Development of Interactive Multimedia-Based Learning Media in an Effort to Improve Student Learning Outcomes in Basic Automotive Technology Subjects Class X

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Abstract

The research aims to develop interactive teaching materials that are integrated with LMS (e-learning) so that the learning process takes place effectively. This research is a type of Research and Development (R and D) research to improve student learning outcomes in the Basic Automotive Technology subject. The development method used in this research is to follow the ADDIE model. The subjects of this research are Learning Media, Learning Materials and Instructional Design. The next lesson is the students of Cibinong Mechanical Vocational School, namely class X TKR 1 as the experimental class. The results of the research show that the quality of the e-learning based interactive learning multimedia that was developed is in the very valid category (88.89), very good in one to one trials (91.07%), very good for small groups (91,93%) and very good for large groups (93,04%). Meanwhile, the t_{count} value is 6.701 and the t_{table} value at the 5% significance level is 2.051, so $t_{count} > t_{tabel}$ or $6.701 > 2.051$, so h_a is accepted and h_0 is rejected. This means that there is a significant difference in the ability to understand material presented using media. So, it is concluded that interactive multimedia based on e-learning is feasible and effective and can improve student learning outcomes.

A. Introduction

Learning is an activity that can be said to be very important in human life, and everyone in living this life must and always carry out learning activities. Ki Hajar Dewantara (Father of Indonesian National Education, 1889 - 1959) explained the meaning of education, namely: "Education generally means efforts to advance the character (character, inner strength), mind (intellect) and body of children in harmony with nature and society" (Daroin & Aprilya, 2023; Filgona et al., 2020; Masitoh & Wagino, 2023).

In the National Education System Law no. 20. In 2003 article 1 paragraph 1 explains "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals and skills that needed by himself, society, nation and state" (Masnu'ah et al., 2022; Sangalang, 2022; Wartoyo, 2022).

Furthermore, Article 3 of the National Education System Law of 2003 explains that "National education functions to develop abilities and shape the character and civilization of a dignified nation in order to make the nation's life more intelligent, aimed at developing the potential of students to become human beings who believe in and are devoted to God Almighty, with good morals. noble, healthy, knowledgeable, capable, creative, independent, and a democratic and responsible citizen" (Ma'ruf et al., 2021; Mansir et al., 2020; Rohman et al., 2022).

Choosing the right media in the learning process is not easy because it requires precision from a teacher to be able to choose media that suits your needs (Abdillah, 2022; Yunita et al., 2024). Apart from requiring a fairly in-depth analysis taking into account various aspects, there are also principles that must be taken into account so that the choice of media is appropriate so that success in learning can be achieved in accordance with the desired goals. There are at least three main principles that can be used as references for teachers in choosing learning media, namely: 1. The principle of effectiveness and efficiency, 2. The principle of relevance, 3. The principle of productivity (Khasanah et al., 2021).

Therefore, there is a need for innovations in the learning process in the form of learning support facilities that are supported by technological advances and the application of the latest technology, so that the learning process can take place in a fun way, especially as students at this time are very familiar with and accustomed to technological devices, especially technology based on Information Technology or Multimedia so that it will make it easier for teachers in the learning process in class later, especially the use of interactive multimedia which will indirectly stimulate students' curiosity about the material that will be presented and of course this will arouse students' interest in learning.

B. Research Methods

The research method used in this research is the Research and Development (R&D) method. This research aims to produce certain products and test the effectiveness of these products. The R&D design model used is a research and development model in the world of education, namely the ADDIE development model (Rohaeni, 2020). This is based on the development produced in the form of software products, namely in the form of teaching materials, both text and interactive videos, which are integrated into the Learning Management System in schools. The ADDIE (Analysis, Design, Development, Implementation and Evaluation) model was developed by Molenda and Reiser (2003) (Furwana et al., 2023; Masruroh et al., 2023). This model is often used to describe a systematic approach to instructional development. Molenda stated "I am satisfied at this point to conclude that the ADDIE model is merely a colloquial term used to describe a systematic approach to instructional development, almost synonymous with instructional systems development (ISD)". Molenda also said that the ADDIE model is a general learning model and is suitable for development research (Prasetyo et al., 2020).

