

Article History

Received 18/07/2023

Accepted: 15/11/2023

Published: 30/12/2023

*Corresponding author

vinnstasya@gmail.com**DEVELOPMENT OF HYPERLINK-BASED LEARNING MEDIA TO IMPROVE STUDENT LEARNING OUTCOMES IN ATOM MATERIALS**Vina Anastasya Hara Tambun^{a*}, Marini Damanik^a^aDepartment of Chemistry, Universitas Negeri Medan, Sumatra Utara, Indonesia, 20221**Abstract**

The development of technology directly requires the world of education to adjust these developments in improving the quality of education to create quality human resources. So that the world of education must be able to utilize technology to create more interesting, comprehensive, and interactive multimedia-based learning media. The purpose of this research and development is to describe the preparation steps and feasibility (validity) of Hyperlink-based PowerPoint learning media to improve student learning outcomes through learning media using the Hyperlink-based PowerPoint learning model which was developed in chemistry learning the development of atomic theory. This research and development produced PowerPoint learning media based on Hyperlink on atomic theory development material which has been declared feasible with the aim of learning media that are interesting and concise but complete for use by students and teachers and improve student learning outcomes. Validity was fulfilled based on the assessment of the validator by material experts and media experts with a feasibility level for media eligibility of 91.3% and material eligibility of 89% so that it is in the very feasible category for media and material. The results of the questionnaire to obtain student responses to the developed Android-based learning media were 80.6%. The results of increasing the value in chemistry learning on the material for the development of atomic theory using PowerPoint learning media based on Hyperlink includes 92.12% of the average student score and is in the very good category which shows that PowerPoint learning media based on Hyperlink on atomic theory development material is suitable for use as a medium learning and to improve student learning outcomes.

Keywords: Learning Media, PowerPoint based Hyperlink, 4D Model, Development of Atomic Theory

doi: 10.24815/jcd.v11i2.33183

Attribution-NonCommercial-ShareAlike 4.0 International
(CC BY-NC-SA 4.0)**INTRODUCTION**

The development of technology directly requires the world of education to adjust these developments in improving the quality of education to create quality human resources. Humans are technology users who can take advantage of current technology and subsequent technological developments. Humans also have to adapt to new technologies that develop through education [1].

Chemistry is one of the subjects taught at the high school level. The material on learning chemistry is a material that contains concepts that are difficult to distinguish and understand by students. One of the materials that students need help understanding is atomic matter. Therefore, teachers are expected to build the concept of the concept so that the atomic material presented can be appropriately accepted and correctly by the students. The goal that teachers must achieve in Chemistry learning is for students to master the concepts and understanding of basic chemistry concepts learned so that it is easy for students to move on to the following learning material. But in the field, many students still need help understanding atomic matter.

The success of a teaching and learning process can be achieved if its aspects run in harmony between educators, learners, and learning resources. With the help of educators who act as facilitators, learners are expected to explore new information from a learning source to improve understanding and knowledge. To assist teachers in the study process, the media is quite important because, in learning activities, students' vagueness of the material presented can be helped by using the media as an intermediary. Learning Media can represent anything less able to explain the teacher through particular words.

One of the media that can be developed into exciting learning media is hyperlink-based PowerPoint, a learning media that can be used to create stimulating learning media. In hyperlink-based PowerPoint, teachers can easily click on the desired section to explain the atomic material being taught to students. Students can also make it easier for teachers to explain the topic if they want to ask about a topic in one medium. In the hyperlink also, the teacher can link the question to the teaching test so that the teacher can ensure that students already understand the atomic material presented. By using hyperlink-based

PowerPoint media, teachers can also link supporting videos to assist teachers in explaining and engaging students in explaining atomic material.

Learning materials are materials identified with deliberately arranged information based on students' capacity to master learning. Learning materials can be poured into a learning medium. Video learning is a shared medium with learning messages that combine principles, thoughts, strategies, and application theories to build a deeper understanding of learning material. One of the attributes of learning videos is animation. Animation is used in learning media because of two things, namely, to attract attention and strengthen motivation. Video animation can show abstract material to be more authentic [2].

