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DEVELOPMENT OF AUDIO-VISUAL LEARNING MEDIA ON MOLECULAR GASTRONOMY MATERIAL

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ABSTRACT

This research aims to: 1) Develop audio-visual learning media on molecular gastronomy topics, 2) Determine the feasibility of audio-visual learning media on molecular gastronomy topics. This study is a research and development (R&D) study through the 4D development model consisting of define, design, develop, and disseminate. The results of the development of audio-visual learning media on molecular gastronomy topics can be described as follows: a) The media has a duration of 12 minutes and 15 seconds, b) The learning media format is in the form of an mp4 video sized at 420.1 MB, c) The sections of the media are divided into the opening stage, aperception material, core material containing explanations about the definition of molecular gastronomy, techniques in molecular gastronomy, practice of making imitation caviar using gelification techniques, evaluation quizzes, and conclusion, d) The media dissemination is done by uploading it through the YouTube platform on the BOGA UNY channel with the URL https://youtu.be/61-ZqZIXkSA. The results of the feasibility assessment of audio-visual learning media on molecular gastronomy topics by subject matter experts received an average score of 100%, which falls into the highly feasible category. Evaluation by media experts resulted in an average score of 95.19%, also classified as highly feasible. The assessment by students yielded an average score of 84.29% on a small scale and 89.71% on a large scale, both falling into the highly feasible category. Based on the feasibility test results, the audio-visual learning media on molecular gastronomy topics is declared highly suitable for use as a learning medium.

INTRODUCTION

The development of technology and science has brought about changes in various aspects of human life, including social, cultural, economic, and educational aspects. Education also requires adjustments in line with these developments, especially concerning learning in schools. One of the adjustment factors related to learning is the use of appropriate teaching media in line with technological advancements.

Teaching devices or media play a crucial role as intermediaries in the learning process, helping teachers convey course content. (Wahid, 2018) emphasizes that learning media are useful for delivering course content, stimulating the feelings, thoughts, attention, and abilities of learners, thus supporting the learning process. The term "media" comes from the Latin word "medium," meaning intermediary or conveyance. According to (Budiman, 2016), media is defined as a means to convey messages or learning information that the message sender intends to communicate to the message receiver. In the context of teaching and learning activities, media is used as a tool to connect messages or materials that teachers want to convey to students. Learning media is defined as a tool used by teachers as an intermediary in conveying information to students, according to (Pradilasari et al., 2019). Another definition of learning media is a medium or intermediary used in the learning process, including aids used by teachers

in teaching and tools to convey messages from the learning source to the learning recipient by (Suryani et al., 2019).

Teaching media comes in various forms, and one type that can assist the teaching and learning process is audio-visual media. According to (Atmaja, 2019), audio-visual media is divided into two types: static and motion audio-visual media. An example of motion audio-visual media that we are familiar with is instructional videos. Audio-visual media plays a crucial role in the learning process, especially when teachers use it as a means to explain materials to students. Audio-visual media provides various stimuli to students due to its visual and auditory nature (Fitriyani, 2019). Observing images and listening to sounds simultaneously enhances students' curiosity and the desire to continue watching the video to completion. This opinion aligns with the function of learning media conveyed by (Nurrita, 2018), which is one of the functions of learning media is to motivate students to learn. With the development of learning media, it not only contains artistic elements but also facilitates students in learning the course materials, thereby increasing students' enthusiasm for learning (Haryoko, 2012).

The subject of food processing and presentation is intended for students in vocational high schools majoring in Culinary Arts. Food processing and presentation involve learning how to process food and present it attractively and creatively. One of the topics in this subject is Molecular Gastronomy. Molecular gastronomy deals with unconventional methods of food preparation and presentation by incorporating scientific elements into the techniques of making a dish, from processing to presentation (Winarno & Winarno, 2017). The application of molecular gastronomy techniques is rarely seen in daily life and is not commonly encountered in our surroundings. This is because the practice of molecular gastronomy requires special understanding. Experiencing molecular gastronomy dishes comes with a significant cost, and not every region has restaurants that serve dishes prepared using molecular gastronomy techniques. This high cost is also consistent with the expensive fees for molecular gastronomy courses.

