Creation of E-Magazine Learning Resource for Pastry and Bakery Products Courses Focused on Low-Calorie Diets

Intan Diah Kusuma *, Mutiara Nugraheni (ID)

Study Program of Culinary Technology Education, Universitas Negeri Yogyakarta, Indonesia
* Corresponding Author. E-mail: intandiah.2019@student.uny.ac.id

ABSTRACT

The objectives of this study are to: (1) Develop an E-magazine learning medium on pastry and bakery products for a low-calorie diet for students, and (2) Determine the feasibility of the E-magazine learning medium on pastry and bakery products for a low-calorie diet. This study is a type of Research and Development (R&D) research using the 4D model, which consists of four stages: 1) Define: conducting front-end analysis, curriculum analysis, learning outcome analysis and learning objective mapping, and learner analysis, 2) Design: selecting media and format, creating a flowchart and storyboard, and then developing the e-magazine, 3) Develop: conducting validation with material experts, media experts, and feasibility testing by students, 4) Disseminate: distributing the media through a flipbook platform. The results of this study indicate that: (1) The product developed is the E-Magazine Learning Medium for Low-Calorie Diet Pastry and Bakery. The E-Magazine can be accessed on the flipbook platform, 2) Based on research data obtained from material experts, the score was 3.38 in the "Very Feasible" category, from media experts, the score was 3.8 in the "Very Feasible" category, and from students, the score was 3.45 in the "Very Feasible" category. This indicates that the development of the E-Magazine Learning Medium for Low-Calorie Diet Pastry and Bakery is deemed feasible for use as a learning medium in Vocational High Schools for Culinary Arts. This initiative not only provided an innovative learning tool but also addressed obesity-related issues by integrating modern technology to engage Generation Z students effectively. Future research is recommended to further explore its impact on practical learning outcomes and continuously improve educational media.

Keywords: Development of learning media, e-magazine, low-calorie diet, pastry and bakery materials

INTRODUCTION

Globalization can have numerous positive impacts on education. It facilitates the quick search for information or knowledge. Globalization also enables students to foster creativity and enhance their learning abilities. With advancements in information and communication technology, students can now easily access various sources of knowledge from around the world, accelerating the learning process and broadening their horizons (Bernaldo & Fernández-Sánchez, 2022). Currently, Indonesia is implementing the Merdeka Belajar curriculum as an adaptation to the era of globalization. The Merdeka curriculum was inaugurated by the Minister of Education, Culture, Research, and Technology, Nadiem Makarim, in February 2022. The Merdeka Curriculum features diverse intramural learning, where content is optimized to give students ample time to deepen concepts and strengthen competencies, making learning more relevant and engaging (Jin, 2023). Educators have the flexibility to choose various teaching tools so that learning can be tailored to the

needs and interests of students. This aligns with the active learning approach emphasized in the Merdeka curriculum, where students are expected to be directly involved in the learning process (Rosmiati et al., 2021).

The use of learning media in the teaching and learning process can stimulate new desires and interests and have psychological effects (inner feelings, attitudes, and character) on students (Yusantika et al., 2018). Research shows that creative learning media can positively impact students' psychology, including their feelings and attitudes toward the material being taught (Rapoport, 2020). Media can provide information to students and vice versa in an intense and smooth manner. Efficiency and learning goals can be achieved if media is used creatively in teaching. The presence of learning media in the educational process will have positive impacts, such as influencing learning success. To ensure that media influences learning success, it must be educational and engaging (Kristiono & others, 2018). Educational and engaging media can enhance learning effectiveness, provided it is used appropriately by educators (Coyer et al., 2019). In this context, the role of teachers becomes crucial in designing and implementing learning media that aligns with current technological developments, including the use of gadgets and interactive learning applications (Ahmed & Mohammed, 2021).

Preliminary studies show that students use gadgets daily. This is because the age range of students is around 16-18 years, which falls into Generation Z. Although Generation Z students are very familiar with technology, many of them use gadgets more for gaming and socializing on social media than for learning (Abhijeet, 2023). To maximize the function of gadgets, interactive learning media can be integrated into them. One of the activities needed to enhance learning is designing learning media that facilitates learning. Media can ease learning by acting as an intermediary that transmits messages from the sender to the receiver (Nurfadilah, 2021).

