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Development of Interaction Dynamics Oriented Learning Video to Support Mathematics Learning in Higher Education

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ABSTRACT

..The integration of interactive media in mathematics education remains limited, particularly in fostering active engagement and meaningful dialogue between lecturers and students. To address this gap, this study developed a mathematics learning video based on interaction dynamics and integrated it with the Edpuzzle platform. The novelty of this research lies in embedding structured interaction patterns within a digital video environment, promoting dialogic learning, pedagogical reflection, and sustained student engagement—elements often lacking in conventional instructional videos. The development process followed the ADDIE model, encompassing five stages: Analyze, Design, Develop, Implement, and Evaluate. This study involved 30 university students from two institutions in Bali. The final product is an interactive video that includes embedded questions and supports both synchronous and asynchronous interactions. Validation was conducted using the Learning Object Review Instrument (LORI) by two content experts and two media experts, while practicality was assessed through the User Experience Questionnaire (UEQ) completed by student participants. The results indicated that the video is highly valid in terms of content and design. Practicality findings revealed excellent ratings in attractiveness, efficiency, clarity, and novelty. These outcomes suggest that the developed video not only enhances the delivery of mathematics content but also supports student engagement and pedagogical development. In conclusion, the study produced a valid and practical interactive video that serves as a promising model for technology-enhanced learning in mathematics education.

Keywords: Learning Video, Interaction Dynamics, Edpuzzle, ADDIE, Mathematics Learning, Practicality, Validity.

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Introduction

Learning mathematics in higher education, especially for students majoring in mathematics education, has its own challenges in terms of engagement, understanding abstract concepts, and mathematical communication skills. In today's digital era, the utilisation of technology in learning is a necessity, especially in the context of higher education which is required to be adaptive and flexible. One of the developing approaches is the application of interaction dynamics, which is the management of interactions between lecturers and students synchronously (directly) and asynchronously (indirectly) to create meaningful and participatory learning experiences (Borba et al., 2016; Mohammad et al., 2024).

This approach has been shown to increase student engagement in mathematics learning, both through real-time online discussions and flexible forum-based collaboration (Mallet, 2008; Yorganci,

2025). In addition, interactions designed with attention to social presence and the active role of lecturers can encourage deeper understanding of mathematical concepts (Brinkerhoff et al., 2024). Therefore, the integration of technology and appropriate interaction strategies is essential to create adaptive, collaborative, and 21st century competency development-oriented mathematics learning.

However, the reality in the field shows that the utilisation of learning media, especially learning videos, still tends to be one-way and does not fully support the dynamics of active interaction. Students are often passive recipients of information, without enough space to interact meaningfully, both with lecturers and fellow students, in a flexible time. This issue is aligned with findings from Mayer's Cognitive Theory of Multimedia Learning (Mayer, 2009), which emphasizes that meaningful learning occurs when learners actively engage with content through selecting, organizing, and integrating information. One-way videos, which do not encourage this engagement, may hinder deeper cognitive processing. Moreover, Moore's (1989) Theory of Interaction in Distance Education identifies three critical types of interaction: learner-content, learner-instructor, and learner-learner. Traditional learning videos predominantly support only learner-content interaction and often neglect the other two forms, which are essential for fostering deeper understanding and collaborative learning.

A number of previous studies have highlighted the effectiveness of online learning, blended learning and the use of learning videos. These studies show that digital media can help improve understanding and learning outcomes, especially during the pandemic (Hermawan et al., 2019; Nikmawati et al., 2019; Radović et al., 2020). However, these studies generally have not explicitly integrated the concept of interaction dynamics, especially in the context of media development that allows a combination of synchronous and asynchronous interactions (Borba et al., 2016; I. Jayantika & Namur, 2022; Rajendra & Sudana, 2018). Interactive learning videos can enhance conceptual understanding, boost student engagement in discussions and collaboration, and increase motivation by offering flexible access to material and supporting deeper learning through group or class interaction (Kay, 2012; Aprilia et al., 2022; Brillian, 2023; Nurwahidah, 2021; Sherer & Shea, 2011). For the next, interactive learning videos designed with user-friendly principles and based on digital technology have a high level of validity based on media expert tests (Tzavara et al., 2018). This shows a research gap in the development of learning videos that are not only informative, but also communicative and interactive according to the characteristics of mathematics learning in higher education (Yorganci, 2025).

Furthermore, there is an anomaly between theory and practice. In theory, technology-based learning is believed to improve student motivation and learning outcomes (Nursidiq, 2023; Permatasari, 2020). However, in practice, students often feel isolated in online or video-based learning due to the lack of two-

way interaction and feedback (Brinkerhoff et al., 2024; Mallet, 2008; Payadnya & Agung Ngurah Trisna Jayantika, 2022). On the other hand, lecturers also have difficulties in facilitating complex mathematical communication through media that are limited to presenting information.

This research plays an important role in filling this gap by developing a learning video specifically designed to support interaction dynamics-oriented mathematics learning. By presenting interactive elements in the video through Edpuzzle that can be integrated in the learning video, as well as scenarios for its use in synchronous and asynchronous contexts, it is hoped that this model will not only strengthen the quality of teaching, but also open up opportunities for further research to develop more humanistic and dynamic media in mathematics education (Ade et al., 2025; Mahendra et al., 2022; Vahini, 2022).