PowerPoint software (Microsoft) has become famous for creating and viewing electronic presentations. Such presentations usually consist of a series of "slides" in sequence to an audience (using a computer, projector, or screen) by a lecturer or displayed sequentially by a person at a computer at her workstation. Increase. However, PowerPoint's "hyperlink" feature allows the user to navigate from one slide of her to another within the presentation by clicking on a given word, shape, or image. Hyperlinks can also electronically "connect" words or pictures to slides in an entirely separate presentation, web pages, email addresses, or other file types. Therefore, hyperlinks can provide a more dynamic and interactive experience than a series of slides alone. This article will guide you through the steps necessary to create hyperlinks and integrate them into your PowerPoint presentation in various ways. This article assumes that you are new to creating hyperlinks but have a basic understanding of the PowerPoint software, including entering text, images, and shapes into your slides. Many excellent articles are available as tutorials on how to create effective PowerPoint presentations.

This study discusses the development of hyperlink interactive multimedia learning media on atomic materials and also this study discusses the feasibility of hyperlink interactive multimedia learning media on atomic materials.

METHOD

The Define, Design, Develop, Disseminate (4D) research model was created by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melyn I. Semmel. In this case, the researcher wishes to create learning media to improve students' interest in their studies. The developed learning media will be tested for feasibility using product validity and media trial use. The 4D model-based development process is divided into four stages, namely:

Define stage

The definition of the development requirements is the first stage in the 4D model. Simply put, this is the stage of needs analysis. Researchers in product

development must refer to the development requirements, analyze, and collect information on the extent to which development must be carried out. Defining or analyzing needs can be accomplished through an examination of previous research (which results in the analysis regarding the development of media that will be created and developed based on a comparison of existing research) and literature studies (which results in an analysis of the material included in learning media as examples from journals and e-books), a syllabus (which resulted in an analysis of the needs of students in carrying out learning), or interviews with teachers/ informant (which resulted in an analysis of the scope of student learning and the range of student scores during chemistry lessons, especially in the matter of atomic structure and the periodic system of elements.).

Table 1. Environmental analysis observation sheet

No	Observation object	Score			
		1	2	3	4
1.	Completeness of learning devices				
	a. The lesson plan accordance				
	b. Student Worksheet availability				
	c. Valid content and taken from various resources				
2.	Mastery of the Materials:				
	a. Fluency in explaining the material				
	b. Ability to answer questions				
	c. Exemplary diversity				
3.	Systematic presentation:				
	a. Completeness of the material description				
	b. Material description leads to the goal				
	c. Material description is in accordance with the syllabus				
4.	Use of media:				
	a. The accuracy of selecting the media with the material				
	b. Skills in using the media				
	c. The media explains the material				

Design stage

The goal of this stage is to create hyperlink-based PowerPoint learning media. The following are the procedures that will be followed:

Media Selection

This stage is carried out to identify learning media based on student needs so that basic competencies are expected to be achieved by students.

Format Selection

This stage is carried out to design learning content, learning resources such as the use of images and writing.

Initial design

The initial design was a version of the learning media before it was validated. This design is based on the results of the analysis that has been done.

Development Stage

This development stage aims to create learning media using hyperlink-based power points on the material to develop atomic theory. Media validation and material validation are carried out by experts at this stage. The validator will provide input that will help improve the making of this learning media.

Disseminate stage

At this stage, the developed media is ready to be distributed. This research was conducted at Senior High School 12 Medan which is located at Senior High School 12 Medan, at Cempaka St. No. 75, Central Helvetia, Sub district of Medan Helvetia, Medan City, North Sumatra 20241. The population in this study were students of class X 2 of Senior High School 12 Medan, totalling approximately 36 students. Sampling used cluster random sampling technique, and obtained class X 2 with a total of 33 students. Students and teachers will receive media delivered via WhatsApp. The following chart illustrates these stages:

