Development of Microlearning-Oriented Explainer Videos on Robotics Learning in Higher Education

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Abstract

The digital era triggers innovation in the learning process where currently, students prefer to find and learn learning resources through the internet/online technology. Microlearning-oriented explainer video media is one solution to accommodate changes in the current way of learning. This research aims to develop and implement microlearning-oriented explainer videos in robotics courses in higher education on a limited scale. The research used the Plomp development model to create explainer videos. The resulting explainer video media is tested for validity, practicality, and effectiveness. The results revealed that the explainer video media that had been developed got excellent results in the aspects of validity and practicality, while the results of testing the effectiveness of the media in the classroom and tested statistically that there were differences in learning achievement between before and after using explainer video media in robotics learning materials. Increased learning achievement of robotics learning materials is evidence of increased student activity and enthusiasm in learning so that learning outcomes can be fulfilled.

Keywords: Digital, Explainer video, Microlearning, Robotics.

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INTRODUCTION

Learning in the digital age provides many changes in planning, implementing, and evaluating learning (Hendri et al., 2021). A significant change in the learning process in this digital era is that students prefer to read literature and find learning references through the internet/online technology rather than reading through books (Hendikawati, Zahid, & Arifudin, 2019; Aslik, Karyono, & Gunawan, 2022; Simanjuntak & Haris, 2023). This phenomenon is a trigger for educators in academic units to innovate to form teaching materials that are relevant and easily accessible via the Internet (Pradnyana, Agustini, & Santyasa, 2021; Anggraini, & Zural, 2022; Nita & Pratiwi, 2022). Changes in learning activities also impact robotics learning in higher education.

In fact, in the robotics learning process, some problems occur, namely student learning activities that tend to be less active, the absence of learning support media, and learning methods are still dominated by direct learning, thus impacting student learning achievement that is less than optimal, according to UAS results data in 2021 and 2022, the average achievement of UAS scores for robotics courses is 60.35 and 62.55. This is clear evidence that there are problems in learning that make

learning robotics challenging. Moreover, the lack of learning media in robotics courses is also an obstacle that causes students not to be able to learn optimally.

The results of the interviews that have been conducted also provide information that robotics learning is more given through presentation slides and oral presentations, where the method tends to be centered on educators (teacher-centered). Robotics learning activities tend to be less varied and less attractive to students. Students are given more material explanations through slides and taking tests, so it is thought to affect the learning achievement of robotics courses that are not optimal. The learning process that has occurred so far does not invite students to be able to be actively involved in improving skills and knowledge because learning activities are still teacher-centered. Learning activities that connect educators and students will be able to connect well with the teaching materials; even though educators can explain learning in a structured and comprehensive manner, the need for a learning medium for students remains important (Iskariyana & Ningsih, 2021; Prestiadi & Nurabadi, 2021; Miftah, 2022).

According to Amelia et al. (2021), Learning using media has a positive impact, namely clarifying the message conveyed, finding solutions to limited space, time, and sensory power, and generating learning motivation (Ariyanto, Kristiyanto, & Nugroho, 2021). There is direct interaction between students and learning resources (Ekayana, Putra, & Destiansyah, 2022). Provide learning stimulation to students and allow them to learn independently according to their talents and learning styles (Simanjuntak & Haris, 2023). The importance of learning media for students in higher education is to support student activities and enthusiasm for learning to develop learning achievements (Suryani et al., 2020; Albana & Sujarwo, 2021; Mulyasari & Sholikhah, 2021).

Realizing the urgency of increasing robotics learning achievement in higher education, the learning process in the digital era is pursued by using a media that can add complete student attraction to learning activities, strengthen students to be able to form their knowledge, explore the meaning of the learning material being studied, be able to think higher-level, innovative and rational and be able to relate learning material to life situations every day (Anggraini et al., 2022; Kanti et al., 2022; Ekayana, 2022). One form of learning media that adopts learning independence is explainer video type learning videos (Sunami & Aslam, 2021; Ikbal & Cantika, 2022).

