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Development of PowerPoint-iSpring Learning Media on Green Chemistry and Global Warming Topics Phase E SMA/MA

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Abstract: PowerPoint-iSpring media supports the learning process where it can display images, videos, animations, text, and others that can increase student activity and learning outcomes. The aim of this research is to produce valid PowerPoint-iSpring learning media on green chemistry and global warming phase E SMA/MA. The type of research used is Educational Design Research with the Plomp model. The validity test was carried out by four chemistry lecturers at FMIPA UNP and two teachers at SMAN 14 Padang by filling out a validation questionnaire. One-to-one evaluation was carried out by three students with different levels of ability. Validation data was analyzed using the Aiken' V index. The results of the content validity test research obtained a value of 0.92 for green chemistry and global warming in the valid category. The construct validity test obtained a value of 0.93 in the valid category and the technical quality validity test obtained a value of 0.93 in the valid category. The average validity test result of PowerPoint-iSpring learning media on green chemistry and global warming is 0.92 in the valid category. The results of the one-to-one evaluation received a good response from students.

Keywords: Global Warming; Green Chemistry; Plomp Model; PowerPoint-iSpring; Validity

Introduction

The independent curriculum was developed as a more adaptive curriculum as part of a learning reform initiative that focuses on important materials and developing the character and skills of students (Kemendikbud, 2022). One of the important materials added to the independent curriculum in chemistry learning is green chemistry and global warming. Green chemistry is an approach to reducing the use of hazardous or toxic substances in chemical processes, including raw materials, reagents, solvents, products, and by-products (Anastas and Warner, 1998).People's lives depend on chemical industry products, oil processing and automotive. Industrial products produce the products we need, but produce waste or emissions that damage the environment and human health (Nakajima, 1991).

Global warming is an increase in the average temperature in the atmosphere, sea, and land on Earth as a result of the burning of fossil fuels and natural gas (Rusbiantoro, 2008). Tamara et al (2019) stated that the Indonesian government needs to study problems related to global warming because there are many natural phenomena that occur due to the impact of global warming (Nikmatin and Yushardi, 2022).

Green chemistry and global warming are very important for students to learn because they relate to protecting the environment. The green chemistry approach aims to eliminate the negative impacts of chemicals from the start of design. According to Anastas and Warner (1998), a combination of 12 chemical principles, if applied, can reduce the use of chemicals that are dangerous to human health and the environment. We can feel the impact of global warming clearly, such as increasing geothermal temperatures and unpredictable weather. Students need to

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understand the basic concepts of global warming material to understand what impacts are occurring and how to deal with them appropriately (Asfuriyah and Nuswowati, 2015).Considering the importance of green chemistry as an approach to preventionpollution due to chemicals that can damage the environment, then the concept of green chemistry needs to be taught in chemistry learning in schools, one of which is in the form of learning media (Nurbaity, 2011).

The results of initial data collection on student completeness carried out in class SMA Negeri 2 Padang had 50% -75% completeness of learning outcomes. When the teacher asked questions and answers, only a portion of the class answering questions, SMA Negeri 16 Padang was 25%-50% active in answering questions and SMA Negeri 2 Padang was 50%-75% active in answering questions.Textbooks alone are not enough to improve students' understanding of studying the material, so learning media is needed, that contains pictures, videos, animations, and sounds that can be operated by users and make it easy to use this media (Munir, 2012).

PowerPoint-iSpring can be a solution for studying abstract chemistry material because it can visualize abstract concepts, present the material in an interesting way, overcome space constraints, and provide opportunities for students to interact with learning material (Azhar et al., 2014). The combination of iSpring with PowerPoint will produce a more attractive and neat display of learning media (Jamilah, 2019).

The use of PowerPoint-iSpring in learning can improve critical thinking skills, and increase learning motivation (Kurnia, 2018). The PowerPoint-iSpring learning media can contain questions that guide students in discovering concepts. The questions asked can involve students more actively in the learning process (Neni, 2015) as well as explore students' memories to remember and relate previously acquired knowledge (Sulo et al., 1980). PowerPoint-iSpring can be used to access HTML 5. Hypertext Markup Language (HTML) 5 technology can be viewed via mobile devices anywhere and anytime (Chumairoh, 2015) such as laptops and cellphones so it is more practical (Sasahan et al, 2017).