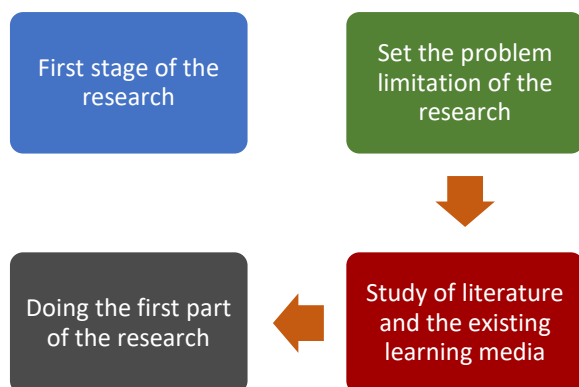


Figure 1. Flowchart of the first stage in 4D model of development

After that, determine the development model that will be carried out, namely by using the 4D method. The 4D method of development was first introduced by S. Thiagarajan, Semmel, and Semmel in 1974 and have been successfully developed and implemented by many researchers in various fields including education. The model consisted of 4 different stages of development i.e define, design, develop, and disseminate. All stages and what we conducted in this research is depicted in Figure 2.

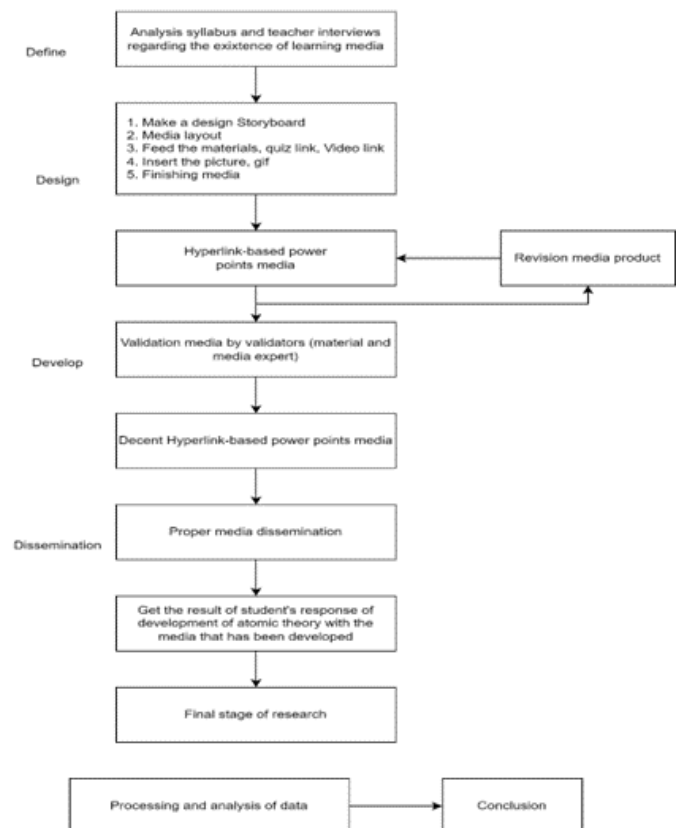


Figure 2. 4D model of development

RESULTS AND DISCUSSION

Define Stage

At this stage analysis is carried out in the form of needs analysis, learning material analysis, and environmental analysis.

Needs Analysis

Needs Analysis aims to identify the product produced in accordance with the needs. The teacher pays attention to the amount of material summarized in one chapter, making it difficult for students to remember the topics being taught and causing boredom. The use of PowerPoint media provided has advantages and disadvantages for the learning process. The advantage is that PowerPoint media can be designed as attractive as possible to attract children's interest. Meanwhile, because the media can provide many material summaries, students often need help to look for other sources.

Based on the results of an interview with one of the teachers of Senior High School 12 Medan, the learning process for developing atomic theory still needs to be improved. This happens because the teacher concludes that students still need to be interested in independent learning and only use one book as a medium provided by the teacher.

On the other hand, every student has a mobile phone, and student X 2 is more likely to have an Android-based mobile phone and be able to use it. Although the learning process is said to be smooth,

technology still needs to be used effectively. Plus, the school provides no application to assist the learning process.

Analysis of Learning Materials

Analysis of Learning Materials is a step in determining learning materials aligned with the curriculum in Senior High School and meeting the student's needs. The researcher continues to define the sub-matter that will be summarized in the development of atomic theory, namely the development of atomic theory starting from John Dalton, J.J. Thomson, Rutherford, and Bohr, to Quantum Mechanics, which are accompanied by weaknesses and strengths as well as research methods from each development of the atomic model studied by researchers.