In the context of educating prospective mathematics teachers, pedagogical skills—particularly the ability to select and utilize learning media that support interaction—are essential. The learning experience created through interaction dynamics-oriented learning videos not only enhances students' understanding of mathematical content but also equips them with the ability to design interactive instruction when they become educators (I. G. A. N. T. Jayantika et al., 2019; Sari et al., 2022). Therefore, the development of this learning media serves not only to improve the effectiveness of current learning but also as a long-term investment in producing adaptive, reflective mathematics teachers who can facilitate 21st-century learning environments.

The novelty of this research lies in its specific focus on embedding interaction dynamics into a video-based learning environment tailored for prospective mathematics teachers, utilizing the Edpuzzle platform. While previous studies, such as by Yulianti et al. (2021), have focused on the effectiveness of video-based learning in improving mathematical understanding (Lestari, 2021), and Putra & Widodo (2022) explored interactive videos to boost student motivation, they did not explicitly address the development of pedagogical skills or simulate classroom interaction within the video structure . Similarly, research by murtafiah (2023) emphasized multimedia integration in mathematics learning but lacked synchronous and asynchronous interaction features linked to teaching practice (Murtafiah et al., 2023). This study goes beyond delivering content or enhancing motivation—it positions the video as a tool for modeling pedagogical strategies and facilitating dialogic, interactive learning. It also incorporates structured interaction points that promote active reflection and teaching scenario design, elements critical for pre-service teacher development.

The implications of this research are twofold. First, it provides a practical model for creating digital learning media that enhances both content mastery and pedagogical thinking. Second, it contributes to

mathematics teacher education by promoting reflective, student-centered instructional approaches aligned with 21st-century educational demands.

The next section presents the methodology that includes research design, research subjects, data collection techniques and data analysis techniques used in this study. Furthermore, the results of this study and the discussion of the results obtained are presented. At the end of this section, conclusions from the research results, limitations and recommendations that become opportunities for further research are presented.

Methods

This research is a Research and Development (R&D) study with the ADDIE model. The ADDIE model involves five phases, including analyse, design, develop, implement, and evaluate(Zhang & Tian, 2024). This model is considered systematic and flexible to be applied in learning media development, including in the context of mathematics education which demands adaptive instructional design.

This research produced a valid, practical and effective Edpuzzle-integrated learning video developed through the five steps of the ADDIE model. The integration of Edpuzzle allows lecturers to insert interactive quizzes and immediate feedback in the video, which is aligned with the goal of creating interaction dynamics-based mathematics learning. By following the structured stages in the ADDIE model, this media development process is not only result-oriented, but also pays attention to the sustainability of the effectiveness of media use in the long term (Kathryn et al., 2016). The subjects of this study were all students taking calculus I course. This research involved 30 students spread across two universities in Bali. Where the implementation of learning is carried out combined with two dynamics of interaction in learning, namely synchronous and asynchronous. The edpuzzle integrated learning video developed was used in both synchronous and asynchronous learning.

The data in this study were collected using Learning Object Review Instrument (LORI) questionnaire and User Experience Questionnaire (UEQ) questionnaire. The LORI questionnaire was used to collect validity data for both material experts and media experts. Meanwhile, the UEQ questionnaire was used to measure the practicality of the edpuzzle integrated learning video.

The edpuzzle-integrated learning video developed will be tested for validity and practicality of the integrated process at the stages of the ADDIE model. The stages of development with the ADDIE model are described as follows.

Table 1. Research Implementation According to ADDIE Flow

No	Stages	Activity description

1	Analyze	At this stage, needs analysis and curriculum analysis were carried out
2	Design	At the design stage, a draft of the edpuzzle-integrated learning video was developed based on the results of the needs and curriculum analysis at the previous stage. In addition, at the design stage, the story board of the edpuzzle integrated learning video was developed.
3	Develop	At this stage, the content of the edpuzzle-integrated learning video is developed based on the draft which is the output of the design stage. At this stage, the validity of the product is tested by 4 experts, namely 2 media experts and 2 material experts. The instrument used for the validity test is LORI.
4	Implement	At this stage, students were tested by applying the learning video integrated with edpuzzle. At this stage, practicality testing is carried out with the UEQ questionnaire.
5	Evaluate	The evaluate stage is integrated in each stage.

The data in this study were collected using LORI questionnaire and UEQ questionnaire. The LORI questionnaire was used to measure the validity of the developed product. The LORI questionnaire was given at the develop stage which involved 2 material experts and 2 media experts. The lattice of the LORI questionnaire is presented in the table below.

Table 2. LORI Questionnaire for Material Expert

No	Aspect	Indicator
A	Content Quality	1. Rigour of the material
		2. Accuracy of material
		3. Regularity in presentation of material
		4. Accuracy in the level of detail of the material
B	*Learning and Alignment*	1. In accordance with the learning objectives
		2. In accordance with the learning activity
		3. In accordance with the assessment in learning
		4. In accordance with student characteristics
C	*Feed-back and adaptation*	Adaptation or feedback content can be executed by different learners or learning models
D	*motivation*	Ability to motivate and attract student attention

Table 3. LORI Questionnaire for Media Expert

No	Aspect	Indicator
A	Presentation Design	Multimedia design (visual and audio) can help improve and streamline learning.
B	Interaction Usability	1. Ease of navigation
		2. Predictable display
C	Accessibility	Ease of access
D	Reusability	Ability to be used in different learning variations and with different students
E	Standards compliance	Adhere to international standard specifications

The UEQ questionnaire is used to measure the practicality of the product when it is tested in classroom learning. The indicators of this UEQ questionnaire are presented in the table below.