Research results from Savitri et al. (2022), revealing the application of explainer videos in the learning process effectively develops students' critical thinking skills and learning independence. Moreover, Andriani and Dewi (2022) and Ikbal and Cantika (2022) show that using explainer videos encourages understanding concepts and student learning interests. Research results Sunami & Aslam (2021), explain that learning videos are effectively used to develop learning independence in online learning synchronously and asynchronously. Educators must pay attention and choose the suitable method according to the characteristics of students to develop the explainer video learning media. According to Savtri, Akhbar, and Aryaningrum (2022), in developing learning media in the form of explainer videos, several things need to be considered, namely the analysis of development needs must be prepared, requiring teamwork between creators and validators (Kanti et al., 2022b), Requires facility support to support video development optimization (Sunami & Aslam, 2021), Preparation of relevant material, requires a relatively

long time and higher costs and learning independence that is too high resulting in students lacking discipline and often delaying completing assignments (Santyasa, Rapi, & Sara, 2020). Students often feel bored if lecturers use the lecture method and there is less variety in learning activities (Santyasa, Santyadiputra, & Juniantari, 2019; Pratiwi & Santyasa, 2021; Ekayana, Muku, & Hartawan, 2021).

Media development needs to consider appropriate learning strategies by the characteristics of the course and students to encourage students to learn proactively. In order to strengthen and focus learning materials on explainer videos, the development of explainer video media needs to use microlearning learning strategies. According to Nugraha et al. (2021), Microlearning is a learning method that allows students to learn anytime and anywhere using small learning materials partitioned in each material sub-chapter. Microlearning strategies allow teaching material or learning outcomes to be broken down into minor points or units, including short learning through images, text, shapes, graphics, and videos (Elpina & Haris, 2023; Simanjuntak & Haris, 2023).

According to Horst & Dorner (2019), the Microlearning learning strategy is an approach that prioritizes the division of learning content into smaller parts and allows independent learning. In this strategy, learning materials are broken down into smaller units, including short lessons in the form of explainer videos (with a maximum duration of 5 minutes). Research results (Yusnidar & Syahri, 2022), Revealing case-study-based microlearning in learning research methodology significantly influences learning outcomes. Research results from (Rafli & Adri, 2022), Explaining Infographic-Based Microlearning in Entrepreneurship Learning Provides Learning Attraction to Students. Research results by Nugraha et al. (2021), Explaining the development of microlearning teaching materials can be adjusted into six forms, one of which is explainer videos, and each form of media developed has its characteristics. Research results in Fitria (2022) explained that the microlearning method accommodates different student learning styles and can be adjusted to student needs.

Based on the problems described, using microlearning methods has had a lot of good impacts on student learning outcomes. Microlearning in previous studies collaborated with case studies, infographics, presentation slides and interactive video conferences, and gamification. It was widely applied to social group learning, but video-explainer-oriented microlearning methods in scientific learning (computers and electronics) have not been widely implemented. So that this research can produce and implement on a limited scale microlearning-oriented explainer videos in robotics courses in higher education.

RESEARCH METHODS

Developing a learning media requires a series of steps to ensure the designed product can be tested for feasibility and effectiveness in learning activities (Borg & Gall, 2002). This research is included in the development research category by adopting the Plomp model. The validation flow of product development in the Plomp development model includes the preliminary, prototyping, and assessment phases. The Plomp model development pipeline is shown in Figure 1.

