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Development of Animated Videos for Nutritional Value Calculation for Agricultural Processing Vocational Students

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ABSTRACT

The objective of this research is to develop and evaluate the feasibility of a whiteboard animation video explaining the calculation of nutritional value information. This study employs the R&D (Research and Development) method using the 4D model (define, design, development, disseminate). The first stage, define, involves analyzing the problem, learners, curriculum, and material. The design stage includes the preparation of materials, storyboard, video script, animated images, and the formation of a production team. Development is the production phase of the media and validation by media and material experts. Dissemination involves the open distribution of the video via uploading to YouTube. The production of the video was dynamic and constrained by costs, labor, and time, necessitating further feasibility validation by users. The research results include: 1) A 12-minute and 54-second video discussing nutritional information and its calculation, uploaded to the Boga UNY YouTube channel. 2) The evaluation results show a high feasibility level, with a score of 95.56% by media experts and 96.89% by material experts. User assessments indicate a score of 90.05% by 30 students from the XII Agribusiness Agricultural Product Processing class at SMK N 1 Pandak. The video is considered highly suitable for use as an educational medium, thus not requiring immediate reproduction.

Keywords: Calculation of nutritional value information, animated educational video

INTRODUCTION

Digitalization is a key feature influencing various aspects of life in the era of the Fourth Industrial Revolution. This transformation presents significant challenges in industries, education, and politics. The ability to leverage digital technology is crucial in today's workforce. Both education and industry must develop transformation strategies that consider human resources with competencies in technology.

A crucial aspect supporting this transformation is the level of digital technology mastery. The teaching and learning process must integrate digital technology. Information and Communication Technology (ICT) is vital for educational advancement at all levels (Tatnall, 2020). The use of technology in education can

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enhance the efficiency and quality of students' tasks and unlock the potential for developing new skills (Mourtzis et al., 2018).

Education continues to evolve with technological advancements. Education 4.0 introduces digital learning that combines the flexibility of distance learning with face-to-face social interaction. It emphasizes competencies, practical experience, and the shift of teachers' roles to mentors (Goldin et al., 2022). Teachers need to transform traditional teaching methods into innovative, student-centered approaches, catering to Generation Z.

Generation Z, raised in a technology-driven culture, requires flexible, technology-based learning (Scholz & Vyugina, 2019). They possess different thinking and problem-solving abilities compared to other generations with limited technological skills (Malyn-Smith & Angelie, 2020). They independently seek information on the internet and prefer engaging audiovisual learning methods (Cilliers, 2017).

Audiovisual technology is an effective tool for interacting with students (Ramlatchan, 2019), and video technology has become a popular educational medium. Effective educational media should engage students, make learning enjoyable, and convey information clearly and concisely (Martin & Bolliger, 2018). The use of media is essential as it allows students to explore further and understand messages through direct actions (Mfreke Umoh & Bassey, 2020).

Educational videos are one of the best methods in learning. TechSmith (2020) found that 83% of people prefer watching videos over reading text or listening to audio. Over 70% of YouTube users use the platform to solve problems.

Videoscribe, software for creating hand-drawn animation videos, is an effective tool for delivering engaging and interactive educational material (Air et al., 2015b). Videoscribe enables users to create attractive videos without special training (Lindsay, 2015). In the digital era, educational media such as videos provide better access and enhance self-learning abilities. Videoscribe, as hand-drawn animation video-making software, is an effective tool in the learning process.

The development of video is an ever-changing field that requires continuous adjustment. Effective video production must follow the latest trends, technologies, and techniques. However, video production is constrained by costs, time, and labor (Korkut et al., 2015), and once completed, it is difficult to change. Before deciding to reproduce a video, its relevance must be considered.

Vocational High Schools aim to train job skills and produce work-ready graduates. One of the competencies in SMK is Agribusiness of Agricultural Product Processing (APHP), which involves understanding agricultural products and processing them. APHP graduates are expected to have skills in processing agricultural products and preserving materials, as well as an understanding of food quality and safety.

The development of educational media focuses on core competency 3.11, which is the evaluation of basic material quality testing, part of the Basic Quality Control of Agricultural Products subject. This competency is foundational in the field of Agribusiness of Agricultural Product Processing, aiming to strengthen the understanding of agricultural product testing, including chemical tests such as carbohydrates, proteins, fats, water, and ash in agricultural materials.

Educational media are needed to support learning in SMK. The use of educational video media with material on calculating nutritional values on product packaging is important due to the lack of similar media. This video can help students understand the Basic Quality Control of Agricultural Products material more deeply. It is expected to facilitate student learning, aid in material comprehension, and provide an overview of product processing, thereby assisting teachers in delivering the Basic Quality Control of Agricultural Products material.