Vocational High School 4 Yogyakarta is one of the vocational schools in Yogyakarta. The use of gadgets as a learning support through mobile learning has not been fully utilized by educators. Thus, learning at the school has not aligned with the current generation of students. One productive subject at Vocational High School 4 is Pastry and Bakery Products. This subject was chosen for research because, according to statistics from the Ministry of Agriculture, in 2018, the consumption of pastry and bakery products, such as sweet bread, increased by up to 500% since 2014. This increase continued during the pandemic in 2021, with Indonesia achieving the highest bread sales in Southeast Asia.

This subject focuses on low-calorie diet pastry and bakery products tailored to current market needs. According to a Ministry of Health survey, in 2023, 23.4% of Indonesia's adult population (aged >18 years) was categorized as obese. Obesity is the excessive accumulation of fat in the body, leading to health problems. A low-calorie diet is a strategic approach for weight loss, as greater weight loss, in terms of fat mass reduction, results in more significant positive health impacts (Zubrzycki et al., 2018).

Students need learning media that aligns with current technological developments, such as gadgets, to understand the material interactively. Learning media can also overcome limitations of space, time, energy, and sensory abilities, and can stimulate learning enthusiasm, provide stimulation, and experiences. In this subject, there is no gadget-based learning media that contains the material.

One proposed solution is the development of an E-magazine for the Pastry and Bakery Products subject, which can serve as a self-learning resource and engage students with the material being taught (Fadillah et al., 2021; Huang & Cheng, 2020). The E-Magazine for the Pastry and Bakery Products subject, focusing on low-calorie diet pastry and bakery products, is a medium that can be used as a tool to understand the material and as a self-learning resource. The E-Magazine for the Pastry and Bakery Products subject is expected to attract students' interest in the material presented. E-magazines are categorized as learning media because they fall into visual and/or multimedia media. The use of E-magazines is expected to assist in explaining various visualizations of lesson concepts that are difficult to explain conventionally. Thus, e-

magazines not only function as learning aids but also as a means to develop students' independence and responsibility in their learning process (Nurngaini, 2024).

In the context of a subject focused on low-calorie diets, E-magazines can provide relevant and useful information for students, given the rising obesity rates in Indonesia (Shin & Hutzel, 2018). With e-magazines, students can access recipes, techniques, and the latest information on industry trends directly, which can enhance their practical skills and prepare them for entering the workforce (Hakim, 2024). E-magazines can facilitate this communication, allowing students to gain insights directly from professionals in the Pastry and Bakery field and expand their networks (Asih, 2023; Hakim, 2024).

The use of e-magazines also aligns with the Merdeka Belajar initiative implemented in Indonesia, which emphasizes the importance of innovation in vocational education (Safaruddin, 2021). By integrating technology and digital media into the curriculum, e-magazines can help create a more flexible and adaptive learning environment that suits the characteristics of Generation Z, who grew up in the digital era (Vierke, 2024). This is important for increasing student motivation and engagement and preparing them for the challenges of an increasingly competitive workforce (Sonia, 2020).

The development of e-magazines in the context of the Merdeka curriculum has a crucial end goal, which is to support the achievement of learning outcomes (CP) in the Pastry and Bakery subject. In the Merdeka curriculum, there is an emphasis on more flexible, student-centered learning based on their needs and interests, allowing them to learn in a more independent and creative manner (Pratycia et al., 2023).

PURPOSE OF THE STUDY

This study aims to: (1) Develop an E-magazine learning medium on pastry and bakery products for a low-calorie diet for students, and (2) Test the feasibility of the E-magazine learning medium on pastry and bakery products for a low-calorie diet.

METHOD

This study falls under the category of research and development, also known as Research and Development (R&D). The concept of research and development refers to a process; research does not produce tangible and visible objects. The Research and Development method is a research method used to produce a specific product and test the effectiveness of that product (Sugiyono, 2011).

In this development research, a product will be produced: an E-magazine learning medium for the Pastry and Bakery subject, focusing on special diet desserts, using the 4D research model (Four D Models), which includes Define, Design, Develop, and Dissemination, as outlined in Figure 1.

