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Developing Video for Food Analysis Course on the Subject of Effect of Yeast, Sugar, and Gluten to Bread Leavening

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Abstract. The study aimed to: 1) develop a video for Food Analysis Course, on the subject of effect of yeast, sugar, and gluten to bread leavening, 2) measure the feasibility of the video, 3) describe the improvement in learning outcome after using the video. The study was a research and development design adapted from Borg and Gall. The feasibility of the video was evaluated by a material expert, a learning media expert, peer reviewers, and teachers. The video underwent main field testing and operational field testing. The operational field testing used a single group pre-test post-test design. The field testing subjects were 38 students from Department of Food Engineering Education, Yogyakarta State University (YSU). The data were collected by video feasibility questionnaire and formative test. The feasibility of the video was analyzed descriptively. The improvement in learning outcome was analyzed using pair t-test. The results of the study revealed as follow. 1) The video for Food Analysis Course has been developed using a presenter format and consisted of opening, preparation, experiment, experiment result evaluation, and closing section. The video was combined with text animation, 2D/3D animation, and background music. The animation was used to visualize microbiological and chemical mechanism in the bread leavening. Video used mp4 format, had a duration of 11 minutes and uploaded to YouTube Channel Pendidikan Teknik Boga – Universitas Negeri Yogyakarta. 2) The video is very appropriate to be used as learning media for Food Analysis Course. 3) The use of the video improved students' learning outcome significantly at 95% confidence level.

INTRODUCTION

Flipped classroom is described as learning strategy that shifts traditional classroom activity (group learning space) to individual learning space at home, with the use of ICT (information and communication technology) [1]. In the flipped classroom design, the students are asked to access recorded teaching video or screencasts, and readings material at home using LMS (Learning Management System) [1]–[6]. LMS may facilitate other activity such as assignment, quiz, discussion and others [2], [5], [6]. After completing the online learning activity at home, the students come to the class. Class activity may vary from collaborative group work, presentation, discussion, problem-based learning, and project-based learning [1], [3], [7]. The flipped classroom is reported to improve conceptual coverage, student engagement, student motivation, peer interaction and teacher satisfaction [2], [5], [6], [8], [9]. The flipped classroom approach is supported by the learning strategy that originated from student-centered learning (SCL) to maximize class time with students' activity [1], [9], [4].

The main learning media used for flipped classroom strategy is video. It varies from recorded teaching video to recorded experiment video. Teachers may explain too fast or too slow depending on the learner individual speed. When teaching is shifting from class to individual space at home, the students have the ability to pause or rewind the teacher's explanation at the suitable speed of each student [3]. The video is important to teaching environment because

it stimulates the audio and visual, helps individual learning and can be used in distance education, blended learning and flipped classroom [10].

Food Analysis Course is a compulsory course in the forth semester in Department of Food Education Engineering, YSU. The course is a practical course discussing: 1) concept and procedure of food analysis, 2) analyze food to understand the effect of the cooking method to nutrients, 3) nutrition analysis and 4) nutrient labeling. Learning media includes hand-out, presentation media, and experiment procedure sheet. The learning design in Food Analysis Course is student-centered learning (SCL) facilitated by e-learning. LMS in YSU is developed using Moodle, named Be Smart V2. The learning activity is designed as flipped classroom. In the asynchronous activity, the students access the e-learning to read the text learning media and attempt the quiz. These activities should be performed before the students coming to the laboratory. Synchronous activity is carried out in Chemistry Laboratory, Faculty of Engineering, YSU. Experiment in Food Analysis Course is performed in groups of 2-3 students. Every group carries out different experiment. After the experiment is accomplished, each group presents the experiment. The presentation is followed by students' discussion. The teacher plays a role as a discussion moderator and facilitator as well as learning designer. According to teacher observation, the students didn't prepare well for the laboratory experiments because they didn't read the experiment procedure sheet. It decreased the students' independence and learning outcome. The students also demand audio-visual learning media to deepen their knowledge.