PURPOSE OF THE STUDY

The purpose of this study is to develop and evaluate the feasibility of a whiteboard animation video that explains the calculation of nutritional value information, specifically designed to enhance the learning

experience of students in the Agribusiness of Agricultural Product Processing program at Vocational High Schools. The study aims to integrate digital technology into the educational process, improve the quality and efficiency of teaching and learning, and support teachers in delivering complex material in an engaging and understandable format. Additionally, the study seeks to assess the effectiveness of this educational media in facilitating student comprehension and its potential impact on educational outcomes.

METHOD

This study employs the Research and Development (R&D) method, which aims to create and test specific products (Sugiyono, 2014). The R&D method involves creating new products through surveys, experiments, action research, and evaluation (Mulyatiningsih, 2011). The products can include models, media, books, modules, evaluation tools, and more. These products are tested in cycles with evaluation and revision before being widely implemented or used in real situations. The development model used in this study is the 4D model, consisting of the stages: define, design, develop, and disseminate.

The defined stage of the research was conducted from August 2019 to March 2020 at SMK Negeri 1 Pandak. The design and development stages took place from August 2019 to March 2020 at UNY. The final dissemination was conducted in July-August 2023 at SMK Negeri 1 Pandak among students of the Agribusiness Agricultural Product Processing program to evaluate the video's feasibility after four years of development.

Participants

The primary data source for this research is obtained through questionnaires. The subjects include two material experts and one media expert. Additionally, the video was evaluated by 30 students from the Agribusiness Agricultural Product Processing program at SMK Negeri 1 Pandak, following Mulyatiningsih's (2011) guideline, which recommends involving a limited number of teachers and students (around 30-100) in the product distribution and testing phase.

Data Collection and Analysis

Data on the feasibility of the educational media were collected using closed-ended questionnaires administered to media experts, material experts, and students. Respondents used a Likert scale from 1 to 4 to assess feasibility, where 4 indicates very feasible, 3 feasible, 2 not feasible, and 1 very not feasible (Widyoko, 2012). The assessment results were based on respondents' answers to the questionnaires.

The data collection instrument was a questionnaire that evaluated the feasibility of the educational video. The questionnaire for media experts focused on aspects of media usage and benefits. The questionnaire for material experts assessed educational content, material, and video benefits. Meanwhile, the questionnaire for students included evaluations of learning, media, material, and video benefits. The data collection instrument follows the research methodology of Purwaningsih (2021), which is similar in developing educational videos using the R&D method and the 4D model. This research shares characteristics with the development of whiteboard animation videos using Sparkol Videoscribe.

This study uses descriptive analysis with descriptive statistics to assess the feasibility of the educational video. Data were collected using a 4-point Likert scale, measuring positive and negative responses to statements. Feasibility assessment was based on scores documented in Table 1.

Questionnaire results were processed by summing the ratings from all respondents for each question and then dividing by the number of respondents. Likert scale data from questionnaires are considered interval scale data. The numerical data from respondents were interpreted qualitatively and compared with the interval scale as per Mulyatiningsih (2011), shown in Table 2, after percentage calculations were completed.

Table 1. Feasibility Assessment Scores

Assessment Aspect	Score
Very Feasible (SL)	4
Feasible (L)	3
Not Feasible (TL)	2
Very Not Feasible (STL)	1

Table 2. Media Feasibility Categories

Score Range	Category
>80%	Very Feasible
66%-80%	Feasible
56%-65%	Not Feasible
<56%	Very Not Feasible

Using the feasibility categories in Table 2, the validation results can be assessed according to the established categories. This guideline is used to determine the feasibility criteria for the educational animation video. The animation video is considered feasible if the respondents' assessment meets at least the "feasible" criteria.

FINDINGS

The whiteboard animation video for vitamins was developed using the 4D approach as follows:

Define

The problem analysis, learners, and curriculum were analyzed in the define stage. Observations were conducted at SMK N 1 Pandak. Based on the curriculum and material analysis, SMK N 1 Pandak uses a student-centered learning approach, but the use of technology has not been fully explored. The teacher of Basic Quality Control of Agricultural Products stated that there was no existing educational media on the calculation of nutritional information.

The development focuses on core competency 3.11, evaluating the basic quality testing of materials, which is part of the Basic Quality Control of Agricultural Products course. This competency supports the understanding of agricultural product testing, including chemical tests for carbohydrates, proteins, fats, water, and ash in agricultural materials.