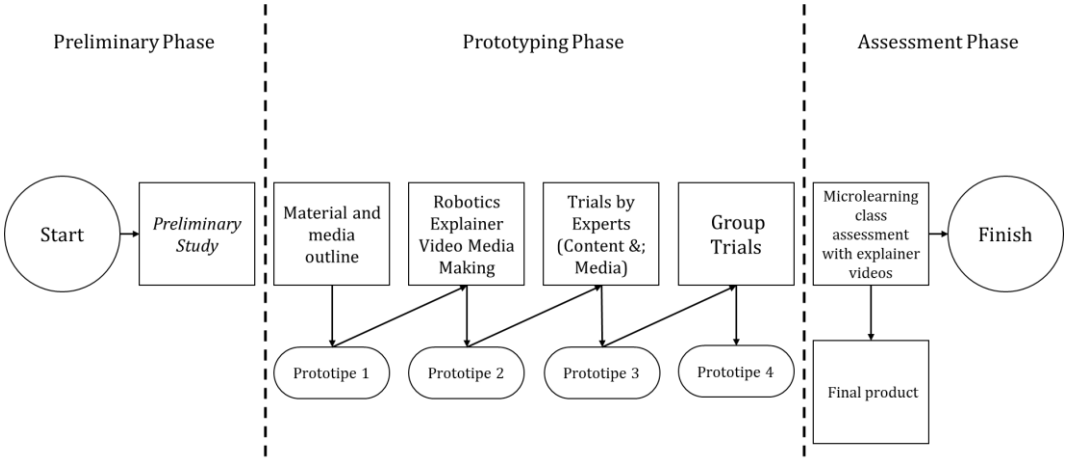

Figure 1. Plomp Development Research Flowchart
(Microlearning Video Explainer Robotics)

To achieve product development goals, the development model becomes an essential reference. The resulting product must refer to the model and undergo feasibility testing to ensure the product meets the needs and desired development goals. The activity in each phase in the Plomp model is described in Table 1.

Table 1. Plomp Model Development Phase

No	Phase	Activity
1	Introduction	In the preliminary phase, a Preliminary Study was carried out at the research location, a literature review and prepared a framework for developing explainer videos and microlearning method studies.
2	Prototyping	The process of developing and making explainer videos is microlearning-oriented. Starting from the initial prototype to the final prototype and carrying out a series of trials by experts (content and media)
3	Evaluation	Assessment in one related class tested the effectiveness of explainer videos and statistical tests (T-tests) of microlearning-oriented explainer videos.

Research Instruments

The research used instruments to assess aspects of explainer video validity, the practicality of explainer videos, and learning effectiveness using microlearning-oriented explainer videos. The description of the instruments is shown in Table 2.

Data Collection Methods

The quality of explainer videos in microlearning is assessed in three parts: the validity of explainer videos, the practicality of explainer videos, and effectiveness. In order to obtain research data, the right way is needed, as the data collection method used in this study is as follows. 1) The validity of the explainer video the feasibility of the explainer video can be known from validation by material experts in robotics in the form of a checklist and validation by media experts in questionnaires. 2) The practicality of explainer videos and the practicality of

explainer video learning media are tested by referring to the usefulness of explainer video learning media in microlearning learning. This practicality can be evaluated through a questionnaire that collects responses from lecturers and students regarding the explainer video learning media used.

Table 2. Instrument Grille

Assessment Aspect	Instruments	Information
Content & Media Expert Validation	Material expert validation sheet	The instrument is a checklist that measures the material's content in the explainer video.
	Media expert validation sheet	Instruments are questionnaires that measure appearance, graphics, functionality, design organization, and usability.
The Practicality of Video Explainer Learning Media in Microlearning	Lecturer response sheet	Instruments in the form of checklists assess the appearance, language, layout, content, accuracy of illustrations and usefulness.
	Student response sheet	The instrument is a checklist that measures appearance, language, layout, accuracy of illustrations, and usability.
The Effectiveness of Explainer Videos in Robotics Learning	Questionnaire sheets &; tests related to robotics materials	Instruments in the form of questionnaires and essay tests related to robotics material before and after using explainer videos

Through questionnaires, data can be obtained related to the extent to which lecturers consider explainer video learning media practical. Lecturers can provide assessments related to ease of use, availability of relevant content, suitability to the subject matter, and features that facilitate effective learning. The lecturer's response provides an essential perspective in evaluating the level of practicality of explainer video learning media. Meanwhile, student response questionnaires can provide insight into the extent to which explainer video learning media can provide practical learning experiences. Students can provide assessments related to the affordability and clarity of videos, clarity of concept information conveyed, success in facilitating understanding of the material, and suitability to individual learning styles. 3) The effectiveness of explainer videos in improving the understanding of robotics material can be measured by referring to the set learning objectives. In this case, explainer video media as a learning aid is expected to increase students' understanding of robotics material. Essay tests can be used as an assessment instrument to evaluate the extent to which learning objectives are achieved.