In order to implement flipped classroom learning strategy in Food Analysis Course, it is necessary to develop prerecorded experiment video. The video should be high-quality in audio and visual, have a duration of 10 – 15 minutes, use voice inflection to keep the students' engagement, have zoom-in and zoom-out images to keep the students focus, and incorporate text callouts to reemphasize the information visually [3]. This research would develop a video for Food Analysis Course, on the subject of effect of yeast, sugar, and gluten in bread leavening. The effectiveness of the video to improve students' learning outcome would be analyzed.

RESEARCH METHODS

Development Model

The study used research and development (R & D) design. R & D is used to design new products which then are field tested, evaluated and tested to meet the required standards [11]. The product developed in this study was a laboratory experiment recorded video. The development model was adapted from Borg and Gall [12]. The development procedure consisted of 10 stages, namely 1) information collecting, 2) planning, 3) product development, 4) preliminary field testing, 5) main product revision, 6) main field testing, 7) operational product revision, 8) operational field testing, 9) final product revision and 10) dissemination and implementation.

Stage 1 included to define the goal of the video and need assessment. Need assessment was performed through observation and interviews with students and teachers. Need assesment was necessary to gather data about the students and teachers' learning problem in Food Analysis Course, which was useful for the video development.

In the planning stage, learning material was written as experiment procedure sheet. The experiment procedure sheet was then designed as video script. The video script was a visualization of the video, which includes the determination of the main picture, additional picture, voice, background music, text animation, animation, duration, and location. After the video script had been developed, the presenter, model, and dubber were selected. The presenter would deliver learning material in the opening and closing section. The presenter was trained to memorize the script and show natural facial expression. The model would demonstrate preparation, experiment, and experiment result evaluation section. The dubber would deliver instruction during the demonstration in the preparation, experiment and experiment result evaluation section.

The third step was product development. The video script was then developed to video, collaborated with LabTV, YSU. The indoor shooting was performed in Chemistry Laboratory, Faculty of Engineering, YSU. The outdoor shooting was recorded in Faculty of Engineering, YSU. Video editing was carried out using Adobe Premier in LabTV, YSU. The recorded video was combined with sound, background music, text animation, picture animation and animation. The total duration was set to be 10 – 15 minutes to avoid audience's boredom. The extension of the video was *mp4*, as the standard of video extension in YouTube.

In the preliminary field testing stage, the video was then evaluated by a material expert, a learning media expert, peer reviewers and teachers. A material expert was an assistant professor in the field of Food Science and a learning

media expert was a lecturer in the field of Video and Broadcasting. Peer reviewers involved 3 assistant professors in Faculty of Engineering, whose expertises were learning media development. Teachers were 3 assistant profesors in the field of Food Science and Pattiserie.

After underwent an evaluation process, the video was revised. Main product revisions included retaking recorded video, retaking recorded dubber's voice, cleaning out the noise, fixing the lighting, inserting text and picture animation, and reselecting 2D/3D animation. The revised video was undergone main field testing stage. The main field testing was performed by 7 students by one-on-one testing (one evaluator working with one student) and 40 students in the real classroom. The results of the main field testing stage were analyzed, so that after minor operational product revision, the video could be used in operational field testing.

Operational field testing was performed using 38 students from the Department of Food Engineering Education, YSU and carried out as one-group pre-test post-test design. The results of the operational field testing were analyzed for further revision if necessary. The video was then disseminated through a seminar with colleagues and uploaded in the YouTube channel of Pendidikan Teknik Boga, Universitas Negeri Yogyakarta. The video was embedded in the LMS Be Smart V2 to be implemented as learning media.

Data Collection Instruments

The research data were collected using video feasibility questionnaire and formative test. The video feasibility questionnaire was developed using 1-4 Likert scale. The questionnaire for material expert consisted of 4 aspects of learning, material, usefulness, and usage. The questionnaire for learning media expert included 4 aspects of media quality (audio-visual, layout, animation, lighting, duration), usage, usefulness, and appropriateness as SCL media. The questionnaire for peer reviewer, teacher and student included 5 aspects of learning, media quality, material, usefulness, and usage. The formative test consisted of understanding in the bread chemistry and readiness to perform the experiment.