Tabel 4. User Experience Questionnaire

No	Indicator	Definition
1	Attraction	The user's general perception of the product as a whole, including impressions of whether the product is fun, interesting or boring.
2	Agility	The ease with which users understand and learn to use the product, including whether the product feels easy to learn and logical.
3	Efficiency	The extent to which users can complete tasks quickly and without excessive effort when using the product.
4	Accuracy	The user's level of trust in the product, including perceived control, predictability, and consistency of the system.
5	Stimulation	The extent to which the product is able to provide a fun, engaging, and motivating experience for the user.
6	Novelty	Perception of how innovative and creative the product is, and the extent to which the product feels interesting and not boring due to its uniqueness.

Results and Discussion

Results

The interaction dynamic orientated learning video developed in Calculus I course is an Edpuzzle integrated learning video. This video is grouped into 4 topics that are assigned to 4 Edpuzzle classes according to the topic, namely Calculus I course Part 1 Class related to Topic Chapter 1 Real Number System, Calculus I course Part 2 Class related to Topic Chapter 2 course Functions, Calculus I course Part 3 Class related to Topic Chapter 3 Limit, Calculus I course Part 4 Class related to Topic 4 Derivative. Edpuzzle application is a programme that can be accessed online at https://edpuzzle.com/

The video development went through the ADDIE stages which are described as follows:

1. Analyze

Findings from the analysis of the Calculus I course reveal that many students struggle with grasping abstract mathematical concepts, especially within key topics such as the real number system, functions,

limits, and derivatives. Some students have a weak mathematical foundation, as well as a lack of interest and ability to explore the material independently. Teaching materials that are generally used consist of PowerPoint presentation slides from lecturers, Calculus I course textbooks as the main reference, and some learning videos that are less interactive.

The learning methods applied in Calculus I courses include lectures accompanied by discussions, discovery learning, and Problem-Based Learning. However, these methods have not optimally created student interaction and collaboration in learning. Discussions and interactions are often dominated by students with more abilities.

2. Design

The video is designed to cover 4 topics, which are Topic Chapter 1 Real Number System, Topic Chapter 2 Functions, Topic Chapter 3 Limits, Topic 4 Derivatives. These four topics will later be assigned to 4 Edpuzzle classes. The video content is made so that the explanation from the resource person is not monotonous, only displaying text related to the material. However, there is interaction in the video when the teacher explains a material. Furthermore, in certain minutes, questions related to the lecturer's explanation will be inserted. Students must answer these questions to be able to continue the video. This is the emphasis of the interaction dynamic aspect, which is creating interaction between lecturers and students synchronously (directly) and asynchronously (indirectly). Interaction dynamic can be improved through learning by integrating learning videos. According to Kay (2012), learning videos that are designed interactively can improve concept understanding while stimulating students to be more active in discussion and collaboration (Kay, 2012). In addition, research by Sherer and Shea (2011) also shows that the use of video media can create a richer and more dynamic learning experience, as students can access the material flexibly and deepen it through group interaction or class discussion (Sherer & Shea, 2011).

At the beginning of the topic, a contextual video is designed as the opening video of each topic. This video will provide an overview of the topic discussed and aims to arouse student motivation and interest in listening to videos related to the topic. Video integration in learning is one way to increase motivation and interest in learning (Aprilia et al., 2022; Brillian, 2023; Nurwahidah, 2021).

3. Develop

Edpuzzle integrated learning video content development is carried out based on the draft which is the output of the design stage. Here is how the class video looks like on Edpuzzle.