Molecular gastronomy is included in the 2013 revised curriculum under the food processing and presentation subject, and it is also part of the independent curriculum included in the fundamentals of culinary subjects. The difference between the molecular gastronomy materials in the 2013 revised curriculum and the independent curriculum lies in the 2013 revised curriculum, which includes basic competencies 3.25 and 4.25, requiring students to analyze and practice molecular gastronomy materials. In the fundamentals of culinary subjects, molecular gastronomy is only covered as general knowledge. One vocational high school using the 2013 revised curriculum is SMK N 1 Ambal.

The learning process will run smoothly if the learning objectives can be maximally achieved. Based on pre-observation results and interviews with the subject teacher, the teacher at SMK N 1 Ambal Kebumen faces challenges, especially in teaching molecular gastronomy to students. The teacher's challenges include a lack of in-depth understanding of molecular gastronomy materials. Meanwhile, molecular gastronomy has basic competencies 3.25 and 4.25, which require students to analyze and practice molecular gastronomy materials, creating a gap between learning objectives and the reality of learning. Another problem is that molecular gastronomy is a practical competence that requires visualization, while the teacher only uses PowerPoint and a book on food processing and presentation, including a book from Yudhistira publisher, as a learning medium. The learning of molecular gastronomy does not use instructional videos because the teacher has not found suitable and easy-to-follow instructional videos.

The development of learning media is one effort to overcome these problems, aligning with the theory presented by (Komalasari, 2019) regarding the principle of using learning media tailored to interests, needs, and conditions. Efforts that can be made include developing

audio-visual learning media in the form of instructional videos to facilitate visualization and understanding of molecular gastronomy materials. This is supported by the theory presented by (Oktaviani, 2019) that audio-visual media is representative for clearly presenting materials with demonstrations that can materialize visualization on difficult-to-explain subjects. Based on the aforementioned issues, the researcher is motivated to develop learning media that can be used to support the students' learning process, specifically wanting to develop audio-visual learning media in the form of instructional videos. Therefore, the researcher is interested in conducting a study entitled "Development of Audio-Visual Learning Media on Molecular Gastronomy Materials."

RESEARCH METHOD

There are three (3) methods or techniques used for data collection in this study, namely: 1) observation, which is a data collection technique that is more specific than other data collection techniques because observation is not only limited to people, but also other objects (Sugiyono, 2019) observation activities are carried out during the learning process of food processing and presentation. 2) Interviews, which are activities carried out to find out the conditions and needs in the field. According to Estberg (in Sugiyono, 2019: 304). In this study, interview activities were carried out by asking several questions to subject teachers and students in schools about the curriculum used, competency achievements, and difficulties experienced then from the results obtained will be studied for the development of learning media. 3) Questionnaire, is a research instrument that contains a number of questions used to obtain information from respondents (Suharsimi, 2013). In this study, questionnaires were used as research instruments to determine the feasibility of learning media. This questionnaire aims to evaluate learning media before dissemination. The data sources used in this study consisted of material experts, media experts, and grade XII students of Vocational High Schools in the Ambal area which were divided into small-scale and large-scale trials. Students are divided into 9 people for small-scale trials and 30 people for large-scale trials (Sugiyono, 2018).