This essay test will cover a variety of questions related to robotics materials, designed to measure a holistic understanding of robotics materials. Combining the

use of explainer videos and essay tests with the correct scoring rubric can measure the effectiveness of explainer videos in microlearning learning related to robotics materials and assess student progress in learning the material.

The data obtained from the data collection results are then analyzed using relevant data analysis techniques. Analysis of research data used using a combination of qualitative and quantitative analysis (mixed method). The purpose of using the mixed method is data analysis so that the research provides comprehensive results and can be developed in the following research. Data from the review process from material experts, media, lecturers, and students were analyzed using qualitative, while data sourced from instruments using the Likert scale and test instruments were analyzed using quantitative. The decision on the validity and practicality of the explainer video is first calculated as a percentage. The percentage results obtained are used as a basis for making decisions regarding the validity and practicality of explainer videos that have been developed. The decision is included in the rating scale category. The rating scale is a reference and decision-making of a media that has been developed, which is based on the percentage results that have been analyzed in the quantitative form to be described comprehensively in the form of elaboration (qualitative).

Table 3. Rating Scale Categories

Achievement Level (%)	Qualification	Information
90 - 100	Excellent	No revision required
75 - 89	Good	No revision required
65 - 74	Good enough	Revised
55 - 64	Not good	Revised
0 - 54	Very unfavorable	Revised

Data on the effectiveness of microlearning-oriented explainer video media on robotics learning were collected through test instruments. The test data was distributed to a class of 25 students. The test was given before and after students learned to use explainer videos to two groups in pairs, in the sense that the subject was the same, but there were two treatments (pretests & posters). The test data is analyzed using a two-sample *t*-test by building the H_0 hypothesis; the H_0 hypothesis will be tested, where the achievement of learning robotics before and after using explainer video media with microlearning methods is no different. The test compares the value of count with t_{table}, or the *Sig*.-value with α=0.05. If the t_{critic} is greater than t_{table}, H_0 is rejected.

RESULTS AND DISCUSSION

The digital era changes how students learn; they now prefer to read or teach materials via the internet/online (Hendikawati et al., 2019). Dealing with this, it is necessary to seek a solution to implementing learning that supports changes in these ways of learning (Qerimi et al., 2023; Sumarmi, Irawan, & Aliman, 2021). The solutions developed also need to pay attention to the characteristics of the material and students to provide a contemporary learning atmosphere through changes in student learning styles (Syahri et al., 2021; Grothaus, Dolch, & Zawacki-Richter, 2021). After going through the preliminary research process related to the need for

innovation that supports the current learning process, media was developed as explainer videos by adopting the microlearning method. Microlearning strategy is a learning strategy that divides material into small parts so that students can better understand learning objectives (Rafli & Adri, 2022; Yusnidar & Syahri, 2022). Microlearning-oriented explainer videos are a breakthrough in robotics courses where it was tough for students to understand how concepts related to robotics that has an impact on learning achievement obtained are less than optimal (Simanjuntak & Haris, 2023; Elpina & Haris, 2023).

The results of explainer video media development are measured based on three aspects: validity, practicality, and effectiveness (Jeki et al., 2023), measuring the validity of explainer video media using expert judges, namely material experts and media experts. The assessment given by material experts related to the material's content on the explainer video media that the media developed is in line with the planned materials. This explainer video supports the learning process for students in learning robotics material. This explainer video also has the function of adopting different learning styles and fast, slow learners in learning. Explainer videos also help students prepare before learning in the classroom (Amalia et al., 2022), Because teaching materials in the form of explainer videos can be given before the learning process meeting in class. The scene in the explainer video is shown in Figure 2.