The development procedures include:

Analysis, at this stage the researcher carries out an analysis by identifying problems and needs through collecting data regarding needs and learning processes carried out in class X basic automotive technology subjects. And based on the problem identification, the results obtained include:

a. The availability of learning support facilities in schools in the form of LMS (E-learning) is still not utilized optimally by teachers and students because the learning carried out still seems conventional and monotonous.
b. The lack of student interest in the learning process is caused by conventional learning which is only based on text books and modules.
c. The learning process tends to be passive and students are less active in responding to learning.
d. The low understanding of students in understanding the material presented is due to students' disinterest in reading material, especially text-based material, so that students are unable to explore further the material presented, therefore the level of student understanding will be very poor.

Based on the identification that the researcher described above, the researcher can conclude what things are needed, namely:

a. Utilization of learning media in the form of a Learning Management System (LMS) / E-learning using the Moodle platform as a learning support media that is already available in schools.
b. The learning media presented are not only supporting modules, but also interactive learning videos, as well as interactive daily test questions so that students are invited to be more active in exploring the material with varied media displays.
c. Through interactive media designed, students are directly invited to be more active in responding to each material presented
d. By making students more active in the learning process, it is hoped that students' level of understanding of the material presented will be higher and it is hoped that students will want to explore more deeply the material discussed.

Design, at this stage, planning is carried out in carrying out development research by designing the following matters:

a. Gathering information related to existing problems in the implementation of Basic Automotive Technology learning at the vocational school level.
b. Collecting data regarding the availability of learning media, the learning process and the form of evaluation provided.
c. Collecting the number of students and the schedule of activities implemented.
d. Literature study related to supporting theories in the form of theories regarding the meaning of interactive multimedia, the use of E-Learning in the form of Learning Management Systems, learning media. The sources obtained are literature studies from several articles, books, previous research and other sources relevant to the research.
e. Designing a draft of interactive learning media which consists of several stages of the learning process that must be followed by students, starting with students filling in the attendance list in the attendance folder, then students entering the learning folder which consists of 3 learning flows, namely starting from student reading materials which contain learning material. , then a learning video which contains a description in the form of a video accompanied by questions in the form of a short quiz which can be answered directly by students, and finally there is an evaluation which contains test questions in the form of multiple choice questions and essays on the material that has been discussed.

Development, in the development step, a product was developed in the form of interactive multimedia which was integrated into the school's Learning Management System (LMS) in order to improve student learning outcomes in the Basic Automotive Technology subject at Cibinong Mechanic Vocational School based on expert validation, with the stages of developing interactive learning multimedia as follows:

1. The learning media is in the form of interactive multimedia which is equipped with student attendance, reading material books and practice questions
2. Designed to be attractive, varied and communicative
3. Equipped with information in the form of text and images
4. Arranged according to the format of an interactive learning system

Implementation, at this stage, trials are carried out on interactive multimedia learning media, this is done to obtain data on the practicality and effectiveness of the learning media being developed. Before it is tested on students in one class, it is first tested on a small group of 7-9 students. The aim is that students as direct users of interactive learning media will certainly have suggestions if there are weaknesses in the learning media, so that these suggestions will be used as material for improving learning media. After the small group test, it was then tested on a larger group, namely experimental class and control class students. The design that the researcher used was the quai experimental design that the researcher used was the One-Group Pretest-Posttest Design. In this design, observations are carried out twice, namely before treatment (O1) and after treatment (O2). The difference between O1 and O2 or O2-O1 is assumed to be a treatment or experimental effect. An overview of this design can be seen in the following table.

Table1. One-Group Pretest-Posttest Design

E (Treatment/Experimental Effect)	O1 X O2

Information:
X : Providing treatment (use of interactive learning media)
O1 : Class pretest before being given treatment
O2 : Posttest of the class given the treatment

Evaluation, this stage is a further stage after design and development, then after obtaining the results of the product feasibility test, the field trial stage is carried out, namely with one to one tests, and small group tests to determine the effectiveness of the product developed as an interactive learning medium in Basic Automotive Technology learning. at Cibinong Mechanical Vocational School.

The subjects used in this research were learning design experts, media experts, and materials experts and involved 29 class X vocational school students majoring in Light Vehicle Engineering as the class used as an experimental class. The scale used in filling out the questionnaire is the Likert scale. Sugiyono stated that the Likert scale is used to measure attitudes, opinions and perceptions of a person or group of people regarding social phenomena on a scale of 1-5 as illustrated as follows.