The development procedure uses a 4D model with 4 stages, namely define, design, development and dissemination. a) Define, the stage of determining and defining learning requirements, namely: 1) Initial analysis, this stage contains interview and observation activities at SMK N 1 Ambal involving teachers who teach food processing and serving subjects as resource persons. The initial analysis stage is useful for bringing up and establishing basic problems encountered in learning. 2) Needs analysis, useful for determining what kind of solution is appropriate and can help solve existing problems in accordance with the curriculum, syllabus and applicable basic competencies. After observations and interviews conducted, the need was found in order to overcome existing learning problems, namely by developing audio-visual learning media on molecular gastronomy material. 3) material analysis, which is the stage of collecting theories about molecular gastronomy starting from understanding, techniques in molecular gastronomy, tools, materials, manufacturing steps, and things that must be considered in using molecular gastronomy techniques, especially gelification techniques. The reference for the preparation of learning videos is the syllabus of Food Processing and Presentation of SMK N 1 Ambal. Material is obtained from various book sources, both physical books and e-books. 4) Objective analysis, namely the results of the development of molecular gastronomy learning media is expected to be a tool that facilitates teachers and students in the learning process in Food Processing and Serving Subjects so that it can help in achieving the learning objectives that have been set. b) Design, is the stage of designing learning tools consisting of several steps, namely: 1) pre-production, is a stage that contains material identification, making learning media scripts, determining talents, dubbers, and also determining vendors as videographers and editors, listing tools and materials that will

later be used in the shooting process 2) production includes the shooting and sound taking stages. The shooting stage was carried out in laboratory 114 of culinary education at Yogyakarta State University. 3) Post-production, which is the editing and mixing stage to combine all components into one learning video according to the story board that has been made. c) Development, after becoming a complete video then validated by material experts, media experts, and development trials divided into small and large scale. At the development stage, after the media gets expert validation, of course, input and suggestions will be given on learning media products. The process of revising learning videos is adjusted to the suggestions and inputs given at the validation stage so that the media developed is even better. d) Disseminate is the stage of dissemination of learning media products that have been developed and through validation tests.

The data analysis technique used in this study is descriptive statistics. Descriptive statistics are statistics used to describe or describe the object under study through sample or population data as it is, without conducting analysis and making conclusions that are generally applicable (Sugiyono, 2019: 206). The formula for calculating the eligibility percentage is as follows:

$$Persentase = \frac{Skor}{Skor\ Maksimal} \times 100\%$$

Information:
Percentage = average score of each aspect or all aspects
Score = sum of scores for each aspect or all aspects
Maximum score = total score of each aspect

The percentage of data derived from questionnaires with the Likert scale can be categorized into interval-scale data. To convert to ordinal scale, conversion can be done by looking at the reference in the following table:

Table 1. Ordinal Scale Conversion

Range of Values	Category
>80%	Very proper
66% - 80%	Proper
56% - 65%	Unproper
<56%	Very Unproper

(Source: (Mulyatiningsih, 2011)

RESULTS AND DISCUSSION

Define

At this stage, namely making observations in learning in class XII of Vocational High Schools in Kebumen during food processing and serving subjects and interviews with teachers who teach food processing and serving subjects. Based on the results of observations and interviews conducted, the following information was obtained: 1) During learning, the teacher teaches with the lecture method and gives tasks that must be done in the form of groups. When the assignment is completed, it is presented in front of the class on a projector or LCD screen. Learning tools used by teachers include textbooks, student worksheets, whiteboards and projectors/LCDs to present PowerPoint presentations on group assignments. In the learning process, the teacher only explains the material through power point presentations and the