Green chemistry and global warming is new material and not many learning media have been developed. Therefore, it is necessary to develop interesting and interactive learning media for students to study green chemistry and global warming. This idea was expressed in the form of research entitled "Development of PowerPoint-iSpring Learning Media in Green Chemistry and Global Warming Topics Phase E SMA/MA".

Method

Researchers use the Plomp development model. This model has 3 development stages, namely preliminary research or initial investigation (preliminary research), prototype formation stage (prototyping) and assessment phase (Plomp&Nieveen, 2013). The research was carried out through expert review and one-to-one evaluation tests, due to limited time and research personnel.

This needs analysis stage was carried out by giving questionnaires to chemistry teachers and students. Based on the results of initial data collection through questionnaires, it is known that teachers have used learning media in the form of printed books, modules, LKPD and PowerPoint in learning green chemistry and global warming. The PowerPoint used by teachers already contains images, animations and videos, however, there are still problems experienced by teachers in using PowerPoint. The availability of a projector, the teacher's difficulty in inserting videos, and less interesting animations were obstacles in this research.

Prototype formation is carried out through several formative evaluations which will produce the final product. The validity test was carried out by 4 chemistry lecturers at FMIPA UNP and 2 teachers at SMAN 14 Padang using a validation questionnaire. One-to-one evaluation was carried out by 3 students with different ability levels. Validity questionnaire assessments are made with sequential whole scale numbers, such as 1, 2, 3, 4, and 5 or 0, 1, 2, 3 (Aiken, 1985). This research uses value levels 1, 2, 3, 4, and 5 which can be seen in the following table 1.

Table 1. Validation Sheet Scores

Answer	STS	TS	N	S	SS
Score	1	2	3	4	5

Information:
STS = Strongly Disagree
TS = Disagree
N = Neutral
S = Agree
SS = Strongly Agree

The validity analysis technique uses Aiken's V Formula scale with the following formula:

$$V = \frac{\sum S}{\left(n(c-1)\right)} \quad (1)$$

$$S = r - lo \quad (2)$$

Information:
V= Average score
S = Value obtained from the validator number
N = Number of validators

lo = lowest validation assessment number
c = highest validation assessment number
r = number given by the validator

Result and Discussion

Result
Need and Context Analysis

In the preliminary stage, a needs and context analysis is carried out through a questionnaire to be given to teachers and students to find out the difficulties faced during the learning process. The results of the needs and context analysis obtained are, the teacher has used an independent curriculum using teaching materials in the form of printed books, modules, LKPD, and PowerPoint which already contain pictures, videos, and animations. However, there are obstacles experienced by teachers in using PowerPoint, such as limited projectors and difficulties in inserting videos. The learning media used has not made students active in learning and has not been able to make students discover concepts independently, especially in green chemistry and global warming. Students like PowerPoint as teaching material because it is interesting because of the images, videos, and animations. There is no learning media that can display videos, images, or animations, and is easily accessible to teachers and students.Based on the results of the analysis above, it becomes a referencefor researchers to develop PowerPoint-iSpring learning media on green chemistry and global warming phase E SMA/MA.

Literature Review

The literature study aims to explore the basic knowledge of research (Plomp and Nieveen, 2013). A literature review was used to find sources related to research into the development of PowerPoint-iSpring Learning Media on green chemistry and global warming.Research conducted by Nurhasanah shows that Ispring Suite-based e-module learning on global warming is suitable for improving the learning process (Nurhasanah et al., 2023). Similarly, the development of the Android Application for Green Chemical Materials in Sustainable Development 2030 for Class (Putri, 2022).

The use of integrated PowerPoint-iSpring learning media with prompting questions on electrolyte and non-electrolyte solution material in class X high school chemistry learning is considered valid and practical (Saputri dan Guspatni, 2021).Research conducted by Neni (2015) found that the questions given could increase student activity.Media useiSpring and PowerPointcan provide good results that have an impact on student learning outcomes and can make students more active in the learning process. This can be seen from cognitive, affective and psychomotor assessment data showing that all students are able to achieve completeness (Pooroeet al., 2020).