Environmental Analysis

Based on the findings from the environmental analysis observations, it is clear that no student worksheets are used during learning, and the teacher only concentrates on one learning resource, namely textbooks, resulting in students being less enthusiastic about learning Chemistry. Instructors also do not make PowerPoint presentations. This affects the learning process.

Some children use cell phones behind them and ignore the learning process. Based on observations made by researchers while teachers and students are carrying out the learning process, it is concluded that a student-centered learning process is needed by using hyperlink-based PowerPoint learning media so that researchers can increase interest in learning, especially in the material for the development of atomic theory.

Design Stage

Selection of Learning Material

The material presented and developed in PowerPoint based on hyperlinks is class X material for the development of atomic theory. The materials presented must meet the indicators of achieving learning objectives that must be conducted following the Independent Curriculum. Then collect material from various accurate sources such as books and journals to enrich the information on the material for the development of atomic theory. Some of the sub-material contained in PowerPoint based on hyperlinks on the material for the development of atomic theory consists of the development of John Dalton's atomic theory, the development of J.J. Thomson, the development of Rutherford's atomic theory, the development of Bohr's atomic theory, development of Quantum Mechanics (Modern) atomic theory.

Application Design

Learning media is made through a careful and planned process at the design stage. In making a hyperlink-based PowerPoint on the material for the development of atomic theory, researchers first

collaborated with subject teachers and supervisors to determine the required resources, menus, and perspectives. The focus of this stage is to collect data and develop elements such as models, covering materials, and display color combinations, all of which are essential in creating effective instructional media that serve the needs of teachers and students.

Based on this research, relevant data were collected about the atomic structure and elements of the periodic system to assist in the creation of hyperlink-based PowerPoint learning media. After the design stage, the content preparation stage will be incorporated into the application. The following figures show the storyboard and content of the PowerPoint-based Hyperlink application feature.

Development stage

Design Validity

This media validation is carried out so that the media used in this study is excellent or feasible to use both in terms of media design and material. Below will be discussed the results of the validation of learning media by learning media expert lecturers and chemistry subject expert lecturers.

Because of the validation results, both media validation and material validation, have shown a percentage of $\geq 61\%$, which means valid. After inputting suggestions or comments from the validator into the hyperlink-based powerpoint learning media in the atomic theory development material it is declared valid and can be continued in the next procedure, namely the product trial stage to retrieve pretest, posttest, and student response data.

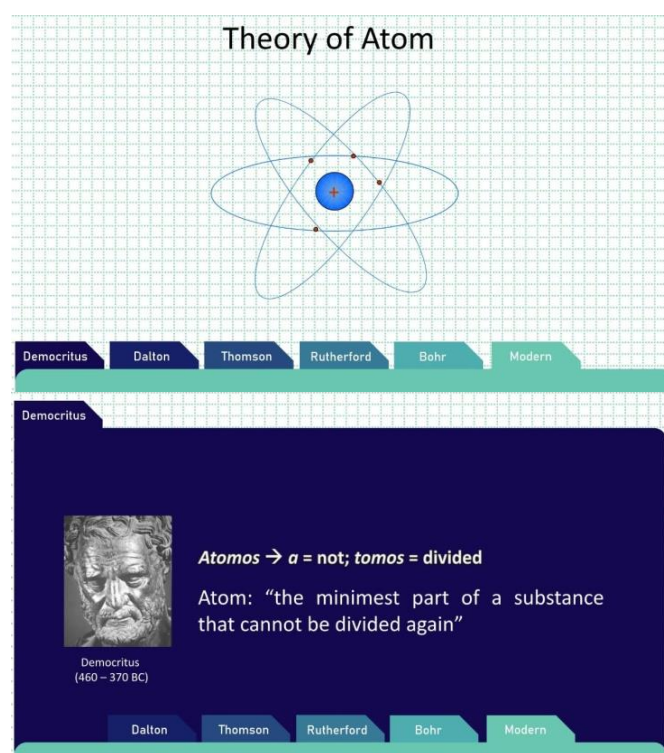


Figure 3. Hyperlink-based Powerpoint media for learning the concept of the theory of atom

Dissemination Stage

After the media is validated, the Hyperlink-based PowerPoint learning media can be distributed in class X 2 of Senior High School 12 Medan. There are 33 students of class X 2 who become testers in assessing the applications that have been developed. The distributed questionnaire has ten statements which are shared in the Google Form. Appendix 4 offers detailed responses to the hyperlink-based PowerPoint learning media research questionnaire.