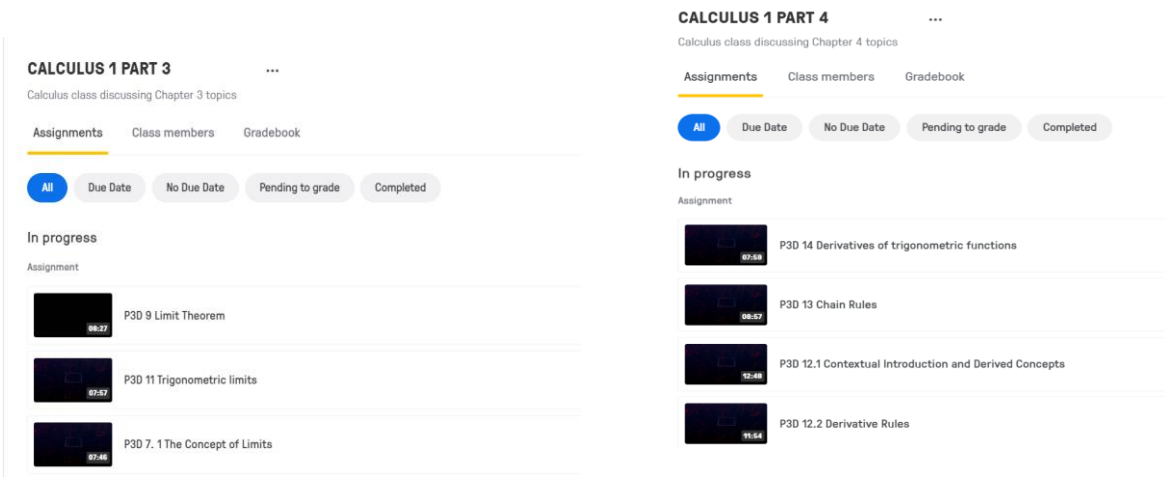

Figure 1. Edpuzzle Classroom View

Each topic is assigned to the appropriate class because in 1 topic consists of several videos according to the subtopic. Here is a video display on each topic.

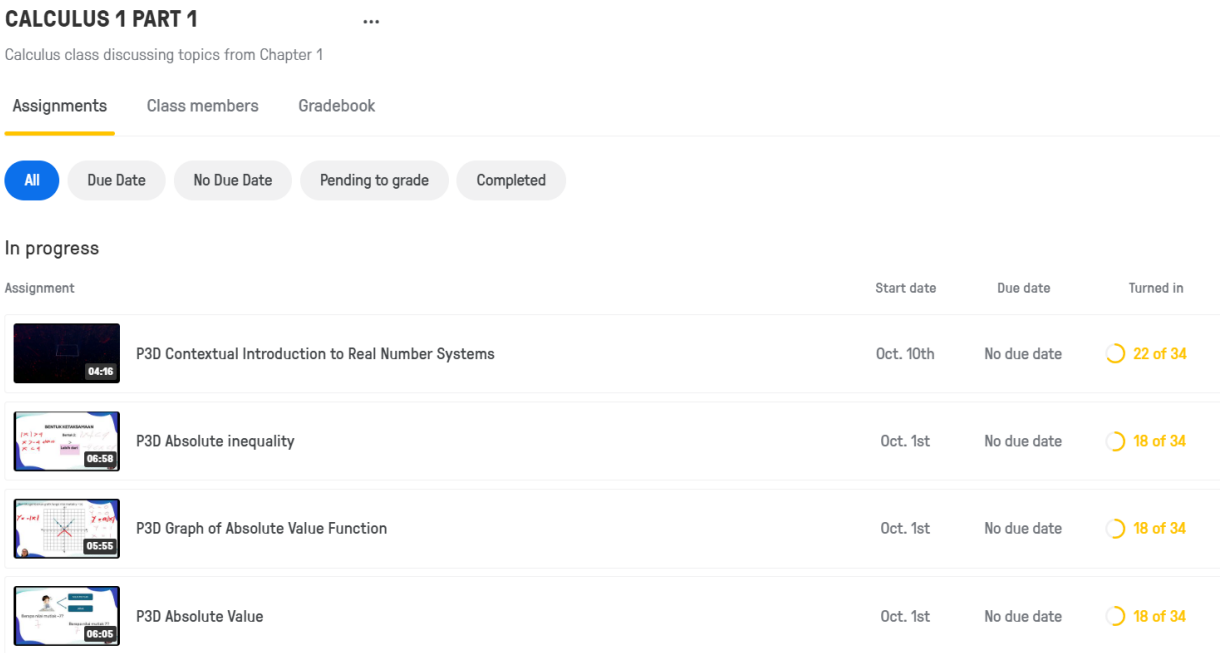

Figure 2. Video Display Topic 1 Real Number System

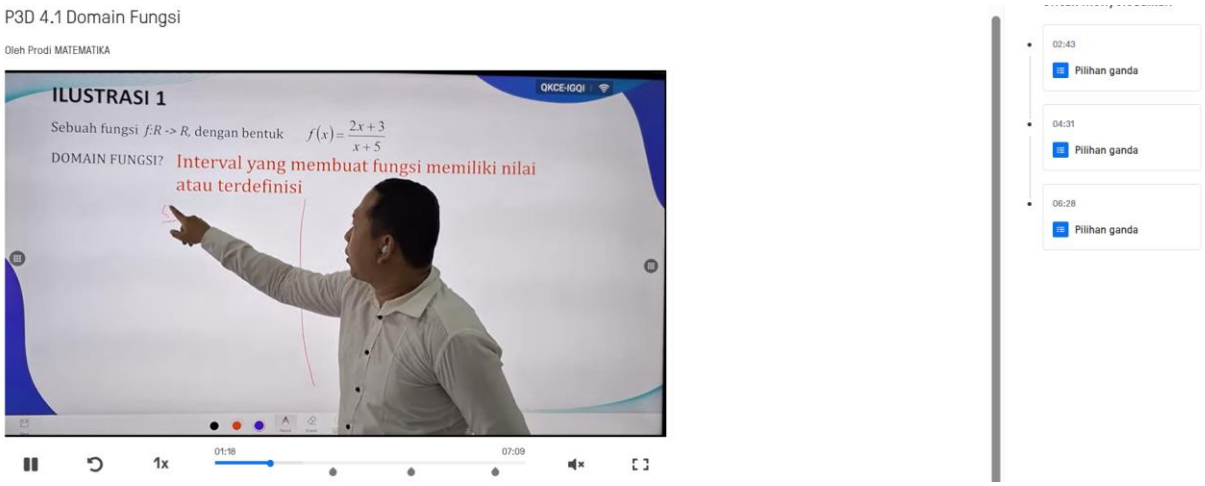

Figure 3. Video Display integrated with questions

Translation:

P3D 4.1 function domain

First illustration

A function $f : R \to R$, in the form of $f(x) = \dfrac{2x+3}{x+5}$. What is the domain of this function?