Theoretical Framework

The conceptual framework is in the form of important concepts from the research carried out based on the analysis that has been carried out. Based on the problem identification at the preliminary stage, a learning media is needed that can overcome the problems felt by teachers and students. Therefore, PowerPoint-iSpring learning media was developed which can be accessed via the web, making it easier for teachers to carry out learning and supporting students to learn independently. After the product is developed, validity testing can be carried out. The theoretical framework is given in Figure 1.

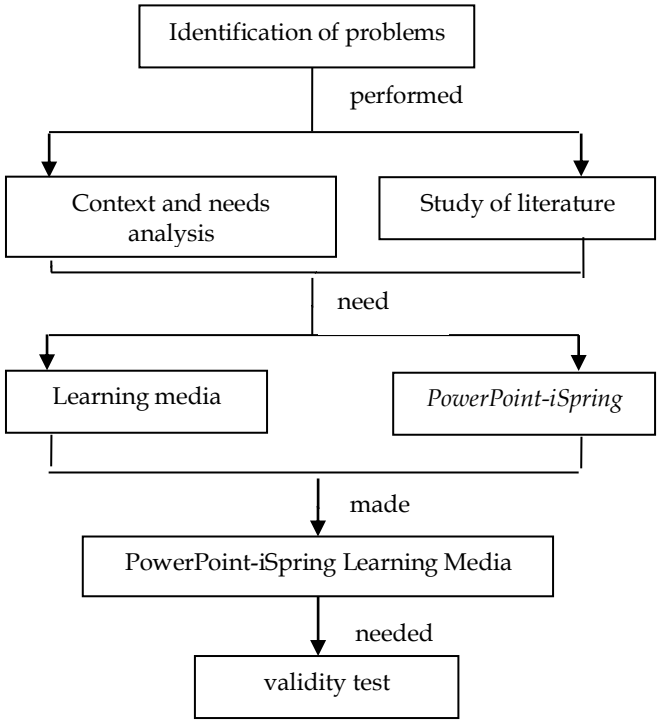


Figure 1. Theoretical framework

Prototyping Stage
Prototype 1

Prototype formation stage, Design in the prototype I determines the components of PowerPoint-iSpring media as the product to be designed. The design is based on the media that will be covered, developer profile, instructions for use, CP and TP, green chemistry material, and global warming material as well as a quiz to determine students' understanding. The design that has been made in flowchart form is called prototype I.Storyboard function to describe the design of the media and find out the storyline of the media that will be developed.