Define ▶ Design ▶ Develop ▶ Disseminate

Figure 1. The 4D Research Flow

The definition stage includes steps to determine the product and specifications to be developed (Sugiyono, 2011). The analysis involves front-end analysis, curriculum analysis, learning outcome analysis, learner characteristic analysis, and learning objective mapping.

In the design stage, activities are conducted to create a design for the predetermined product (Sugiyono, 2011). The chosen medium is the E-magazine Learning Medium for the Pastry and Bakery Subject, focusing on Low-Calorie Diets for the Culinary Arts class XI. The design stage includes: a) format

selection, b) media selection, c) flowchart creation, d) scriptwriting, e) storyboard creation, f) e-magazine media creation.

In the development stage, activities are conducted to transform the design into a tangible product and repeatedly test the product's validity until it meets the desired specifications (Sugiyono, 2011). At this stage, the created media is ready for content and media validation testing. After validation testing, improvements are made based on revisions and suggestions from media and content experts.

The dissemination stage involves activities to distribute the perfected product for maximum use by others (Sugiyono, 2011). This stage involves the dissemination of the developed and validated learning media product to a broader group, which can be used in other classes, schools, or relevant institutions requiring E-magazine learning media.

Research Location and Time

This research was conducted at SMK N 4 Yogyakarta, located at Sidikan Street No.60, Sorosutan, Kec. Umbulharjo, Kota Yogyakarta, Daerah Istimewa Yogyakarta 55161. The research timeline was adjusted to the schedule of the relevant parties, with data collection taking place from April to June 2024.

Research Population and Sample

The population in this study consists of class XI students in the Culinary Arts Program (2 classes totaling 70 students). The sample in this study is one class of 32 culinary students from class XI, selected using a cluster sampling approach. This sample was chosen because it possesses characteristics representative of the population and can reflect the needs and weaknesses of the existing learning media.

Cluster sampling was chosen for several reasons: first, this method allows for efficiency and ease of access to the sample, which in this case is a group of students in one class, saving time and resources. Second, the selected class is considered to have characteristics representative of the overall population, which is important to ensure that the research findings can be generalized. Third, cluster sampling is suitable when there are resource constraints, such as time and cost, making random sampling from the entire population impractical. Finally, this approach aligns with the research objective of developing and testing learning media in a specific and controlled context.

Data Collection Tools

According to Mulyatiningsih (2012), data collection methods involve systematic steps to gather data using instruments or other devices. The three main methods used are: observation, which involves systematic observation and recording of visible phenomena on the research subject to obtain supporting data; interviews, which use guidelines in the form of an outline of issues to assess students' learning competencies through interviews with teachers; and documentation, which gathers qualitative data from documents, with researchers using cameras to capture observation activities.

Instrument Validity and Reliability

A data collection tool or research instrument is a tool used to measure observed natural or social phenomena (Sugiyono, 2011). The research instrument used in this study is a questionnaire. The questionnaire is a closed-ended survey, allowing respondents to answer with provided choices. The questionnaire is given to media experts, content experts, and students as respondents. This questionnaire is structured using a Likert scale with four answer choices.

The instrument's validity in this study is assessed through a validation process conducted by content and media experts. This validation ensures that the questionnaire can measure aspects relevant to the research objectives. Content and media experts provide evaluations and feedback to refine the questionnaire, ensuring that the questions align with the taught material and are understandable by students.

The validation process by experts and limited-scale trials with students can be considered steps to ensure the instrument's consistency and reliability. Using a Likert scale in the questionnaire provides a consistent structure for evaluation, which can help achieve good reliability.

FINDINGS

Development of E-Magazine Learning Media for Pastry and Bakery for a Low-Calorie Diet

This development research aims to produce an E-Magazine learning medium that meets good and feasible criteria. The four stages of research undertaken are: (1) define, (2) design, (3) development, and (4) disseminate. The final product of this research is the E-Magazine for the Pastry and Bakery Product Subject on a Low-Calorie Diet for Vocational High School class XI. Below is a general presentation of the evaluation data of the E-Magazine for the Pastry and Bakery Product Subject on a Low-Calorie Diet, obtained from content experts, media experts, and limited-scale trials.