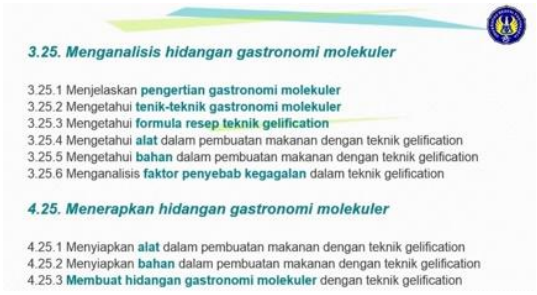
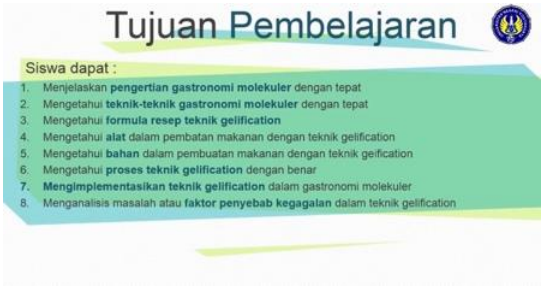
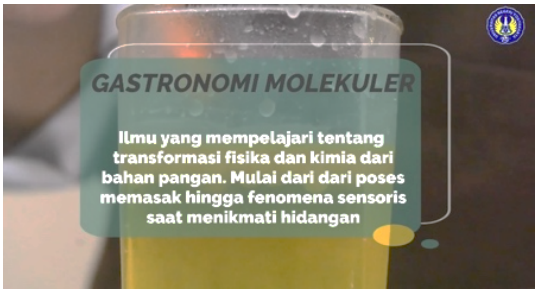
display of the learning media is less attractive because there are only pictures and explanatory text. 2) During the learning process there are some students who talk to themselves and do not pay attention to the teacher who is explaining the material. There are students who focus on paying attention to the teacher when explaining, and others tend to be passive. 3) The economic background of students is sufficient, in this case all students already have gadgets / electronic devices. Gadgets owned by students are used in the learning process in class because the learning process used involves the use of technology such as to access material and tests through google forms. 4) Teachers have difficulty teaching molecular gastronomy material due to limited teacher knowledge and skills on the material and lack of related learning media. 5) In general, the facilities in the school have supported the use of technology-based media. The room used for teaching there is LCD and Digital TV which is used to help the learning process. The school also provides wifi that can be accessed by students and teachers to support the learning process. From the define stage described in the initial analysis and needs analysis, it resulted in the conclusion that learning media is needed that can help visualize molecular gastronomy material so that it is easy for students to understand. The media that is considered the most appropriate is audio-visual learning media.

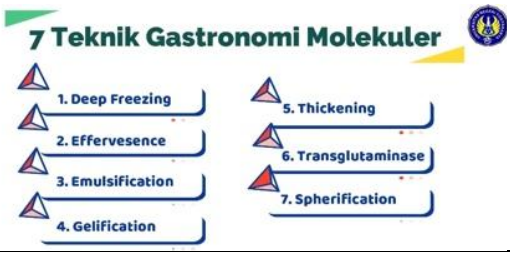
Design

The design stage is divided into 3 stages, namely: 1) pre-production, including identifying material about molecular gastronomy, making video scripts, assigning vendors who serve as cameramen and talents, 2) production, including shooting activities for shooting and recording audio, 3) post-production, including the editing and mixing stages, namely uniting all pieces of video per scene and audio into one unified video. The following are parts of audio-visual learning media on molecular gastronomy material:

Table 2. Parts of Learning Media

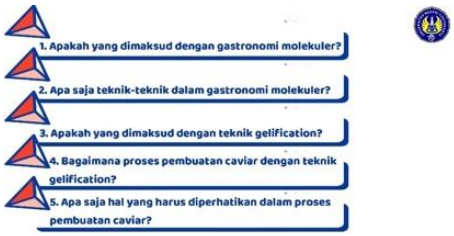
No	Scene	Figure	Information
1.	Opening		Title "Video Pembelajaran Gastronomi Molekuler"
2.	Opening		Displays the names of students, supervisors, material expert validators and media expert validators.

No	Scene	Figure	Information
3.	Opening		Explain the learning video flow concept map
4.	Opening		Displays competency achievement indicators 3.25 and 4.25
5.	Opening		Display learning objectives associated with competency achievement indicators
6.	Apperception Material		Explain apperception material to provoke students' knowledge about molecular gastronomy
7.	Core material		Explain the meaning of molecular gastronomy

No	Scene	Figure	Information
8.	Core material		Featuring techniques in molecular gastronomy
9.	Core material		Explain molecular gastronomy techniques one by one. This scene explains the deep freeezing technique
10.	Core material		Segment switching that addresses gelification techniques further
11.	Core material		Explain the reasons for choosing the gelification technique for beginners, as well as the additives used
12.	Core material		Explain more about additives in gelification techniques and safety doses

No	Scene	Figure	Information
13.	Core material		Segment change of carrot caviar making practice as a complementary garnish to sushi dishes
14.	Core material		Displays the tools used in caviar-making practice
15.	Core material		Displays the ingredients used in caviar-making practices
16.	Core material		Displays a table of recipe formulas as a reference for making caviar
17.	Core material		Substitution of segments of steps in the manufacture of caviar
18.	Core material		Explain step by step making a gelatinous solution from carrot juice