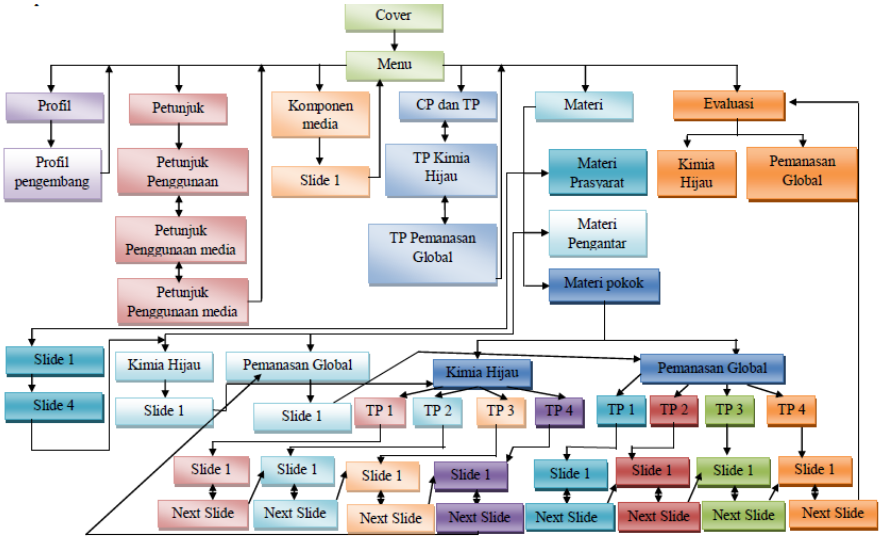
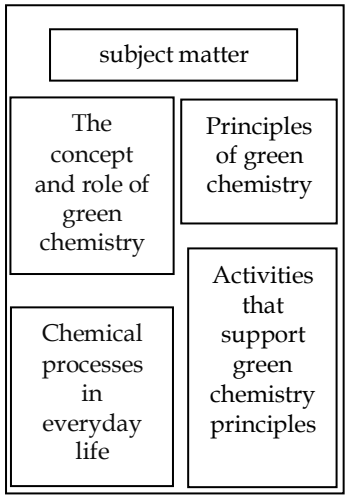
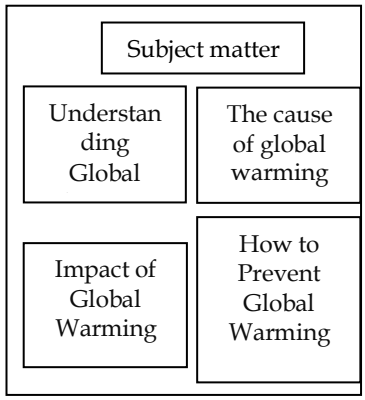
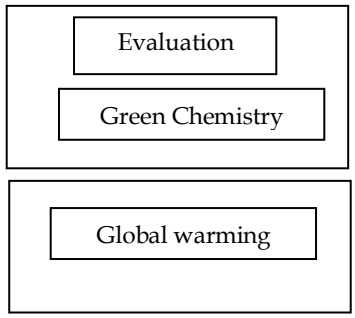


Figure 2. Flowchart

Table 2. Storyboard

Page	Design	Description
Cover	Title Creator name: Nim: Supervisor: FMIPA START UNP	Cover image with a background of events between global warming and green chemistry. Start button to start learning media.
Home	Title Profile CP and TP Instruction Material componen evaluation	On this page there are media components: 1. Profile 2. Instructions 3. Media components 4. CP & TP 5. Material 6. Evaluation
Material	Material Introduction Precondition subject matter	The material page consists of prerequisite material, introduction and main material. There is a home icon to return to the main page

Main material of green chemitry		The main material of green chemistry consists of 4 learning objectives, namely: 1. The concept and role of green chemistry 2. Principles of green chemistry 3. Chemical processes in everyday life 4. Activities that support green chemistry
Main material of global warming		The main material on global warming consists of 4 learning objectives, namely: 1. Understanding global warming 2. Causes of global warming 3. Impact of global warming 4. How to prevent global warming
Evaluation		The evaluation consists of 20 questions for each material. The types of questions given are different and random.

Prototype II

Prototype I that has been made is evaluated by oneself (self-evaluation) by checking the components that must be present in the PowerPoint-iSpring learning media, and if there are parts that are not complete, revisions are made to produce prototype II. The evaluation results of the PowerPoint-iSpring learning media components are declared complete based on the Kemendiknas(2010), namely title/identity, instructions for use, learning outcomes and learning objectives to be achieved, learning materials, learning steps and evaluation.

Prototype III

Product validity is seen based on content and construct validity. Content validity is the need for interventions and designs that are based on existing scientific knowledge. Construct validity is the suitability of components to the design of learning media (Plomp and Niveen, 2013). The results of the data analysis of the PowerPoint-iSpring learning media video validity test can be seen in Table 2. Based on Aiken's V formula, the closer the value is to 1, the better the level of validity (Aiken, 1985). The minimum limit is said to be valid based on the number of validators used in the research. The number of validators used in this research was six people with five selected

categories in the questionnaire, the valid value limit was 0.79 based on the Aiken coefficient table (1985).