Figure 2. Graphic display of explainer video

The second assessment on the validity aspect is testing from media experts, where media testing will be assessed on the explainer video media developed. The aspects assessed are appearance, graphics, functionality, and design contained in the explainer video media. The average assessment score given by media experts is 96.7% and, if matched into the rating scale table, is included in the outstanding category. The opinion given by media experts on explainer videos that have been developed is that these explainer videos provide a form of learning that is to the point of the material delivered and adds motivation to learning (Yasin, Anwar, & Luneto, 2021). The use of images, videos, and graphics in the video greatly supports student understanding in learning, aligning with the learning objectives to be achieved (Darojat, Ulfa, & Wedi, 2022).

Based on the assessment of material and media experts on explainer video media, it was concluded that the validity of explainer videos developed for robotics learning materials is excellent. Therefore, the assessment proceeded to the experimental test stage of explainer video media, which was assessed by lecturers who taught robotics courses and small-group students. The results of testing by media experts are shown in Table 4.

Table 4. Results of Media Explainer Video Trial from Media Experts

Assessment Aspect	Criterion	Percentage (%)	Information
Explainer Video Graphics	1. Use of fonts	95	Excellent
	2. Layout and layout	95	Excellent
	3. Display design	98	Excellent
Video Explainer functionality	4. Media suitability	98	Excellent
	5. Design organization	95	Excellent
	6. Operating technique	98	Excellent
	7. Usefulness	98	Excellent
	Average	96, 7	Excellent

The practicality of explainer video media is assessed from the responses of lecturers who teach robotics courses and students who study robotics. Testing the practicality of a developed media is very important to measure how practical and easy it is to use by users, so explainer video media needs to be assessed directly by those who use it, namely lecturers and students. The practicality aspect of media is assessed from several categories, namely appearance, content, and language. The assessment results from the lecturer's side of the explainer video media get an average score of 96.1%. It is included in the outstanding category if matched with the rating scale. The opinions expressed by the lecturer who teaches robotics courses are related to explainer video media, where this video media is beneficial in strengthening the concepts of students who will study robotics courses (Ma & Li, 2021). Students get the essence of existing learning resources related to robotics through the explainer video. The aspects of appearance, content, and language used in explainer videos are very suitable to the current learning concept, with the existence of this explainer video makes students able to prepare more innovative ideas in the learning process (Ratnawati et al., 2021).

Table 5. Results of the Practical Trial of Explainer Video Media from the Lecturer's side

Assessment Aspect	Criterion	Percentage (%)	Information
Display	1. Video Display Quality	96	Excellent
	2. Character suitability	96	Excellent
	3. Material suitability	98	Excellent
Content	4. Suitability of purpose	98	Excellent
	5. Accuracy of the material	96	Excellent
	6. The content on the video resonates with students	95	Excellent
Language	7. Appropriateness of intonation, style of language	95	Excellent
	8. Voice clarity	95	Excellent
	Average	96,1	Excellent

Furthermore, responses from students who took robotics courses gave an average score of 96.5% and entered the outstanding category. Student assessment

of explainer video media is fascinating, and the explanation presented on the media is obvious and helps in learning. The aspects of understanding, appearance, interest, and attractiveness of the developed media are excellent. In addition, explainer video media supports several examples of robotics applications that exist in the real world, thus making the activities carried out support constructivist learning (Budyastuti & Fauziati, 2021; Masgumelar & Mustafa, 2021), Where students build their understanding through the learning resources used and the environment to strengthen the concepts of the material they learn. The results of testing the practicality of explainer video media from the student side are shown in Tables 5 and 6.