Define Stage

The define stage involves deciding and characterizing needs in the learning process and gathering information on the extent of development required. This stage involves establishing and defining the requirements needed in learning development, which includes front-end analysis, curriculum and core competency analysis, learning outcome and objective mapping analysis, and learner analysis.

In the front-end analysis stage, the researcher conducted an initial observation at SMK N 4 Yogyakarta to interview the teacher of the Pastry and Bakery Product subject. This was done to ensure that the resulting learning media aligns with the learning objectives outlined in the competency standards. Additionally, the initial analysis aimed to review the latest data in Indonesia regarding the adult population, which shows a high prevalence of obesity. This also helped determine the subject to be developed. The final analysis was conducted as a learning media needs analysis to identify problems as the basis for developing the Pastry and Bakery E-magazine.

In the curriculum and core competency content analysis stage, the author analyzed the content of the pastry and bakery subject, which includes the attitudes, knowledge, and skills that students must possess to master competencies in the culinary field. This subject is crucial for students after graduation, as it is expected to support them in pursuing employment, further studies, or entrepreneurship, especially as entrepreneurs capable of creating low-calorie pastry and bakery products beneficial to consumers.

The learning outcomes according to the syllabus for the pastry and bakery subject on a low-calorie diet include an indicator point in meetings 13-14, which is to analyze pastry and bakery for a low-calorie diet. The researcher selected this material to give students an overview of the expertise program in low-calorie diet pastry and bakery, which is a requirement in the culinary department. This aims to foster passion and encourage students to plan and engage in learning activities. Additionally, this subject supports pastry and bakery knowledge and skills, particularly in low-calorie diets, aligning with the goals of vocational high schools.

The next stage is the learning objective mapping, which involves identifying the goals to be achieved in the learning process using the developed media. The learning objectives are for students to explain the

concept of a low-calorie diet, identify food ingredients for a low-calorie diet, determine the tools and materials for making low-calorie pastry and bakery, outline the procedures for making low-calorie pastry and bakery, and determine the criteria for low-calorie pastry and bakery products.

The final stage of defining the e-magazine is learner analysis, which involves identifying the characteristics of the target learners for the development of learning tools. Learner analysis was conducted through interviews with the subject teacher. This interview aimed to identify student characteristics and understand their responses and attitudes during the learning process. The findings from this stage revealed that most students find it challenging to understand the material, and the media used does not align with the characteristics of Gen Z students. The research and development conducted are expected to produce learning media that captures students' attention and motivates them to be more active in learning activities.

Design Stage

The design stage aims to design the learning media tools. Six steps must be undertaken in this stage: media selection, format selection, flowchart creation, scriptwriting, storyboard creation, and e-magazine development.

Media selection involves identifying relevant learning media based on the material and characteristics of the learners. Media selection is also aligned with the latest curriculum analysis, learning outcome analysis, and learning objective mapping, as well as learner characteristics consistent with Generation Z or the 4.0 era.

Format selection is useful for designing the content of the E-Magazine for the Pastry and Bakery Product Subject, which includes core material, enrichment material, issues presented as articles, interactive quizzes, and links to the latest learning resources for students. Format selection is aligned with the media and learning approach to be used. After format selection, the next step is creating the product flowchart. The e-magazine flowchart includes the cover, authors, table of contents, introduction, learning outcomes, indicators, latest articles, material descriptions, quizzes, evaluation sheets, and closing.

Scriptwriting consists of material that provides an overview of the main content to be developed in the e-magazine, including: (1) the definition of pastry and bakery, (2) the definition of a low-calorie diet, (3) the requirements for a low-calorie diet, (4) tools and materials for making low-calorie pastry and bakery products, and (5) the benefits of a low-calorie diet.

The e-magazine storyboard includes the layout plan, visual components, headlines for each page, text/material on each page, and the number of pages to determine how many pages will be created. The storyboard facilitates the design process and ensures the media aligns with the initial goals and plans.