Table 2. Scale criteria

Score	Information
5	Very good
4	Good
3	Enough
2	Not good
1	Very not good

The percentage calculation from the data that has been obtained is processed using the following formula:

$$P = \frac{\sum x}{n} \times 100$$

Information:

P: Presentation of the score sought
$\sum x$: Number of answers given by the validator
n : Maximum number of scores

After the score percentage is found, then determine the achievement level criteria which are in the following table:

Table 3. Achievement Level Criteria

Achievement Level	Qualification	Information
90 – 100%	Very good	No need to revise
75 – 89%	Good	No need to revise
65 – 74%	Enough	Needs revision
55 – 64%	Not good	Needs revision
<55%	Very not good	Needs revision

C. Results and Discussion

In the analysis step, based on the results of the observations made, it was found that various kinds of problems occurred to students in the Basic Automotive Technology subject, starting from the learning process which still used the classical method by only using the Manual Book so that in the end it greatly influenced the learning outcomes obtained by the students. to text-based student learning outcomes evaluation activities and many students have not yet reached the KKM standard scores, while the facilities available at schools range from internet networks that are available in each class to learning support facilities in the form of a Learning Management System (LMS).) or what is also known as E-Learning, is available and capable, which should be a supporting tool that can be utilized by teachers and students in the learning process in order to increase the expected learning targets and outcomes. Based on the description of the problem, the researcher took steps to try to overcome this. The steps taken by the researcher in this case were to try to develop learning media that was integrated with existing e-learning. The initial step taken by researchers in developing interactive multimedia-based learning that is integrated with e-learning media is to analyze the needs and objectives of this development, in this case including:

a. What materials are presented in the Basic Automotive Technology subject
b. Looking at student learning outcomes in formative and summative assessments
c. Teaching materials used by teaching teachers
d. Available facilities and infrastructure
e. Problems and difficulties that arise
f. Efforts made in efforts to overcome problems that occur.
g. Expectations in the learning process carried out using media

The design stage is designing learning media, in this step a draft of interactive learning media is carried out which consists of several stages of the learning process that must be followed by students, starting with students filling in the attendance list in the attendance folder, then students entering the learning folder which consists of 3 steps. Learning starts from student reading materials which contain learning material, then learning videos which contain descriptions in the form of videos accompanied by questions in the form of short quizzes which can be answered directly by students, and finally evaluation which contains test questions in the form of choice questions. doubles and essays about the material that has been discussed.

Development stage, at this stage a feasibility test is carried out by 3 experts, namely instructional design experts, media design experts and material experts on products that have been designed and then validated with the aim of obtaining suggestions, improvements and input so that the resulting product has the appropriate level of feasibility. Good. The following validation results by learning design experts, media experts and material experts can be seen in Table 4, Table 5 and Table 6.

Table 4. Validity Results by Learning Material Experts

No	Validity Variables	Validity Value	Criteria
1	Didactic Terms	**88.89%**	Valid
2	Construction Requirements	**92.86%**	Very valid
	Overall Ideal Percentage	**91.30%**	**Very valid**

Table 5. Validity Results by Learning Media Experts

No	Validity Assessment Indicators	Validity Value	Criteria
1	Media display	86.00%	Valid
2	Product quality	95.56%	Very valid
3	Media clue layout	80.00%	Valid
	Overall Ideal Percentage	**90**%	**Very Valid**

Table 6. Validity Results by Instructional Design Experts

No	Validity Assessment Indicators	Validity Value	Criteria
1	Aspects of needs analysis	85.00%	Valid
2	Learning design aspects	90.00%	Very valid
3	Product development aspects	90.00%	Very valid
4	Usage aspects	100%	Very valid
5	Assessment aspect	100%	Very valid
	Overall Ideal Percentage	**91**%	**Very Valid**

Improvements to aspects of the product's appearance to make it look more attractive, and product usage instructions to make it easier for users and video and sound displays to more clearly explain the teaching material being discussed.