"the interval that makes the function have a value or be defined"

In this video, students are given a video of the presentation of the material and integrated with questions that must be worked on by them. The video that is developed cannot be accelerated or skipped. The questions integrated in the video must also be worked on because there is a report for the lecturer regarding the work on the questions as seen in the picture below.

Putri, Gayatri	0/100	1/1	Jan 9
Agustinakurniati, Tinakurniati	33/100	1/1	Okt 29
Jenai, Rosy	33/100	1/1	Nov 11
Adi Irwansyah, Rama	67/100	1/1	Nov 8
Anandita, Friska	67/100	1/1	Nov 12
Jelita Ingel, Adelvina	67/100	1/1	Okt 31
Goring, Maria Anggriana	100/100	1/1	Nov 1
Dwipa Dianariska	100/100	1/1	Okt 29
Ni Komang Suningsih	100/100	1/1	Okt 26

Figure 4. Video Display integrated with questions

Figure 4 is a report in one edpuzle video. This report can automatically be accessed by lecturers through classes that have been created in the lecturer's edpuzle account. The data provided in this report are the scores obtained by students and the duration of students watching the video. The green line shows the duration of watching by students. This report also provides the scores obtained by students when working on questions integrated with the video. These data show how students perform in the learning process.

The duration of the video developed in each video is no more than 10 minutes to anticipate student boredom in watching the video. Subtopic videos with dense material are made into several videos to keep the duration from being long. Brame in 2016 stated that learning videos are not only related to their content, but also very much related to how the content is presented. Likewise, (Naidoo & Hajaree, 2021) stated that long video durations tend to be ineffective and are not watched by students when learning is carried out online.

Furthermore, at this stage, the validity testing of the product was carried out by 4 experts, namely 2 media experts and 2 material experts. The instrument used for the validity test was LORI with the following results.

Table 5. Validation Results

No	COMPONENT	Average Score	CRITERIA
1	Edpuzzle Learning Video Material Validation	4,45	Very worthy
2	Edpuzzle Learning Video Media Validation	4,42	Very worthy

Based on the validation results, it was found that learning videos can be used in Calculus I course. Of course, with suggestions for improvements that need to be made, namely related to the material explained in the video so that it directs students to the concept, and is able to develop students' critical thinking.

4. Implement

The trial was conducted on students by implementing edpuzzle integrated learning videos. The following are student responses to the trial conducted.

Table 6. Trial Responses

No	Aspect	Response
1	Learning Video Display	Most students considered the video display to be quite good and interesting, although there were some notes regarding the sound quality and the use of music in some parts that were considered distracting.
2	Language in Video Learning	The language used in the videos was considered simple, easy to understand, and appropriate. However, some students wanted more structured language to improve comprehension.
3	Material in the Learning Video	The majority of students considered the material presented to be quite clear and interesting, although some found it difficult to understand.

The results of student responses to the use of learning videos showed generally positive responses, with some notes for improvement. In terms of appearance, the video was considered quite good and interesting, although there were complaints about the sound quality and the use of music which was considered distracting. The language used in the video was considered simple and easy to understand, but some students suggested the use of more structured language for optimal understanding. Meanwhile, the learning material was considered quite clear and interesting, although some students felt that there were still parts that were difficult to understand and required a more systematic delivery.

After several improvements were made based on the trial response, it was continued with implementation. Product implementation was carried out on Mathematics Education students of PGRI Mahadewa University and partner students from IKIP Saraswati Tabanan. Evaluation of product implementation was carried out using the User Experience Questionnaire (UEQ). The following are the results of the UEQ analysis.

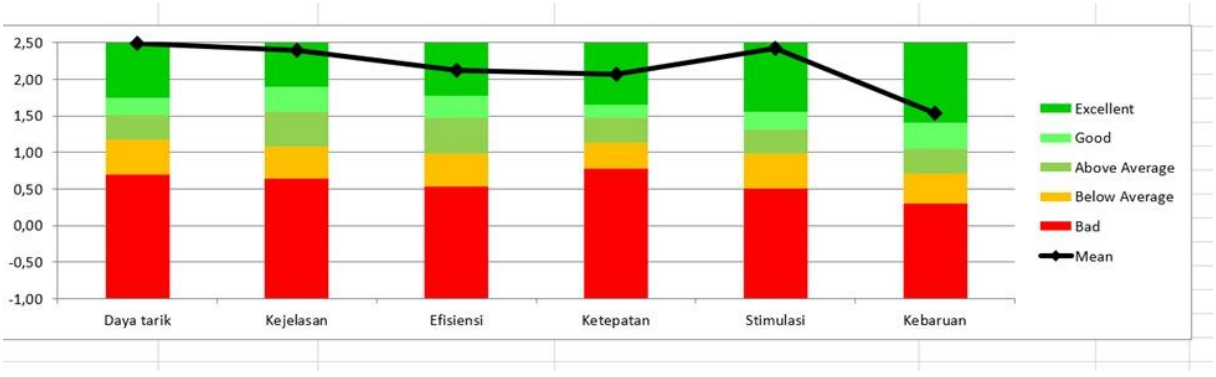

Figure 6. UEQ Analysis Results

Based on the diagram, it can be seen that each UEQ indicator, namely Attractiveness, Clarity, Efficiency, Accuracy, Stimulation, and Novelty of the product are in the Excellent category. This indicates that the practicality of the product is very good.