No	Scene	Figure	Information
			
19.	Core material		Explain the process of caviar formation using a pipette dropped into cold salad oil
20.	Core material		Features the process of plating caviar as a garnish on sushi dishes
21.	Core material		Displays *after plating* along with explanations of parts in the dish
22.	Core material		Segment change on *tips and tricks* to minimize failure in caviar making

No	Scene	Figure	Information
23.	Core material		Explain one of the *tips and tricks* in minimizing failure in making caviar
24.	Quiz		Quiz segment change
25.	Quiz		Presenting quizzes for students to deepen their understanding of molecular gastronomy material that has been delivered
26.	Closing		View production team credits

Develop

The learning media that has been completed will then be developed through an expert validation process, development trials, and several product revision processes.

1) Feasibility test validation results

Validation is carried out by material experts and media experts. The results of validation by material experts and media experts are described as follows:

Table 3. Material Expert feasibility test Results

Learning Aspects	Σ Score	Σ Score Max	Percentage	Category
Learning	16	16	100%	Very proper
Material	60	60	100%	Very proper
Benefit	24	24	100%	Very proper
Averages			100%	Very proper

Learning media feasibility test by material experts based on all aspects of assessment, learning media get a 100% feasibility percentage so that it is included in the category of very feasible to be used as learning media.

Table 4. Feasibility Test Result Of Media Experts

Learning Aspects	Σ Score	Σ Score Max	Percentage	Category
Learning	51	52	98,08%	Very proper
Material	7	8	87,5%	Very proper
Benefit	20	20	100%	Very proper
Averages			95,19%	Very proper

Learning media feasibility test by media experts based on all aspects of assessment, learning media get a feasibility percentage of 95.19% so that it is included in the category of very feasible to be used as learning media.

2) Development trials

Trials of developing audio-visual learning media on molecular gastronomy materials were carried out by students who were divided into small-scale trials by 9 students and large-scale trials by 30 students.

Table 5. Results of small-scale development trials

Learning Aspects	Σ Score	Σ Score Max	Percentage	Category
Learning	148	180	82,22%	Very proper
Material	90	108	83,33%	Very proper
Media	245	288	85,07%	Very proper
User	180	216	83,33%	Very proper
Benefit	216	144	87,5%	Very proper
Averages			84,29%	Very proper

The results of small-scale development trials for learning media to students based on all aspects of learning videos get an average feasibility percentage of 84.29% so that it is included in the category of very feasible to be used as a learning learning media.

Table 6. Results of large-scale development trials

Learning Aspects	Σ Score	Σ Score Max	Percentage	Category
Learning	548	600	91,33%	Very proper
Material	311	360	86,38%	Very proper
Media	858	960	89,38%	Very proper
User	642	720	89,17%	Very proper
Benefit	443	480	92,29%	Very proper
Averages			89,71%	Very proper

The results of large-scale development trials of learning media to students based on all aspects of learning videos get an average feasibility percentage of 89.71% so that it is included in the category of very feasible to be used as a learning media.

3) Product revisions

Input or revision from material experts and media experts is used as material for improvement so that the resulting media is suitable for use as learning videos. The improvement starts from the opening scene, namely adding the name of the validator, adding the university logo at the beginning to the end of the video, then adding learning outcomes. In

the core material, the improvements made are adding supporting images related to the additives used.

Disseminate

At the disseminate stage, dissemination of the final product that has been declared feasible is carried out. Dissemination is carried out by disseminating the results of research and development of learning media through journals so that they can become literature for readers on related material. Dissemination of audio-visual learning media on molecular gastronomy materials is carried out offline and online. Offline dissemination is carried out through teachers of Food Processing and Serving Subjects, while online dissemination is carried out through uploading learning media through the BOGA UNY Youtube platform with a link https://youtu.be/61-ZqZIXkSA.