The following displays interactive multimedia products that are integrated with e learning/LMS.
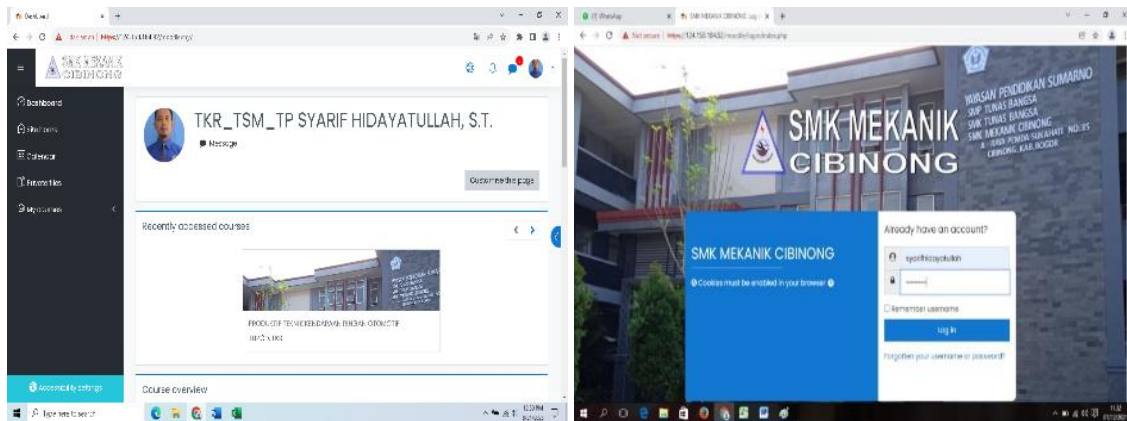
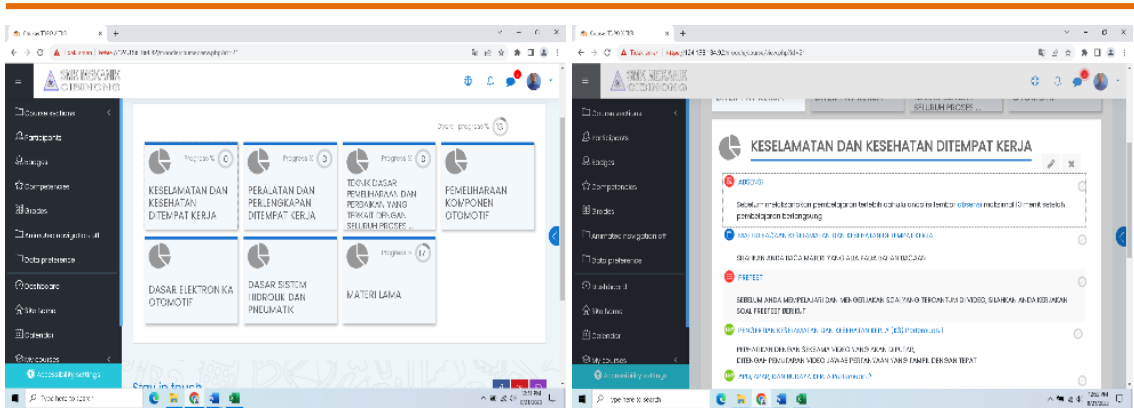**Figure 1**. Facade view of E learning at Cibinong Mechanical Vocational School

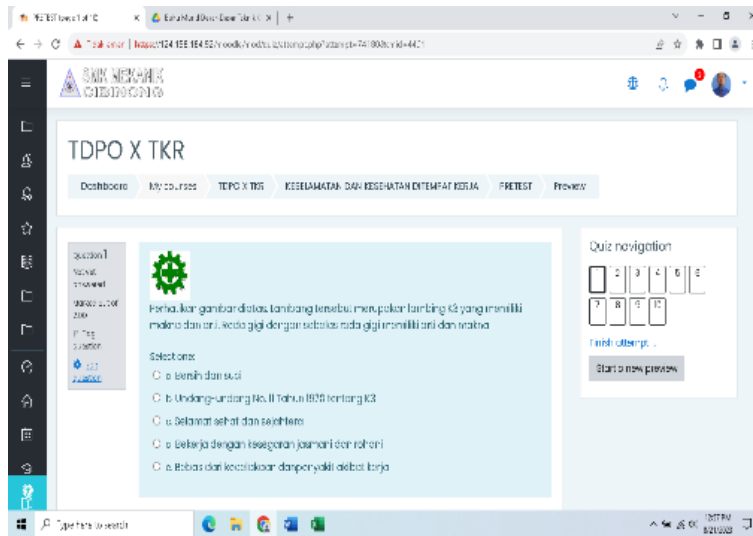**Figure 2**. Initial display of interactive multimedia material with various learning themes