Analysis of student characteristics revealed that students' learning styles align with Generation Z traits, preferring individual, engaging, visual, and technology-based learning. However, educational media at SMK N 1 Pandak is limited to verbal media such as presentations, handouts, and books. The school has internet and generator facilities that can support ICT use in learning. Based on the define stage analysis, this study will develop a whiteboard animation video for calculating nutritional value information.

Design

The first step was to prepare the material. This stage involved breaking down the core and basic competencies in the SMK N 1 Pandak curriculum, including learning objectives and indicators. After the breakdown, validation was carried out by an expert with expert judgment, and revisions were made as needed, such as adjusting the nutritional requirement calculations using the latest standards.

The material was developed into a storyboard with two parts: visual and narration. The storyboard aimed to provide an overall view of the video flow and facilitate the scriptwriting process. The storyboard was organized into a table with columns for scene number, visual source, and narration. The narration

writing process involved drafting, feasibility assessment, and revision. The narration was written in conversational language, avoiding overly technical or complex terms (Clark & Mayer, 2016). Vocabulary use was simple and direct (Anggraeni et al., 2021a; Anggraeni et al., 2021b). The visual sources were animated images designed using Paint Tool Sai software through stages such as design, sketching, consultation, and coloring. Both material and media experts evaluated the storyboard.

The video production team included a scriptwriter and validator, illustrator, image format editor, voice-over artist, audio editor, and animator. Team members were selected based on their skills, experience in video development (Hansch et al., 2015), and their ability to create character designs and artistic skills suited to VideoScribe characteristics. The whiteboard animation video used colored images. The voice-over artist was chosen for their clear voice, lack of a strong local accent, and appropriate intonation. Figure 1 shows the storyboard development flow for the visual part, including design, sketching, sketch revision, and image coloring.

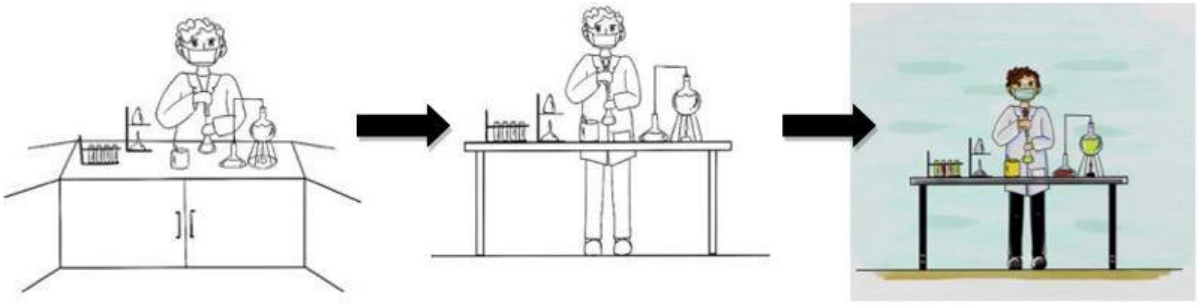

Figure 1. Storyboard Development Flow for Visuals

Develop

The animation video was developed using VideoScribe software. The initial animated images were created in JPEG format, then converted to SVG format using Inkscape. Only SVG format images draw well in VideoScribe (Air et al., 2015a). The voice-over was recorded using a Zoom H4N digital voice recorder with a condenser microphone and edited using Adobe Premier Pro.

After approval of the animated images and audio recordings, the animation process used VideoScribe software and audio integration with Filmora. The laptop specifications used were an HP Elitebook G1 Intel Core i5-4300U Haswell Up to 2.4GHz with 8GB RAM. The video was produced in mp4 format with a duration of 12 minutes and 54 seconds.

The produced video was evaluated for feasibility by media experts and material experts. The results of the feasibility test are presented in Table 3.

Table 3. Feasibility Test Results by Experts

Aspect	Material Expert	Media Expert	Category
Usage	97.50%	90.00%	Very Feasible
Benefit	100%	100%	Very Feasible
Media	-	96.67%	Very Feasible
Learning	95.83%	-	Very Feasible
Material	97.32%	-	Very Feasible
Total	96.89%	95.56%	Very Feasible

Figure 2(a) shows the video thumbnail on YouTube with an attractive image reflecting the content. One main feature of whiteboard animation is showing hand movements while drawing or writing, as shown in Figures 2(b), 2(c), and 2(d). The introduction includes general information on nutrition labels and proximate analysis in the laboratory, seen in Figures 2(b) and 2(c). The content on nutritional information calculation is shown in Figure 2(d). Each scene's duration was adjusted to match the voice-over narration.