5. Evaluate

Students need an approach that can motivate exploration of abstract concepts and application of formulas. Structured learning media is needed to improve understanding and independence. However, it can still create interaction and collaboration. The media that can be used is a learning video oriented to interaction dynamic which aims to increase student involvement. This video is integrated with Edpuzzle which can facilitate the interaction dynamic aspect. The product developed has been validated by media and material experts, so it is very feasible to be implemented. The trial results show that the product is very practical according to the indicators in UEQ.

Discussion

The use of learning videos with Edpuzzle shows high validity because it is able to integrate interesting visual content with interactive features that support active student engagement. Edpuzzle allows the insertion of questions, comments, and discussions directly into the video flow, so that it not only conveys information in one direction but also invites students to think critically and actively during the learning process. This is in accordance with the principles of active learning recommended in constructivist theory, which emphasizes the importance of student participation in building understanding.

From the perspective of media expert analysis, the validity of Edpuzzle videos is reflected in their technical aspects and effective design. Experts assess that the visual appearance, audio quality, and flow of presentation of the material in the video are in accordance with the standards of good learning media. In addition, the Edpuzzle platform which is easy to access and use also increases the suitability of this media as a means of online or hybrid learning. The interactivity provided by Edpuzzle adds value to this media, because it not only presents information but also measures student understanding in real-time. This is in line with the research findings of Tzavara (2018), which state that interactive learning videos designed with user-friendly principles and based on digital technology have a high level of validity based on media expert tests (Tzavara et al., 2018).

Meanwhile, from the analysis of material experts, the validity of the video can be seen in the suitability of the content to the curriculum, the accuracy of the concepts conveyed, and the relationship between the material and learning objectives. Material experts stated that the content developed in the Edpuzzle video has contained clear learning indicators, uses language that is appropriate to the level of cognitive development of students, and presents contextual examples that support understanding of

concepts. Research by Faridi (2021) supports this by stating that the validity of the material in video-based learning media increases when the content is developed with reference to the curriculum and involves experts in the validation process. In addition, the learning video product with edpuzzle is also concluded to be very practical through practicality tests on lecturers and students (Faridi et al., 2021).

The practicality of learning videos with Edpuzzle is very much felt in the context of lectures, because this platform makes it easy for lecturers to deliver material flexibly and in a structured manner. Lecturers can upload relevant learning videos, insert questions, and provide additional explanations in important parts. This entire process can be done without requiring special technical skills, making it easier for lecturers to design interactive digital learning. Students can also access these videos at any time through their devices, allowing them to adjust their study time to their own rhythm. Research by Maulidya and Zain (2023) states that lecturers at the tertiary level consider Edpuzzle to be a very practical medium because its features support independent and collaborative learning (Zain-alabdeen, 2023).

In addition, in terms of learning management, Edpuzzle offers high efficiency for lecturers. With the student activity tracking feature, lecturers can find out who has watched the video, answered questions, and how far they understand the material. The results of the answers can be directly summarized in the Edpuzzle system, so lecturers do not need to make separate evaluations or correct them manually. This is very helpful especially in large classes, where individual evaluations can be very time-consuming. In Fitra (2021) study, lecturers stated that using Edpuzzle reduces the administrative burden, as well as makes it easier to provide more targeted feedback to students (Fitra & Maksum, 2021).

From a student perspective, Edpuzzle learning videos are considered very practical because they allow them to learn according to their needs and pace. Students can pause, repeat, or speed up the video according to their understanding, and answer questions directly which makes them more active during learning. The comments and notes feature from lecturers inserted in certain parts of the video also helps students understand important points without having to take notes manually. Narbito (2022) research found that students felt helped by the clear and interactive learning structure through Edpuzzle, and felt more prepared to discuss or complete assignments after watching learning videos(Narbito et al., 2022) . Therefore, Edpuzzle is a practical and effective solution in technology-based learning in higher education.

The limitations of this study that can serve as a basis for future research include: (1) the limited implementation context, as the trial was conducted only at two higher education institutions with a focus on Calculus I, making the generalizability of the findings to other courses or institutions restricted; (2) the effectiveness of the media in improving student learning outcomes has not been explored in depth; and (3) the video content remains basic due to time constraints aimed at maintaining student engagement..