Data Analysis

The feasibility data were analyzed descriptively and converted to decide to the feasibility. Feasibility was calculated using Equation 1. Very appropriate was described as 75-100% of feasibility, appropriate as 50-74.9%, not appropriate as 25-49.9% and very not appropriate as 0-24.9%.

$$\text{feasibility} = \frac{\text{obtained score}}{\text{maximum score}} \text{ x } 100\% \quad \text{i)}$$

The formative test was performed as pre-test and post-test. The pre-test was undertaken before the students see the video. Post-test was applied after the students see the video. The difference between pre-test and post-test was analyzed through pair t-test, using Data Analysis plug-in from Microsoft Excel 2013. If the level of significance is less than 0.05, it can be concluded that Ho is rejected, or there is an improvement in learning outcome after the students used the video as learning material.

RESULTS AND DISCUSSION

Product Development

The video for Food Analysis Course has been developed. The video is recorded experiment about the effect of yeast, sugar, and gluten to bread leavening. The video also comes with 2D/3D animation to describe the microbiological and chemical mechanism in the bread leavening. The video was edited using Adobe Premiere. It has 11 minutes duration with *mp4* extension and uploaded to the YouTube channel of Pendidikan Teknik Boga, Universitas Negeri Yogyakarta. With the explosion of information and communication technology, the number of the video keeps growing and video sharing sites are becoming more popular, such as YouTube, Vimeo, TED-Ed, Khan Academy, Coursera, EdX, Udacity, and Iversity[13], [14], [15]. In 2018, YouTube is the number 4 among most visited

top sites in Indonesia [16]. Due to the popularity of YouTube in Indonesia, the university is encouraged to have its own YouTube channel as that happened in the United States [17].

The development of the video was started with video script. The video consists of 5 sections, namely opening, preparation, experiment, experiment result evaluation, and closing. Opening and closing section are delivered by the presenter. Presenter scene was recorded from head to waist to focus students' attention. The speed of the presenter's voice was set not too past so that the students understand the material presented. The facial expression had to be natural, smiling face and eyes kept focus on the camera. The presenter should look friendly to the students.

Opening Section

The video is started with text animation 15 seconds to reveal video and producer identity, such as video title, author, production time and author affiliation, as shown in Fig.1.

(a) (b) (c)

FIGURE 1. (a) Video title. (b) Video author and production time. (c) Author affiliation.

Presenter greets the students and explains learning outcome, as shown in Fig.2.(a). The presenter then explains a brief introduction about physical properties of the bread and microbiological and chemical mechanism in the bread leavening. Presenter explanation also comes with pictures and 3D animation as in Fig.2.(b) and (c). The picture and 3D animation go into the scene as the presenter is delivering the material. The picture and 3D animation were searched from Google and YouTube and they didn't have any license so that they could be reuse noncommercially with modification. The original source of the picture and animation is informed in the last scene of the video.

(a) (b) (c)

FIGURE 2. (a) Greeting from the presenter. (b) Bread picture to explain the physical properties of bread. (c) 3D animation to explain the microbiological and chemical mechanism in the bread leavening.

Preparation Section

(a) (b) (c)

FIGURE 3. (a) Model shows the equipment by hand. (b) The model shows the material by hand. (c) Material list.

Figure 3 shows preparation section. The preparation section is guided by dubber voice. Dubber mentions the name of the equipment and material used in the experiment. The model shows the equipment and material by hand, as shown in Fig.3.(a) and (b). The preparation section is ended by the list of equipment and material used in the experiment, as shown in Fig.3.(c).

Experiment Section

Figure 4 reveals experiment section. Dubber explains experiment process step by step and model demonstrate how to do the experiment. If the experiment is critical or has a high degree of difficulty, the experiment images will be zoomed in and dubber will explain the critical process, as shown in Fig.4.(b). The experiment section also displayed table that should be completed by the students during experiment process, as shown in Fig.4.(c). The green color section is the part of the table that should be filled during the experiment.