Unlike typical whiteboard animation videos, this study used colored images to capture Generation Z students' attention. The video ends with a mind map summarizing all the material, as shown in Figure 2(e).

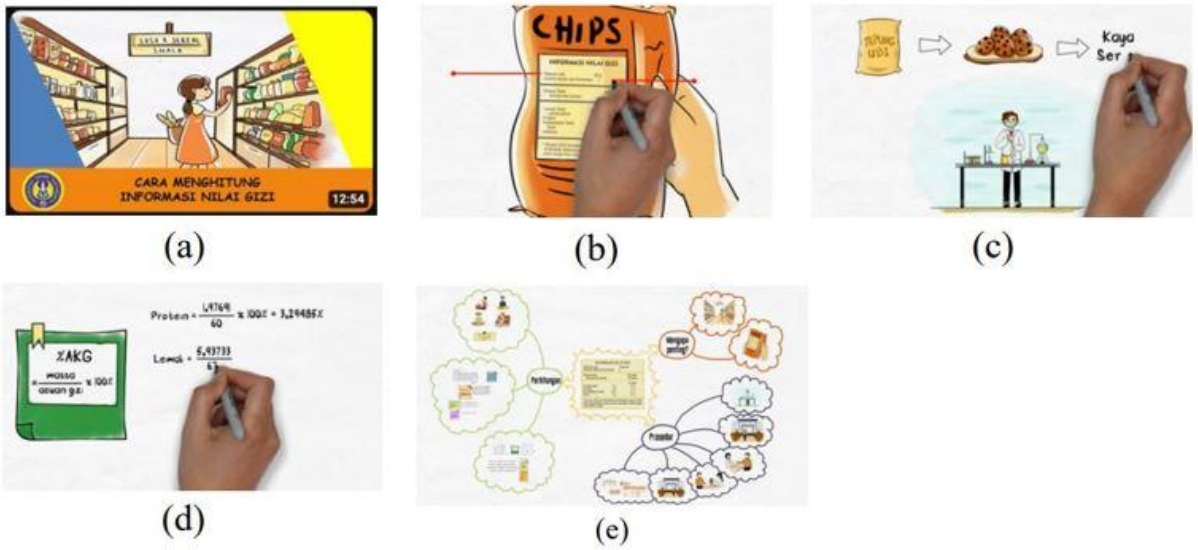

Figure 2. Nutritional Value Calculation Video Includes: (a) Thumbnail on YouTube, (b) Nutritional Information, (c) Proximate Analysis in the Laboratory, (d) Nutritional Value Calculation, and (e) Mind Mapping of the Entire Video Content

The results showed material expert scores of 86.25% and media expert scores of 96.21%, and by Rinawati et al. (2021), which showed material expert scores of 90.96% and media expert scores of 98.96%. Media experts suggested improvements to the video, including naming the video developers and possibly displaying proximate analysis in text form at the 2:35 mark. These suggestions will be considered for future revisions if time permits. Validation by material experts indicated the need to revise the nutritional requirement calculations to comply with the latest regulations, specifically the Indonesian National Agency of Drug and Food Control Regulation No.09 of 2016 on Nutrition Label References. These revisions will be revalidated until the material experts confirm the video's feasibility as an educational medium.

Disseminate

After incorporating feedback from material and media experts, the revised video was finalized with a duration of 12 minutes and 54 seconds. It was then openly disseminated by uploading it to the Boga UNY YouTube channel on March 21, 2020, accessible via this link, considering that over 70% of YouTube viewers use the platform to solve their problems (TechSmith, 2020). The nutritional value calculation video has garnered 9,710 views, 286 likes, and 0 dislikes over three years. It has also received positive feedback from the public, particularly from small business owners who found it beneficial based on the comments received.

With the dynamic progression of times, the 2013 curriculum has been replaced by the independent curriculum in 2023. Hence, a feasibility assessment by users was necessary to ensure that the video developed under the 2013 curriculum in 2019-2020 remains applicable under the new curriculum in 2023. The video is expected to benefit students and teachers by enhancing the quality of education under the new curriculum. The results of the feasibility assessment are shown in Table 4.

Table 4. User Feasibility Test Results

Aspect	Feasibility	Category
Learning	90.42%	Very Feasible
Media	91.02%	Very Feasible
Material	90.21%	Very Feasible
Benefit	91.67%	Very Feasible
Usage	86.94%	Very Feasible
Total	90.05%	Very Feasible

The difference in assessments between experts and students can be attributed to generational differences. Students, being part of Generation Z, are highly skilled in technology as they have grown up in the digital era. They are active users and adept at utilizing technology (Scholz & Vyugina, 2019). As digital natives, Generation Z students have different technological abilities than previous generations (Malyn-Smith & Angelie, 2020), giving them deeper insights into educational videos.