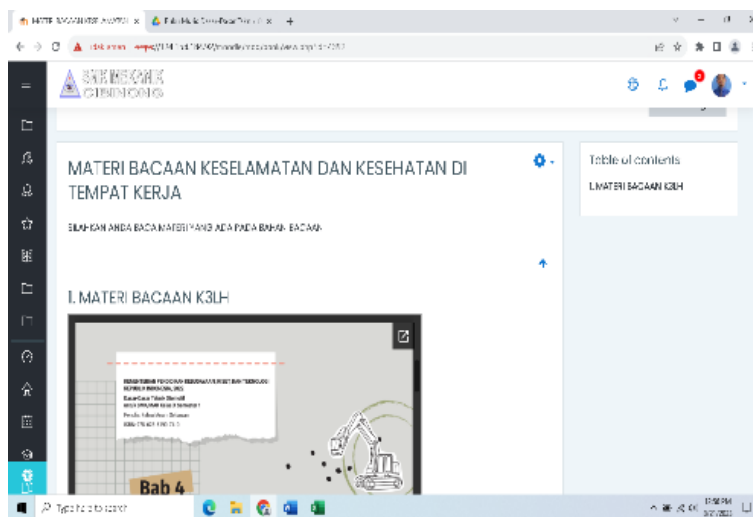**Figure 3**. Pre-test question display layer

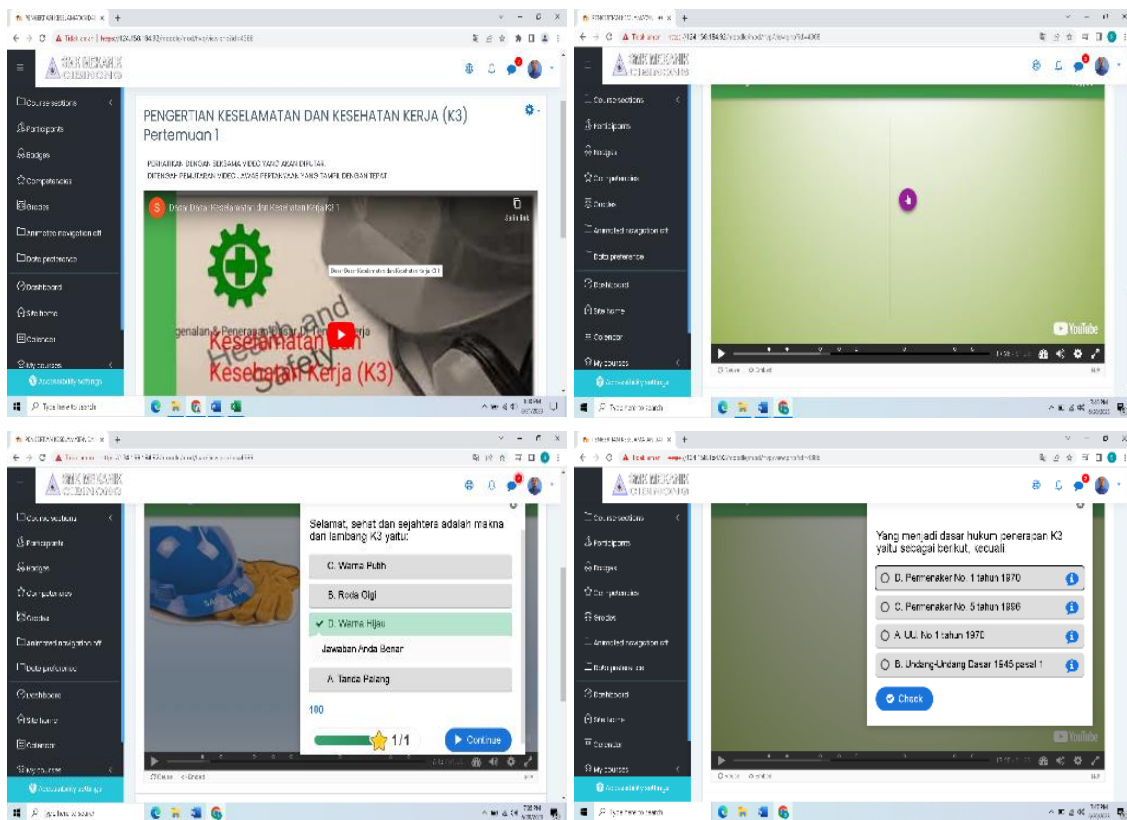**Figure 4**. Display of the e-book layer as supporting material