The result from 33 students of class X 2 of Senior High School 12 Medan answered ten statements with an overall percentage of 80.6%. This percentage is classified as "strongly agree" with the researcher's questionnaire. Using hyperlink-based PowerPoint learning media can stimulate students' interest in learning more about chemistry, especially in the material for developing atomic theory.

Learning Outcome Data

To determine the effect of using hyperlink-based power point learning media on the atomic theory development material on improving student learning outcomes, a test was carried out whose grades had been predetermined by the teacher to determine student completeness in understanding the atomic theory development material. In this study, was 1 test given to the sample, namely the post-test given to students at the product trial stage in small or limited groups; in this case, the test will be conducted at X 2 Senior High School 12 Medan. The questions are taken from various sources, such as chemistry books and internet questions that the previous tutor analyzed and approved. Once fulfilled, the questions can be tested during product trials. The results of this test will be used as a reference for concluding at the end of learning, and the results of the post-test will then be compared with the results of the student test (minimum criteria of mastery) on the atomic theory development material to determine whether there is an increase in student learning outcomes. The following will discuss student response and learning data collected at the product trial stage.

The test is carried out whose value has been predetermined by the teacher to determine the students' completeness in understanding the material to develop atomic theory. This test was carried out on May 20, 2023. There is a post-test in this study which was given to students at the product trial stage in small or limited groups; in this case, the test will be conducted in class X 2 of Senior High School 12 Medan.

From the results obtained from the post-test, which was held using 20 validated questions, we got a score that we can see in Figure 4.8. According to the results obtained from the post-test, which achieved a class average score of 92.12 from the minimum criteria of mastery score of 70, it can be seen that students can understand much better and are more interested in learning by using hyperlink-based PowerPoint,

especially in the material for the development of atomic theory. The class average score reached 92.12, with one person getting the lowest score, namely 75, and nine people touched the maximum score, namely 100, and the rest got scores from 80 to 95. With no students getting scores below the minimum criteria of mastery.

CONCLUSION

The quality of hyperlink-based PowerPoint interactive multimedia learning media as a high school chemistry learning medium for class X in the development of atomic theory has been successfully developed using 4D development which achieved an average revised score of 4.56 out of 5 and received an average revision score. the final statement is very valid/strongly agreed. In the selection of material for the development of atomic theory which has been validated by the validator gets a score of 89% and gets a final statement that is very valid or very agrees.

In the data from the pre-test and post-test results, it can be seen that there was an increase in learning outcomes after being given treatment in the atomic theory development material using hyperlink-based PowerPoint learning media. From these data the average value of students experienced an increase in the average value, namely from 70 to 92.12. Then the number of students who completed as many as 33 students with the lowest score of 75 with a percentage of 100%. Therefore, the hyperlink-based PowerPoint learning media has a very good effect on improving student learning outcomes in the material for developing atomic theory at Senior High School 12 Medan.

REFERENCES

- [1] Doyan, A., Harjono, A., & Jana, M. (2021, February). Effect of learning media tank ripple wave with the implementation of guided inquiry model on concept mastery of high school students. In *Journal of Physics: Conference Series* (Vol. 1816, No. 1, p. 012017). IOP Publishing.
- [2] Dwijayani, N. M. (2019, October). Development of circle learning media to improve student learning outcomes. In *Journal of Physics: Conference Series* (Vol. 1321, No. 2, p. 022099). IOP Publishing.
- [3] Habibah, N., & Napitupulu, S. (2021). Pengaruh Media Powerpoint Fitur Hyperlink Terhadap Hasil Belajar Matematika Siswa Pada Materi Bangun Datar Kelas III SD Negeri 101771 Tembung. *Invention: Journal Research and Education Studies*, 57-63.
- [4] Hadisaputra, S., Gunawan, G., & Yustiqvar, M. (2019). Effects of Green Chemistry Based Interactive Multimedia on the Students' Learning Outcomes and Scientific Literacy. *Journal of Advanced Research in Dynamical and Control Systems (JARDCS)*, 11(7), 664-674.