Video production evolves dynamically (LinkedIn, 2023), is constrained by costs, labor, and time (Korkut et al., 2015), and is difficult to modify once completed. The feasibility test of the nutritional value calculation video developed in 2019-2020, conducted with users in 2023, received positive feedback with a score of 90.05%. This indicates that the video is still highly suitable for use as an educational medium and remains relevant to current competencies, thus not requiring immediate redevelopment.

DISCUSSION

The study aimed to develop and evaluate the feasibility of a whiteboard animation video explaining the calculation of nutritional value information for students in the Agribusiness Agricultural Product Processing program at Vocational High Schools. The research employed the 4D model, encompassing define, design, develop, and disseminate stages. The problem analysis, conducted at SMK N 1 Pandak, identified a gap in the use of technology for teaching nutritional value calculation, aligning with the student-centered learning approach but lacking educational media. This aligns with previous findings by Tatnall (2020), highlighting the necessity of integrating ICT into education to enhance learning outcomes.

The feasibility evaluation by media and material experts indicated high feasibility levels, with scores of 96.89% and 95.56% respectively, corroborating the effectiveness of whiteboard animation as an educational tool. These findings are consistent with previous research by Surya et al. (2021) and Rinawati et al. (2021), who reported high feasibility scores for educational videos. The high feasibility rating suggests that the animation video meets the educational needs and preferences of Generation Z students, who favor engaging, visual, and technology-based learning methods (Scholz & Vyugina, 2019).

The user feasibility test conducted in 2023, three years after the video's initial dissemination, yielded a total feasibility score of 90.05%, further validating the video's suitability as an educational medium under the new independent curriculum. This ongoing relevance highlights the video's adaptability and effectiveness in enhancing the quality of education, as evidenced by its positive reception and significant viewership on YouTube.

The study contributes to the field of educational administration by demonstrating the practical application of R&D in developing educational media that effectively bridges curriculum changes and technological advancements. It underscores the importance of continuous evaluation and adaptation of educational tools to meet evolving educational standards and student needs. The research also offers valuable insights into the integration of digital media in vocational education, providing a model for future developments in educational technology.

However, the study faced limitations, including constraints on production costs, time, and resources, which are common challenges in video production (Korkut et al., 2015). These limitations suggest the need for sustainable funding and resource allocation strategies in future research and development projects. Additionally, the dynamic nature of technology and curriculum changes necessitates ongoing updates and revisions to maintain the relevance and effectiveness of educational media.

Future research should explore the long-term impact of such educational tools on student learning outcomes and engagement. It should also investigate the potential for scaling and adapting these tools across different educational contexts and subjects. By addressing these areas, future studies can further enhance the contributions of educational technology to the field of educational administration and management, particularly in areas such as educational leadership, policy and planning, academic economics, and educational politics.

In conclusion, the whiteboard animation video developed in this study has proven to be a highly feasible and effective educational tool, meeting the needs of both educators and students. Its success underscores the value of integrating innovative digital media into educational practices, paving the way for future advancements in educational technology and administration.

Product Limitations

The whiteboard animation educational video on calculating nutritional value information has several limitations, including:

1) The research only includes a feasibility test and does not cover the effectiveness of the learning.
2) The Basic Quality Control material is only partially explained in the video.
3) The video is uploaded on YouTube, requiring devices and internet data.
4) Limitations in video production skills necessitate collaboration with third parties, leading to a longer development duration.
5) Limited time for further video improvements.

CONCLUSION

The educational video was developed using the 4D approach (define, design, development, disseminate) and focuses on calculating nutritional value information for the Basic Quality Control of Agricultural Products course. The video content covers the importance of nutritional information on product packaging, the details on nutrition labels, how to obtain proximate analysis results, and the process of converting these results into nutritional value information. With a duration of 12 minutes and 54 seconds, the video was uploaded to the Boga UNY YouTube channel. The material experts rated the video at 96.89%, and media experts gave a score of 95.56%. User evaluations resulted in a score of 90.05%. These high ratings indicate that the video is highly suitable for use as an educational tool and does not require immediate redevelopment. The findings suggest that integrating engaging and visually appealing educational media like whiteboard animation videos can significantly enhance the learning experience for Generation Z students, who prefer interactive and technology-based learning methods. Future efforts should focus on maintaining the relevance and updating the content as needed to align with evolving educational standards and technological advancements.

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