Table 6. Results of the Practical Trial of Video Explainer Media from the Student Side

Assessment Aspect	Criterion	Percentage (%)	Information
Understanding	1. Language	95	Excellent
	2. Learning materials	95	Excellent
	3. Needs in the learning process	98	Excellent
Display and	4. Video views	98	Excellent
Quality	5. Explainer videos are presented in contextual and up-to-date	98	Excellent
Interests and Interests	6. Fostering learning motivation when using explainer videos	95	Excellent
	Average	96,5	Excellent

Testing the validity and practicality of explainer video media has entered the four prototype media by obtaining excellent results. The next stage is entered at the effectiveness test stage, using class trials and assessments using tests (pretest and posttest). The stages in carrying out the effectiveness test include 1) providing tests related to robotics material before being given explainer video media, 2) explainer video media given to all students through live viewing in class and played twice, 3) students are given back the previous test to do, and finally students are given a questionnaire of responses related to explainer video media that has been aired. The results of class responses to explainer video media gave excellent results. Students are very interested in learning robotics materials through explainer videos; besides that, through explainer videos, students get more precise information related to the material being given.

Effectiveness testing is carried out by providing students with pretest and posttest test instruments. The test instruments provided have been tested for validity and reliability. The reliability test results with Alpha Cronbach get a result of 0.852, indicating that the instrument used has high internal consistency. The pretest and posttest results obtained from students are tested for data normality using Kolmogorov Smirnov with the results obtained by the distribution of incoming data in the standard distribution so that it can be continued on the *t*-test. Table 7 is a summary of descriptive statistics for pretest and posttest data.

Table 7. Pretests and Posttest Achievement Learning Robotics

Statistics Descriptive	Robotics Learning Achievements	
	Pretest	Posttest
Mean	60,53	81.75
StDev	10,112	7,163
Varian	102,174	51,012
Max	75	92
Min	40	68

Table 7 shows the results of student learning achievement through the implementation of pretests and posts related to robotics materials. The results obtained are differences between learning before and after using explainer videos. The results obtained are still in the form of an average score for pretests of 60.53, while the average score for posttest is 81.75. The test results provide information about differences in learning achievement's mean score (average). However, these results are insufficient to decide whether the difference in learning achievement is due to the use of explainer video media. Therefore, *t*-test with statistical assistance is needed to conclude the explainer video media's effectiveness in learning.

Table 8. Paired Sample Test Results Using Explainer Video Media

	Mean	StDev	*t*	*df*	*Sig*. (2-tailed)
Pretest-Posttest	-21.328	10.945	-9.129	21	.000

Based on Table 8, statistical test results were obtained from the pretest and posttest results. In this data, paired samples test results were obtained in the mean column of 21.328 and std deviation of 10.945. The calculated value obtained is 9.129, and when compared to t_{table}=2.068, the count is much higher, and the *Sig.* The value obtained from this test is 0.000, then the *Sig.*-value compared to the significance level (α=0.05, obtained *Sig.* value is much smaller than 0.05. Therefore, referring to these results can be drawn conclusions rejecting H_0, where the achievement of learning robotics before and after using explainer videos is different.

The success of research on developing microlearning-oriented explainer video media gets perfect scores in terms of validity, practicality, and effectiveness. Although the results of this study received perfect scores from media testing that has been carried out, there are still limitations and shortcomings in this study. The limitation of this study is that the explainer video was developed only to strengthen the understanding of the initial concept, namely at meeting 1 – meeting three, and has not accommodated all meetings carried out in the robotics learning process. Follow-up in the future is expected to develop media that accommodate middle and final meetings to support learning activities through project or case activities and strengthen student learning experiences.

CONCLUSION

Developing microlearning-oriented explainer videos is a breakthrough that should be developed in the robotics learning process. Explainer videos for robotics courses were successfully developed, and a series of tests were carried out: validity,

practicality, and effectiveness. The test results revealed that the explainer video got excellent results. Explainer videos are also carried out with statistical testing (T-test) to measure the average difference in learning, where there are differences before and after the media is used, which has an impact on increasing learning achievement. The practical benefits of the results of this research are a breath of fresh air for students studying robotics in adding relevant references to reinforce concepts in learning. It is hoped that in the future, it will provide more contemporary learning resources and support technological developments in the field of learning in the digital era. Explainer videos are supported for lecturers and students in strengthening learning activities to achieve the expected learning outcomes. This research in the future can be continued at the quasi-experimental research stage by comparing learning outcomes using explainer videos with the usual learning model (direct learning).

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