Table 2. Validity Data Analysis Results

Validity Aspect	V	Category
Content validity of green chemistry	0.92	Valid
Content validity of global warming	0.92	Valid
Construct validity	0.93	Valid
Technical quality	0.93	Valid
Average	0.93	Valid

Testing the validity of the PowerPoint-iSpring learning media content on green chemistry and global warming obtained an average value of 0.92 in the valid category. The validity of valid content is determined by the quality of the content, the quality of learning, the quality of interactions, and the quality of the material display (Plomp&Nieveen, 2013). The PowerPoint-iSpring learning media developed is valid if it is in accordance with the assessment components. The TP presented in the PowerPoint-iSpring learning media is in accordance with the learning outcomes and the material presented is in accordance with the learning objectives. Descriptions of the material and questions contained in the media guide students in discovering concepts independently through the media used during the learning process.

The suggestions given by the validator become a reference in improving PowerPoint-iSpring learning media to produce higher-quality media. Some of the suggestions given for media components, namely adding connecting words between materials on the media cover and turning off unnecessary features, can be seen in Figure 2.

Figure 4. Media Cover Appearance Before Revision

Figure 5. Cover appearance after revision

The second suggestion from the validator is to turn off the next and previous buttons so that students access the material via hyperlinked images to go to the desired material.Students must be able to learn to analyzeapplication of green chemistry principles in the concept of Environmental Knowledge. Application of a number of chemical principles in designing the use or production of chemicals to reduce the use or production of hazardous materials that can harm the health of living creatures and preserve the environment (Nurbaity, 2011). each principle is explained by researchers with the aim of making students understand each principle better.

Figure 6. Display of Green Chemistry Principles material before revision

Figure 7. Appearance of Green Chemistry Principles Material After Revision

The third suggestion from the validator is to replace language that is simpler and can be understood by students in the answer choices given. In Figure 6 the language used was too difficult to understand so it was changed as in Figure 7.

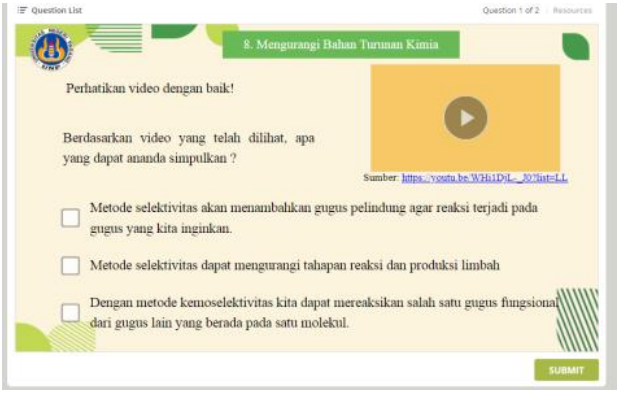


Figure 8. Use of unrevised language

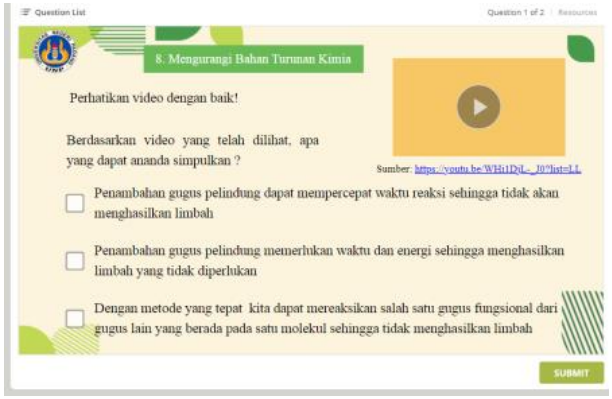


Figure 9. Use of revised language

The fourth suggestion is to replace images with videos. The information in the images provided is lacking so a video is needed which contains more information about the material to be presented.