After creating the e-magazine framework/storyboard, the e-magazine is developed based on the storyboard, consisting of: (1) front page/cover, (2) authors page, (3) table of contents page, (4) introduction page, (5) article page, (6) quotes page, (7) info at a glance page, (8) concept map page, (9) learning outcomes and objective mapping page, (10) background page, (11) main material page, (12) enrichment material page, (13) quiz page, (14) evaluation sheet page, (15) references page, and (16) closing page. Figure 2 shows the cover page design.

Development Stage

In the development stage research, activities are conducted to transform the design into a tangible product and repeatedly test the product's validity until it meets the desired specifications (Sugiyono, 2011). This stage aims to produce a revised development product based on feedback from media experts, content experts, vocational high school culinary teachers, and vocational high school culinary students. Development stages include validation process and feasibility testing.

Content Expert Validation

In the content expert validation process, several aspects of the e-magazine are assessed, including presentation, graphic aspects, and the characteristics of the developed Pastry and Bakery e-magazine. Validation was conducted on June 3, 2024, and June 26, 2024. The validation results and feedback from content experts can be seen in Table 1.

Table 1. Content Expert Revisions

Feedback	Follow-up Actions
Ingredients for making pastry that are rare in Indonesia should not be included	Replace with ingredients that are abundant in Indonesia
Material sources from websites/internet should be replaced with those from books/international research	Replace and add high-quality and reliable sources
Words that are too formal should be changed to popular words because it's an e-magazine	Change the wording to be more casual and use popular terms
Adapted product recipes should be practiced or include original low-calorie pastry recipes	Add original recipes and analyze additional correct recipes
Convert foreign recipes to Indonesian measurements in grams	Change recipe measurements to grams and explain abbreviations
Use one example of a cake-making procedure, such as the creaming method, instead of bakery procedures	Add detailed explanation of the creaming method and include the cake-making procedure in the enrichment material
Move enrichment material to the end of the document	Relocate enrichment material from the beginning to the end
Adjust the criteria for results and ensure product examples and photos are only of cakes	Change the description and photos in the criteria for results
In the quiz section, one question is less relevant because puff pastry is not discussed	Replace one quiz question with a question about the creaming method

Figure 2. Cover and Closing Pages of the E-Magazine

The product revision by the content expert was conducted once as an improvement. During the evaluation and validation, the content expert provided feedback and comments on the material content developed by the researcher.

Media Expert Validation

Validation was conducted on May 31, 2024. During this validation, the media expert provided feedback on the e-magazine in terms of media aspects, including format, icon usage, appeal, and consistency of the e-magazine. The validation results and feedback from the media expert can be seen in the Table 2.

Table 2. Media Expert Revisions

Feedback	Follow-up Actions
Make the article more engaging and add a variety of images, enlarging them	Make the article more engaging by adding and enlarging related images
Use more casual language in the tips and tricks sub-section (strategies for achieving lower-calorie cakes)	Change the tips and tricks page to a casual language to attract students to read
Place the sub-section on prohibited food ingredients in the theory section	Change the layout of the sub-section on food ingredients
Pay attention to word breaks	Revise words with incorrect breaks
Lower the quiz background sound	Reduce the background sound on the Quizizz website (related media link)

The product revision by the media expert was conducted once as an improvement. During the evaluation and validation, the media expert provided feedback and comments on the media developed by the researcher.

Feasibility Testing of the E-magazine

The stage following approval by content and media experts is limited-scale feasibility testing. The limited-scale test was conducted by 32 students of class XI Culinary Arts at SMK Negeri 4 Yogyakarta. The feasibility test began with a brief explanation of the E-Magazine for the Pastry and Bakery Product Subject on a low-calorie diet, followed by distributing the e-magazine to students for reading and study. Subsequently, students provided evaluations and feedback through a feasibility questionnaire available online via Google Forms.