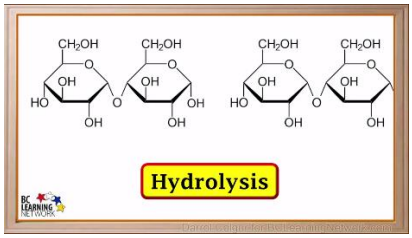
(a) (b) (c)

FIGURE 4. (a) Model demonstrates the experiment. (b) The camera zooms-in the experiment step. (c) Table of experiment result.

Experiment Result Evaluation Section

Evaluation section displays the model holds or points out to experiment result as long as dubber explains the experiment result, as shown in Fig.5.(a). The evaluation section is also presented with 2D animation to help students' visualization about chemical mechanism in the bread leavening. The 2D animation as shown in Fig.5.(b) displays the hydrolysis reaction by amylase to produce disaccharides. This animation goes into the video scene when the dubber explains the chemical mechanism of wheat flour hydrolysis by yeast. The difficult microbiological mechanism is also delivered by the presenter (Fig.6.(a)), with the help of 2D animation (Fig.6.(b)) which explains the fermentation process during bread production and time-lapse video during bread leavening (Fig.6.(c)).

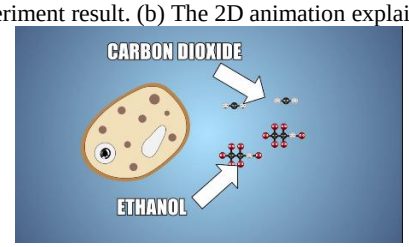
(a)



(b)

FIGURE 5. (a) Model points out the experiment result. (b) The 2D animation explains chemical reaction by yeast fermentation.

(a)



(b)

(c)

FIGURE 6. (a) Presenter delivers microbiological mechanism in bread leavening. (b) The 2D animation displays the microbiological mechanism in the bread leavening. (c) Time-lapse video during bread leavening.

Closing section

Figure 7.(a) shows closing section delivered by the presenter. The presenter encourages the students to do the experiment successfully. The last scene of the video displays the sources of the images and animations used in the video.

(a)

(b)

FIGURE 7. (a) Presenter close the video by greetings. (b) List of URL of image and animations original source.

Product Evaluation

The feasibility of the video was evaluated by a material expert, a learning media expert, peer reviewers and teachers. The result of the validation by a material expert could be seen in Table 1. According to the material expert, the material aspects of the video was declared to be very appropriate, with the average feasibility of 96.5%. No revision was needed in material aspect.

TABLE 1. Material validation result by a material expert.

No	Aspects	Score	Maximal Score	Feasibility, %	Category
1.	Learning	27	28	96.4	Very appropriate
2.	Material	43	44	97.7	Very appropriate
3.	Usefulness	18	20	90.0	Very appropriate
4.	Usage	19	20	95.0	Very appropriate

5.	Total	107	112	96.5	Very appropriate

Table 2 showed the validation by a learning media expert. The result indicated that the video was very appropriate, with the average feasibility of 90.2%. The minimal score was in the aspect of media quality, which included audio-visual, layout, animation, lighting, and duration. The learning media expert suggested revisions, such as: 1) clean out the audio noise to improve audio quality, 2) add images and animations to improve visualization in order to ease the students understanding, and 3) revise the brightness and contrast in the outdoor scene.

TABLE 2. Learning media validation result by a learning media expert.

No	Aspects	Score	Maximal Score	Feasibility, %	Category
1.	Media quality	68	76	89.5	Very appropriate
2.	Usage	22	24	91.7	Very appropriate
3.	Usefulness	11	12	91.7	Very appropriate
4.	SCL media appropriatness	18	20	90.0	Very appropriate
5.	Total	119	132	90.2	Very appropriate

Table 3 displayed the validation by peer reviewers and teachers. The result showed that the video was very appropriate with the average feasibility of 97.7% and 92.3% according to peer reviewers and teachers respectively. Peer reviewers and teachers suggested revisions, such as: 1) prolong the duration of long texts or tables having many texts, 2) add text defining learning outcome, and 3) add additional information in observation table.