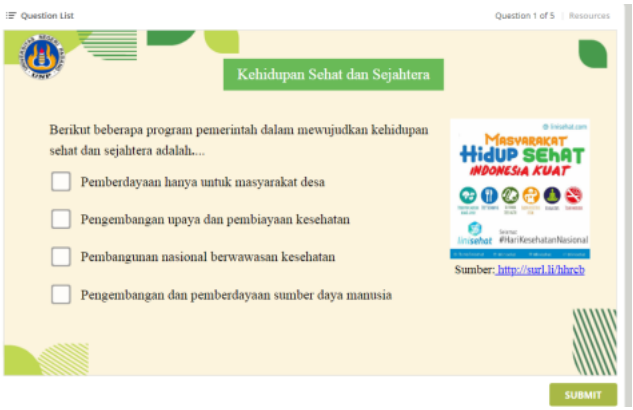


Figure 10. Material for a healthy and prosperous life agenda before revision

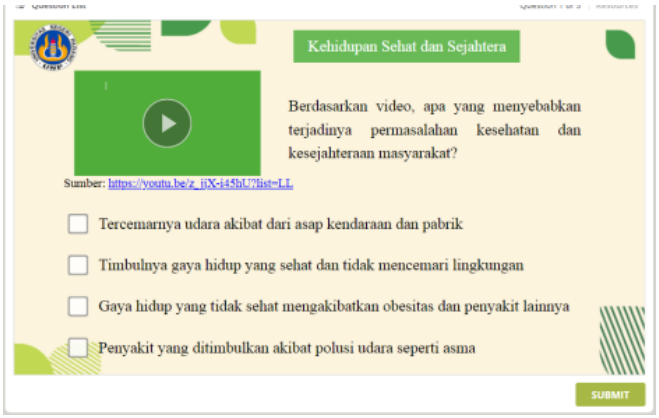


Figure 11. Material for a healthy and prosperous life agenda after revision

The fifth suggestion is to add a replacement solution for styrofoam that is more appropriate by green chemistry principles of designing chemical materials and products that are easily degraded after use. The previous solution was to bring your own food container, the right solution is to replace styrofoam with a more environmentally friendly and harmless material, namely areca nut fronds.

Figure 12. An inappropriate replacement solution for Styrofoam

Figure 13. Addition of solutions that are more in line with the principles

The suggestions given by the validator were revised to produce better learning media. The next stage is to carry out a one-to-one evaluation test on three students with different abilities. The research results were in accordance with the researchers' expectations that the media developed was good, but there were several revisions based on suggestions given by students. The media components can be used well by students, the language used can be understood by students, the use of color in the media and the fonts used do not interfere with the clarity of the learning material, and the images and videos contained in the media can be seen clearly and are easy to understand. Suggestions given by students to improve media suitability. First, some images cannot be enlarged. Secondly, it is best if the media can also be accessed via a device because not everyone has a laptop/computer at home.

Discussion

The development of learning media is seen based on school needs. The model used is Plomp with a prototype approach to produce quality products. The media characteristics of quality are seen as valid, practical, and effective (Plomp and Nieveen, 2013).Themedia was developed by designing storyboards and flowcharts which are useful for expressing researchers' thoughts and ideas in learning media so that they look attractive (Kunto et al, 2021).Mediadisplays are made as good as possible to meet visual design principles (Smaldino et al., 2012). This is in line with research conducted by Abi Hamid et al. (2020) which states that well-designed learning media will help students learn learning material because media is communication to convey messages and information.

PowerPoint learning media combined with the iSpring application can provide a new learning atmosphere for students to make it fun and increase curiosity about the learning material (Salfitri&Guspatni, 2021).

For students who are weak in learning, they can return to the material, quizzes, and evaluate until students understand the material on green chemistry and global warming because the PowerPoint-iSpring learning media can be used repeatedly. Apart from that, the advantage of the iSpring application is that it can check questions to reduce the situation when taking quizzes, is more efficient, and can find out the answer scores directly (Zakaria, 2017). Teachers can check students' answers via e-mail connected to iSpring, so they don't spend a lot of time checking students' quiz results. Teachers can group students according to their level of knowledge, from those who already understand the material and those who do not understand the material, to students who are remedial and need enrichment from the results of the quizzes they have taken.

The results of the prototype formation stage are in the form of valid PowerPoint-iSpring learning media on green chemistry and global warming phase E SMA/MA. PowerPoint-iSpring media is categorized as valid based on the function of the media which can attract students' attention and direct students' attention to learning related to the use of language, images, videos, design, font size, and color selection (Arsyad, 2010). The ease of using media for one component and another is consistent so that it is easy to use in the learning process (Andriani &Guspatni, 2022). The media display is made as good as possible so that visual design principles are still met (Smaldino et al., 2012).

