Table 17](#) shows that the post-test scores for the experimental class and control class are significantly different. These results indicate that there is a difference in the average cognitive between control class and experimental class students. This means that e-books blending CTL are effectively used to improve students' cognitive. This result supported research Rahmayani et al (2021) which states that the use of e-books can improve student learning regulation which can then improve student learning outcomes. This is because e-books can be used anytime and anywhere so students can use them for independent learning. In accordance with the development of e-books blending CTL, in the learning process in class e-books are used as a student learning resource. However, these e-books can be accessed by students outside school hours so that students can use them for independent study. Apart from that (Siallagan et al., 2022) states that the application of e-books can increase student activity and learning outcomes. These results show that by using e-books students' activities become more active during the learning process, in accordance with the learning description experimental class students have a higher motivation to present the results of their discussions compared to the control class. This result is also supported by research Asrowi et al (2019) with the result that interactive e-books are effectively used to increase students' knowledge compared to printed textbooks.

### 4) N-Gain Score Test

The n-gain score test was used to find out how effective the e-book blending CTL, so an n-gain score test was carried out. The n-gain score test results can be seen in [Table 18](#).

**Table 18.**  
N-Gain Test Results Cognitive Outcome Scores

Class	Mean N-Gain Score	Score Min.	Score Max.	Category
Control	51.03	21.24	93.75	Less effective
Experiment	65.12	23.08	88.89	Effective enough

Based on the n-gain percent score above, it shows that the average n-gain score for the experimental class is 65,12, which is in the quite effective category and 51,03 for the control class, which is in the less effective category. Based on these results, it can be concluded that e-books blending CTL are more effective in improving students' cognitive. This means that e-books blending CTL can improve students' cognitive learning outcomes. This is because the material in the e-book is complete and extensive, the material is linked to the environment, there are individual and group assignments that can help students understand the concept of the material and there is blending with the CTL approach.

E-books help students to understand the concept of material in an organized and complete manner so that their understanding is more complex. Research by Nizatama et al (2019) states that students' mastery of concepts taught using e-books is better than students who are not taught using e-books. In line with research by Wijaya et al (2022) in their meta-analysis, it was found that e-books have a high influence on students' mathematics learning achievement, which shows that e-books can facilitate better mathematics learning than traditional printed books.



In addition, the e-book used in this research is blending with the CTL so that the learning process is more focused and systematic. The CTL approach can improve student learning outcomes in accordance with research (Hidayat, 2016) which shows that CTL-based learning can train students to discover their own knowledge and link material concepts to real life so that the information obtained lasts a long time and can improve student learning outcomes. These results are in accordance with research conducted by Harun (2021) which states that the use of contextual learning has a positive influence on improving student learning outcomes, Norra (2018) the contextual approach increases student motivation and learning outcomes, Telaumbanua et al (2022) the CTL approach is effectively used in biology learning, Neftyan et al (2018) the CTL approach can improve student learning outcomes, by gaining meaning in learning, student can obtain better learning outcomes.

## CONCLUSION

Based on the results of product development, it can be concluded that the e-book blending CTL is suitable for use in biology learning material on the structure and function of plant tissues based on assessments by material experts and media experts. E-Book blending with the practical CTL is used in biology learning based on assessments by biology teachers and students. The E-Book blending CTL is effectively used to boost students' argumentation and cognitive skills in terms of increasing the average argumentation skills test scores, level of argumentation skills and students' cognitive test scores.

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