Figure 5. Interactive video display

One to One Test, After the e-learning based interactive multimedia product has been validated by the validator and has been revised, the product is then tested on two groups of students, each with 3 students representing low, medium and high levels of ability, here are the test results one to one carried out on the product being developed:

Table 7. One to One Test Analysis Results

No	Assessment Aspects	Mark	Criteria
1	Student Interest and Product Display	87.62%	Very good
2	Use Process	80.00%	Good
3	Multimedia Models	96.67%	Very good
4	Time	100%	Very good
	Overall Ideal Percentage	**91.07%**	**Very good**

Small Group Testing, After the e-learning based interactive multimedia product has been validated by validators and has been revised, the product is then tested on two groups of students, each with 7 students representing low, medium and high levels of ability, following are the results of one trial to one carried out on the product being developed:

Table 8. Results of Small Group Test Analysis

No	Assessment Aspects	Mark	Criteria
1	Student Interest and Product Display	90.61%	Very good
2	Use Process	89.52%	Very good
3	Multimedia Models	90.48%	Very good
4	Time	97.14%	Very good
	Overall Ideal Percentage	**91.93%**	**Very good**

Large Group Test, after carrying out the small group trial, then carry out the large group trial. Large group trials were carried out in 4 meetings with a total of 29 students. After learning using the product developed, namely interactive multimedia based on e-learning and filling out an assessment in the form of a student response questionnaire which was carried out to assess the validity of the product. Following are the results of large group trials:

Table 9. Results of Large Group Test Analysis

No	Assessment Aspects	Mark	Criteria
1	Student Interest and Product Display	93.20%	Very good
2	Use Process	93.68%	Very good
3	Multimedia Models	92.18%	Very good
4	Time	93.10%	Very good
	Overall Ideal Percentage	**93.04%**	**Very good**

T-test is a statistical analysis technique that can be used to find out whether there is a significant difference between two sample means or not. Comparing two means can be done from one sample group, for example by comparing the mean of the pretest results and the mean of the posttest results of the 28 students in the sample. Conclusion $t_{count} > t_{table}$ where $6.7018 > 2.0518$.

From the results of the work above, we get t_{count} prices = 6.7018 and t_{table}= 2.0518. In this case it turns out t_{count} greater than t_{table} because it is significant. Because it is significant, it can be concluded that "there is a significant difference in children's ability to understand Basic Automotive Technology material using interactive multimedia learning which is integrated with the Learning Management System (LMS)."

With the development of products that support the learning process, researchers suggest that interactive multimedia learning based on e-learning can be used to improve student learning outcomes in the learning process because it has been tested with quite good results. If further research is to be carried out related to the development of this product, it is to further improve the quality of the product by paying attention to various aspects and also developing it with different materials and collaborating with other methods. The researcher suggests that future researchers can add more experts so that interactive learning multimedia can be better and expand the population and test subjects in the research.Other researchers who will conduct research on the development of Interactive Multimedia are advised to monitor students during the learning process using interactive multimedia, so that the learning process can run optimally.

D. Conclusion

This research and development uses the ADDIE (analysis, design, develop, implementation and evaluation) development model with each stage carried out systematically. Based on the feasibility test of the development product through assessment by instructional design experts with a percentage of 91%, by media experts with a percentage of 90%, a percentage of 91.30% by material experts, thus the e-learning based interactive multimedia development product is considered "very feasible". And based on the results of comparing the values of $t_{count} > t_{table}$ or $6.0718 > 2.0518$, it can be said that there are differences in learning outcomes and effective use.

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