The self-evaluation stage aims to determine the completeness of the media components that have been created, cover, home, strategy button, profile, instructions for use, learning outcomes and learning objectives, materials, and evaluation for students. In this research, improving the language used, and replacing videos with images that are more appropriate to green chemistry and global warming, has the potential to produce deeper learning and understanding (Mayer, 2009).

Prototype II was produced after the self-evaluation stage, this prototype was assessed by experts or expert review and evaluated individually or one to one evaluation. Validation based on content, construction, and technical quality through media assessment instruments that have been approved by the thesis supervisor. The data obtained in the validation questionnaire were analyzed using Aiken's V formula. Based on Aiken's V formula, the closer the value is to 1, the better the level of validity (Aiken, 1985).

The minimum limit is said to be valid based on the number of validators used in the research. The number of validators used in this research was six people with five selected categories in the questionnaire, the valid value limit was 0.79 based on the Aiken coefficient table (1985) which can be seen in Table 4. Based on the questionnaire given to the validators there were suggestions and comments which must be repaired. Using images that do not match the material, simplifying sentences so that they are easily understood by students, and adding sounds when clicking on the features provided, but in this improvement, we cannot add sounds to several features found in i-Spring such as the next and previous buttons. Apart from that, this will also

increase the file size. Correction of typographical errors has also been corrected.

Testing the validity of the PowerPoint-iSpring learning media content on green chemistry and global warming obtained an average value of 0.92 in the valid category. The validity of valid content is determined by the quality of the content, the quality of learning, the quality of interactions, and the quality of the material display (Plomp&Nieveen, 2013).Thematerial presented in the media contains images, videos, animations, and text which can help students understand the concepts of the material presented (Sakiah and Effendi, 2021).

The suggestions given by the validator become a reference in improving PowerPoint-iSpring learning media to produce higher-quality media. Some suggestions given for media components include the language and font color used. The overall construct validity test score obtained an average Aiken V of 0.93 in the valid category. Construct validity testing relates to the consistency of product components with each other (Plomp and Nieveen, 2013). This is supported by PowerPoint-iSpring which contains material in the right order, a combination of text, images, and videos that can be observed clearly.

Individual evaluations or one-to-one evaluations are carried out to determine students' assessments of the media that is being developed. Individual tests are carried out with three students who have different abilities. One-to-one evaluation aims to see the level of clarity, interest, and errors contained in the media (Plomp&Nieveen, 2013). The results of the analysis of students' responses to PowerPoint-iSpring media on green chemistry and global warming have attracted and increased students' interest in learning, especially on green chemistry and global warming. The language used in the media can be understood so that it helps students discover material concepts through images, discourse, videos, and animations.

The assessment of the PowerPoint-iSpring learning media given by students received positive comments and there were several comments given, namely that the media should be accessible via a device because not all students have laptops/computers. This cannot be done because the laptop used by researchers to develop media cannot use applications that convert to Android so it can only be accessed via an HTML link. Based on this, to overcome this, learning should be carried out in a computer laboratory so that students can access PowerPoint-iSpring learning media.

The validation results of the PowerPoint-iSpring learning media on green chemistry and global warming material in phase E SMA/MA which have been carried out obtained content validation of 0.92 on green chemistry material and 0.92 on global warming material, 0.93 construct validation and media expert validation or technical quality of 0.92. All suggestions and comments given by validators and students have been corrected so that it can be concluded that the PowerPoint-iSpringlearning media on green chemistry and global warming is said to be valid and can be used in the learning process.

Conclusion

Based on the results of research on the development of PowerPoint-iSpring learning media on green chemistry and global warming phase E SMA/MA, it can be concludedPowerPoint-iSpring learning media on green chemistry and global warming phase E SMA/MA can be developed using the plomp model. The PowerPoint-iSpring learning media on green chemistry and global warming phase E SMA/MA that was developed obtained an average validity value of 0.92 with the valid category.

Author Contributions

This article was prepared by two authors, namely Y.D and G.G. All members worked together to complete this article.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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