Discussion

Based on the conducted research, the first stage is "define." In this phase, the researcher gathered information about the required product based on the identified issues in the field. Interviews with teachers and students revealed that Vocational High Schools in Ambal, Kebumen, have learning facilities that support the use of instructional media, including an available LCD projector. However, due to time and budget constraints, instructional videos have not been developed by teachers, and there is no suitable audio-visual instructional media for molecular gastronomy that aligns with the learning competency achievements.

The "design" stage began with preparing the content for the media and creating the video script. The script underwent consultations with experts to ensure that the developed media would meet expectations and be well-directed. Once approved by both media and subject matter experts, the process moved on to the video production stage.

The production of media in this stage was considered complex, requiring extensive preparation in terms of self-preparation, equipment, materials, and location. The filming process took a considerable amount of time for each scene, involving repetition until the desired results were achieved. After completing the filming stage, the next step was audio recording, which required a quiet location to avoid interference with the narrator's voice. Subsequently, the editing and mixing stage commenced, a time-consuming process of selecting and combining all scenes and images according to the established storyboard. The editing process was repeated multiple times until the video met the expected standards.

"Development" is the main stage in product development research. The finished media product underwent validation by experts and was revised as needed. Recommendations and input from subject matter and media experts were instrumental in refining the product to meet user needs and ensure its suitability for use.

Suggestions and feedback from experts included adding the names of validators. Initially, only the researcher's and supervisor's names were listed, but after improvement, the names of the content and media validators were added. Another suggestion was to include learning achievements. Initially absent, learning achievements for molecular gastronomy were added for KD 3.25 and KD 4.25 after improvement. Adding the university logo at the beginning and end of the video was also recommended. This addition aimed to establish copyright for the created instructional media. The final input was to include additive materials in each molecular gastronomy technique. Initially, explanations for each technique only featured the resulting product. After improvement, images of additives such as sodium alginate and calcium lactate were added to facilitate students' understanding of each molecular gastronomy technique.

After the instructional media product underwent the revision and improvement process, it can be concluded from the overall responses of the experts and students that none of them

rated the product as "very inadequate." Only a small portion gave a rating of "adequate" (3), while the majority gave a score of "very suitable" (4). Based on the assessments from subject matter experts, media experts, and the developmental trial with culinary students in grade XII, it can be interpreted that the developed instructional audio-visual media for molecular gastronomy is considered highly suitable for use as a learning resource/alternative instructional media. Therefore, the developed instructional media is expected to help and facilitate the learning process, both in the classroom and individually, to better understand the material and enhance students' competencies. This aligns with previous research on instructional videos conducted by Priska Dayanti (2016), which concluded that there was a significant difference between the experimental and control groups, with the experimental group performing better.

The "dissemination" stage is the final phase of product development, involving the distribution of the product that has undergone feasibility testing and developmental trials and is free from the revision stage. The instructional media product's dissemination was done by sharing the video file with teachers of food processing and presentation subjects. Extensive dissemination was also carried out by uploading the instructional video to YouTube, making it accessible to everyone in need through the link https://youtu.be/61-ZqZIXkSA.

CONCLUSION

Audio-visual learning media in molecular gastronomy material can be described as follows, a) The media has a duration of 12 minutes 15 seconds, b) The format of learning media in the form of mp4 videos measuring 420.1 MB, c) The sections of the media are divided into the opening stage, perception material, core material which contains an explanation of the understanding of molecular gastronomy, techniques in molecular gastronomy, the practice of making imitation caviar using gelification techniques, evaluation quiz, as well as closing, d) Media dissemination is carried out by uploading media through the youtube platform on the BOGA UNY channel with the URL https://youtu.be/61-ZqZIXkSA.

The feasibility test results of audio-visual learning media on molecular gastronomy material by material experts received an average score percentage of 100% with a very decent category. The results of the feasibility test by media experts received an average score percentage of 95.19% in the very decent category. The score of the feasibility trial results conducted on 30 students received an average score percentage of 89.17% so that audio-visual learning media on molecular gastronomy material was declared very feasible as a learning medium.

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