Conclusion

This study produced a mathematics learning video based on interaction dynamics integrated with Edpuzzle through the ADDIE development model approach. The developed video successfully created a more interactive, communicative, and adaptive learning experience for students' needs in calculus I course. Validation by material and media experts showed that this product was in the very feasible category, both in terms of content and media appearance. In addition, the results of the practicality test using the UEQ questionnaire indicated that the learning video was very practical to use, with all indicators in the very good category. Thus, this learning media can be an innovative solution in supporting mathematics learning in higher education, especially in creating meaningful interactions synchronously and asynchronously.

This study has several limitations. First, the implementation of the product was only carried out at two higher education institutions in Bali with Calculus I courses, so the generalization of the results in the context of other courses or institutions is still limited. Second, the aspect of learning effectiveness in terms of improving student learning outcomes has not been studied in depth, because the focus of the study is more on the validity and practicality of the media. Third, the duration and depth of the video material are limited to remain interesting and not burden students, which causes the presentation of the concept to be still basic.

Further research is recommended to test the effectiveness of this learning video on improving students' learning outcomes and critical thinking skills quantitatively. In addition, the development of similar videos can be extended to other mathematics courses with variations in pedagogical approaches to accommodate various learning styles. Future researchers are also encouraged to integrate collaborative interaction elements, such as group discussions or peer feedback through the Edpuzzle platform or Learning Management System (LMS), to enrich the dynamics of interaction and bring the learning experience closer to real classroom situations.

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References

Ade, I. P., Payadnya, A., Atmaja, I. M. D., Noviyanti, P. L., & Wibawa, K. A. (2025). Exploring " Wa

Pat Nem Tus Dasa ” : the potential of a Balinese traditional mod 2 counting system in culturally based mathematics learning. *Journal for Multicultural Education*. https://doi.org/10.1108/JME-02-2025-0050

Aprilia, S. I., Ratnasari, D., Yahya, M. S., Islam, U., Sunan, N., Yogyakarta, K., Islam, U., Saifuddin, N., & Purwokerto, Z. (2022). Penggunaan Video Pembelajaran Untuk Meningkatkan Motivasi Belajar. *Evaluasi: Jurnal Manajemen Pendidikan Islam*, *06*(01), 87–95.

Borba, M. C., Askar, P., Engelbrecht, J., Gadanidis, G., Llinares, S., & Sánchez, M. (2016). Blended learning , e - learning and mobile learning in mathematics education. *ZDM Mathematics Education*. https://doi.org/10.1007/s11858-016-0798-4

Brillian, M. T. (2023). Behind the Scenes of Learning : Analyzing the Influence of Video Quality and Technology on Student Motivation and Understanding Di Balik Layar Pembelajaran : Analisis Pengaruh Kualitas Video dan Teknologi pada Motivasi dan Pemahaman Mahasiswa. *Jurnal Ilmu Informasi Perpustakaan Dan Kearsipan*, *12*(02), 75–82.

Brinkerhoff, M. R., Porter, E., & Anderson, J. (2024). Success in Asynchronous Courses Through Increasing Student ’ s Social Presence. *Journal of Higher Education Theory and Practice*, *24*(7), 113–121.

Faridi, H., Tuli, N., Mantri, A., Singh, G., & Gargrish, S. (2021). A framework utilizing augmented reality to improve critical thinking ability and learning gain of the students in Physics. *Computer Applications in Engineering Education*, *29*(1), 258–273. https://doi.org/10.1002/cae.22342

Fitra, J., & Maksum, H. (2021). Efektivitas Media Pembelajaran Interaktif dengan Aplikasi Powntoon pada Mata Pelajaran Bimbingan TIK. *Jurnal Pedagogi Dan Pembelajaran*, *4*(1), 1–13.

Hermawan, E., Jayantika, I. G. A. N. T., & Andari, N. K. L. (2019). Pengaruh Media Pembelajaran Audiovisual dalam Bentuk Diktat Kartun Terhadap Hasil Belajar Siswa dengan Mengontrol Kemampuan Numerik Siswa. *Jurnal EMASAINS*, *VIII*(1), 122–130.

Jayantika, I. G. A. N. T., Parmithi, N. N., & Dyanawati, N. P. A. (2019). Quantum teaching learning model as solution to improve learning activity and mathematics learning outcome. *Journal of Physics: Conference Series*, *1321*(2), 1–6. https://doi.org/10.1088/1742-6596/1321/2/022119

Jayantika, I., & Namur, G. (2022). Peran teknologi pembelajaran dalam meningkatkan literasi digital matematika. *Indonesian Journal of Educational …*, *3*, 284–291. https://doi.org/10.5281/zenodo.7033331

Kathryn, A., Hess, N., Greer, K., & Hess, N. (2016). Designing for Engagement : Using the ADDIE Model to Integrate High-Impact Practices into an Online Information Literacy Course Designing for Engagement : Using the ADDIE Model to Integrate High-Impact Practices into an Online Information Literacy Course. *Communications In Information Literacy*, *10*(2), 264–282.

Kay, R. H. (2012). Computers in Human Behavior Exploring the use of video podcasts in education : A comprehensive review of the literature. *Computers in Human Behavior*, *28*(3), 820–831. https://doi.org/10.1016/j.chb.2012.01.011

Lestari, I. (2021). *Experiential learning using STEM approach in improving students ’ problem solving ability Experiential learning using STEM approach in improving students ’ problem solving ability*. https://doi.org/10.1088/1742-6596/1806/1/012005

Mahendra, I. W. E., Parmithi, N. N., & Jayantika, I. G. A. N. T. (2022). *Combining STEAM learning and*

performance assessment to optimise students ' higher-level thinking abilities. *20*(4), 258–263.