TABLE 3. Validation result by peer reviewers and teachers.

No	Aspects	Maximal Score	Peer Reviewers		Teachers		Category
			Score	Feasibility, %	Score	Feasibility, %	
1.	Learning	20	19.7	98.5	17.3	86.5	Very appropriate
2.	Media quality	44	40.0	90.9	40.7	92.5	Very appropriate
3.	Material	16	15.0	93.8	14.3	89.4	Very appropriate
4.	Usefulness	32	31.0	96.9	30.7	95.9	Very appropriate
5.	Usage	8	8.0	100.0	7.7	96.2	Very appropriate
6.	Total	120	113.7	94.7	110.7	92.3	Very appropriate

The video was then revised as suggested by a learning media expert, peer reviewers, and teachers. The revised video was evaluated through main field testing stage, performed by one-on-one testing of 7 students and 40 students in the real classroom. The results of the main field testing stage were revealed in Table 4. The video is very appropriate with the average feasibility of 85.3% and 88.2%. But the media quality feasibility is less than other aspects. This result shows that the young generation in the age of 20's can not to tolerate the audio-visual quality defect such as noise and lighting. The students also requested for additional animations to ease their understanding.

TABLE 4. Validation in the main field testing stage result.

No	Aspects	Maximal Score	One-on-one testing		Classroom testing		Category
			Score	Feasibility, %	Score	Feasibility, %	
1.	Learning	20	18.0	90.0	18.3	91.5	Very appropriate
2.	Media quality	44	36.1	82.0	37.4	85.0	Very appropriate
3.	Material	16	13.6	85.0	14.2	88.8	Very appropriate
4.	Usefulness	32	27.6	86.3	28.7	89.7	Very appropriate
5.	Usage	8	7.0	87.5	7.3	91.3	Very appropriate
6.	Total	120	102.3	85.3	105.8	88.2	Very appropriate

After the minor revision, the video used in operational field testing. The average feasibility of the video in operational field testing was 89.3%. The feasibility of learning was 92.8%, media quality 87.9%, material 88.0%, usefulness 89.8% and usage 88.5%. All of the aspects showed that the video is very appropriate. Pre-test and post-test were performed before and after the students see the video to measure the video effectiveness as learning media. Table 5 indicated the paired t-test between pre-test and post-test. The results showed that p-value is lower than 0.05 at 95% confidence level so that the post-test was significantly increased after the students see the video. The video was able to improve students' learning outcome significantly. Sever et al reported the development of prerecorded experiment video to replace teacher demonstration method. The use of prerecorded experiment video didn't show any significant different in student attitude and academic achievement, compared with those of the control group using teacher demonstration method. It was concluded that the prerecorded video could replace teacher demonstration method [10].

TABLE 5. The paired t-test between pre-test and post-test.

	Pre-test	**Post-test**
Mean	11.2368	19.4211
Variance	7.1586	11.3855
Observations	38	38
Hypothesized Mean Difference	0	
df	37	
t Stat	-13.5662	
P(T<=t) two-tail	$6.1866 . 10^{-16}$	
t Critical two-tail	2.0262	

The video was uploaded to the YouTube channel of Pendidikan Teknik Boga - Universitas Negeri Yogyakarta and embedded in Be Smart V2 to be used as SCL learning media to support the implementation of flipped classroom.

CONCLUSION

The video for Food Analysis Course is a prerecorded experiment video on the subject of effect of yeast, sugar, and gluten to bread leavening. The video is developed using *mp4* format, having 11-minute duration and being uploaded to the YouTube. To access the video, the students need handphone or laptop equipped with internet connection which is available on YSU campus. According to experts, peer reviewers, teachers, and students, the video is very appropriate as learning media. According to the field testing result, the video improves the students' learning outcome.

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