- [5] Hapsari, A. S., & Hanif, M. (2019). Motion graphic animation videos to improve the learning outcomes of elementary school students. *European Journal of Educational Research*, 8(4), 1245-1255.
- [6] Julisawati, E. A., Sjafrina, F., Hurnaningsih, H., Wigiyanti, W., Rokoyah, K., & Warsito, F. G. P. (2022). The Utilization of PowerPoint-Based Learning Media by Utilizing Hyperlinks. *Community Development Journal* 3(3), 1438-1441.
- [7] Lisfatkandayant, U., Muharini, R., Sartika, R. P., Enawaty, E., & Erlina, E. (2022). Development of Flashcard Learning Media on the Topic of the Development of Atomic Theory. *EDUKATIF: JURNAL ILMU PENDIDIKAN*, 4(2), 3120-3132.
- [8] Ma'arif, I. B., & Aslamuddin, F. B. (2021, December). Developing English Learning Media Based ICT for Seventh Grade Junior High School. In *Multidiscipline International Conference* (Vol. 1, No. 1, pp. 215-222).
- [9] Nabillah, T., & Abadi, A. P. (2020). Factors causing low student learning outcomes. *Prosiding Sesiomadika*, 2(1c).
- [10] Nurasliza, N., & Yulita, I. (2020). Development of Chemistry Comic (Komia) Based on Malay Culture on the Topic of the Development of Atomic Models for 10th Grade Students. *Student Online Journal (SOJ) UMRAH-Keguruan dan Ilmu Pendidikan*, 1(2), 507-519.
- [11] Pramesti, P. D., Dibia, I. K., & Ujianti, P. R. (2021). Interactive Online Learning Media Based on PowerPoint with Hyperlink Functionality. *Journal of Pedagogy and Learning*, 4(2).
- [12] Rachmavita, F. P. (2020, October). Interactive media-based video animation and student learning motivation in mathematics. In *Journal of Physics: Conference Series* (Vol. 1663, No. 1, p. 012040). IOP Publishing.
- [13] Sahronih, S., Purwanto, A., & Sumantri, M. S. (2019, March). The effect of interactive learning media on students' science learning outcomes. In *Proceedings of the 2019 7th International Conference on Information and Education Technology* (pp. 20-24).
- [14] Sary, P. Y., & Jahro, I. S. (2022). The development of interactive multimedia based lectora inspire on chemical bonding material for grade X senior high school. *Educenter: Jurnal Ilmiah Pendidikan*, 1(4), 362-371.
- [15] Situmorang, A. S. (2020). Microsoft Teams for Education as an Interactive Learning Platform Enhances Learning Interest. *Sepren*, 2(1), 30-30.
- [16] Sumarni, R. A., Bhakti, Y. B., Astuti, I. A. D., Sulisworo, D., & Toifur, M. (2020). The development of animation videos based flipped classroom learning on heat and temperature topics. *Indonesian Journal of Science and Mathematics Education*, 3(3), 304-315.
- [17] Syarifah, S., Bahtiar, Y., & Fikri, A. K. (2022). Designing Learning Media for The Effectiveness of Vocabulary Junior High School. *APPLICATION: Applied science in Learning Research*, 1(3), 173-178.
- [18] Wardhana, S. O., Nabilah, S., Dewitasari, A. P., & Hidayah, R. (2022). Interactive E-Module Based on the Nature of Science (NoS) in the Development of Atomic Theory to Enhance the Cognitive Level of Science Literacy for Students. *UNESA Journal of Chemical Education*, 11(1), 34-43.
- [19] Widiyanti, F., & Nandiyanto, A. B. D. (2021). Interactive PowerPoint Implementation as a Digital Learning Media in Increase Understanding Theory Temperature and heat in students Elementary School. *International Journal of Research and Applied Technology (INJURATECH)*, 1(2), 342-349.
- [20] Wulandari, A. P., Salsabila, A. A., Cahyani, K., Nurazizah, T. S., & Ulfiah, Z. (2023). The Importance of Learning Media in the Teaching and Learning Process. *Journal on Education*, 5(2), 3928-3936.