Mallet, D. G. (2008). Asynchronous Online Collaboration As A Flexible Learning Activity and An Authentic Assessment Method in An Undergraduate Mathematics Course. *Education Tech Research Dev*, *4*(2), 143–151.

Mohammad, N. M., Nica, M., Kraus, D., Levere, K. M., & Okner, R. (2024). Student experience using synchronous and asynchronous instruction in mathematics classes. *Pedagogical Research*, *9*(2).

Murtafiah, W., Diah, N., Lestari, S., & Yahya, F. H. (2023). How Do Students ' Decision-Making Ability In Solving Open-Ended Problems ? *Journal of Mathematics Education*, *12*(1), 133–150.

Naidoo, J., & Hajaree, S. (2021). Exploring the perceptions of Grade 5 learners about the use of videos and powerpoint presentations when learning fractions in mathematics. *South African Journal of Childhood Education*, *11*(1), 1–12. https://doi.org/10.4102/sajce.v11i1.846

Narbito, R. S., Trinova, Z., Supit, D., & Salim, N. A. (2022). Jurnal Pendidikan dan Konseling. *Manajemen Pendidikan Dengan Pendekatan Tpack Sebagai Solusi Pembelajaran Jarak Jauh Di Era Society 5.0*, *4*(5), 8471–8481.

Nikmawati, E. E., Widiaty, I., Achdiani, Y., Hurriyati, R., & Mubaroq, S. R. (2019). Educational digital media for traditional food of Kampung adat cireundeu: An ethnopedagogy perspective. *Journal of Engineering Science and Technology*, *14*(5), 2540–2551.

Nursidiq, et al. (2023). Penerapan Video Pembelajaran Untuk Meningkatkan. *Jurnal Pembelajaran Matematika Inovatif*, *6*(2), 441–448. https://doi.org/10.22460/jpmi.v6i2.11155

Nurwahidah, et. a. (2021). Media Video Pembelajaran Dalam Meningkatkan Motivasi Dan Prestasi Mahasiswa. *Rausyan Fikr*, *17*(1).

Payadnya, I. P. A. A., & Agung Ngurah Trisna Jayantika, I. G. (2022). How do Digital Native Students Responses to Balinese Ethnomathematics Problems? *Jurnal Pendidikan Progresif*, *12*(2), 785–795. https://doi.org/10.23960/jpp.v12.i2.202230

Permatasari, K. . (2020). Efektivitas Pembelajaran Daring Menggunakan Media Online Di Masa Pandemi Covid-19 Pada Mahasiswa Pgmi Staim Blora. *Jurnal Ilmiah Pedagogy*, *15*(3).

Radović, S., Radojičić, M., Veljković, K., & Marić, M. (2020). Examining the effects of Geogebra applets on mathematics learning using interactive mathematics textbook. *Interactive Learning Environments*, *28*(1), 32–49. https://doi.org/10.1080/10494820.2018.1512001

Rajendra, I. M., & Sudana, I. M. (2018). The Influence of Interactive Multimedia Technology to Enhance Achievement Students on Practice Skills in Mechanical Technology. *Journal of Physics: Conference Series*, *953*(1), 012104. https://doi.org/10.1088/1742-6596/953/1/012104

Sari, D. M., Herawati, S., Vermana, L., Matematika, M. P., & Hatta, U. B. (2022). Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Cerita Berdasarkan Prosedur Newman Pada Kelas XI MIPA 1 SMAN 5 Padang. *JURNAL TUNAS PENDIDIKAN*, *5*(1).

Sherer, P., & Shea, T. (2011). Using Online Video to Support Student Learning and Engagement. *COLLEGE TEACHING*, *59*, 56–59. https://doi.org/10.1080/87567555.2010.511313

Tzavara, A., Komis, V., & Karsenti, T. (2018). A Methodological Framework for Investigating TPACK Integration in Educational Activities using ICT by Prospective Early Childhood Teachers. *Italian Journal of Educational Technology*, *26*(1), 71–89. https://doi.org/10.17471/2499-4324/976

Vahini, et. al. (2022). Pengembangan Video Pembelajaran Interaktif Berbasis. *Jurnal Pendidikan Dan*

Pembelajaran Matematika Indonesia, *11*(1), 9–18.

Yorganci, S. (2025). The impact of synchronous online discussions and online flipped learning on student engagement and self - regulation among preliminary undergraduates in a basic math course. In *Educational technology research and development* (Issue 0123456789). Springer US. https://doi.org/10.1007/s11423-025-10459-0

Zain-alabdeen, E. H. (2023). Evaluation and Perception of an Edpuzzle Class Compared with a Traditional Class among Oral Radiology Undergraduate Students. *European Journal of General Dentistry*, *12*(2).

Zhang, X., & Tian, D. (2024). Effects of applying blended learning based on the ADDIE model in nursing staff training on improving theoretical and practical operational aspects. *Front. Med.*, *June*, 1–10. https://doi.org/10.3389/fmed.2024.1413032