Table 3. Feasibility Assessment Criteria

Score Interval	Category
$X \geq \bar{x}+1.SBx$	Very Feasible
$\bar{x}+1.SBx > X \geq \bar{x}$	Feasible
$\bar{x} > X \geq \bar{x}-1.SBx$	Less Feasible
$X < \bar{x}-1.SBx$	Not Feasible

Source: Mardapi (2008)

Test Data Results

The test data description contains all the survey results used for the feasibility test in developing the E-Magazine for the Pastry and Bakery Product Subject on a Low-Calorie Diet for Class XI Culinary Arts at SMK N 4 Yogyakarta. The questionnaires used include those for content experts, media experts, and student respondents. Content experts evaluated the material, media experts assessed the appeal of the e-magazine, and students conducted the feasibility assessment of the learning e-magazine. Students' evaluations were based on media appearance, media accessibility, learning content, material content, and the benefits of this learning e-magazine.

Results of the Content Expert Feasibility Test

The content expert test data was obtained from evaluations conducted by two content experts: lecturers in the Pastry and Bakery course at Yogyakarta State University. The content expert evaluation was based on the syllabus and learning outcomes used in vocational high schools for culinary arts. The results from the content expert evaluation were considered for the feasibility of the material presented in the learning e-magazine. The evaluation for content experts in Low-Calorie Diet Pastry and Bakery Learning included: alignment with objectives, alignment with 4.0 learning resources, and alignment with student characteristics. The results of the validation by content experts on these three aspects are shown in Table 4.

Table 4. Content Expert Evaluation Data

No.	Evaluation Indicator	Average Score	Category
1	Alignment with Objectives	3	Very Feasible
2	Alignment with Learning Material Sources	3.6	Very Feasible
3	Alignment with Student Characteristics	3.25	Very Feasible
Total Average Score		3.38	Very Feasible

Based on Table 4, it can be seen that the average score for each indicator evaluated by the content expert falls into the "Very Feasible" category. The material evaluation was reviewed in three aspects: alignment with objectives, alignment with 4.0 learning resources, and alignment with student characteristics. The indicator for alignment with objectives received an average score of 3, alignment with 4.0 learning resources received an average score of 3.6, and alignment with student characteristics received an average score of 3.25. The overall average score is 3.38, meaning that the material in the e-magazine for continental food processing and presentation is "Very Feasible" for use in Low-Calorie Diet Pastry and Bakery Learning for class XI Culinary Arts students at SMK Negeri 4 Yogyakarta.

Results of the Media Expert Feasibility Test

The media expert test data was obtained from evaluations conducted by one media expert, a lecturer in Culinary Arts Education. The media expert evaluation in Low-Calorie Diet Pastry and Bakery Learning was based on the appeal of the e-magazine, which included: media appearance, accessibility, content, learning, and the benefits of the e-magazine. The media expert's evaluation data for the e-magazine can be seen in Table 5.

Table 5. Media Expert Evaluation Data

No.	Evaluation Indicator	Average Score	Category
1	Media Appearance	3.7	Very Feasible
2	Accessibility	3.8	Very Feasible
3	Benefits	4	Very Feasible
Total Average Score		3.8	Very Feasible

Based on Table 5, it can be seen that the average score for each indicator evaluated by the media expert falls into the "Very Feasible" category. The e-magazine evaluation as a learning medium includes indicators such as media appearance, accessibility, and benefits. In this validation, the media appearance indicator of the e-magazine received an average score of 3.7, media accessibility received an average score of 3.8, and the benefits aspect received an average score of 4. The overall average score for media validation is 3.8, which means that the e-magazine for Low-Calorie Diet Pastry and Bakery Learning is "Very Feasible" for use as a learning medium in the pastry and bakery subject for a low-calorie diet at SMK Negeri 4 Yogyakarta.

Results of the Limited-Scale E-magazine Feasibility Test

The limited-scale feasibility test of the e-magazine was conducted to determine students' evaluations regarding the feasibility of the E-Magazine for the Pastry and Bakery Product Subject on a Low-Calorie Diet. This test was conducted after content and media validation was approved by experts and deemed feasible for use with improvements, according to the feedback or suggestions provided. The E-Magazine for the Pastry and Bakery Product Subject on a Low-Calorie Diet for class XI Culinary Arts was tested for feasibility on a limited-scale group of 32 students from class XI Culinary Arts at SMK Negeri 4 Yogyakarta. The results of the e-magazine usage trial can be seen in the table below.

The limited-scale feasibility test was conducted to determine the feasibility of the e-magazine, evaluated by 32 student respondents. Data collection from students was done by distributing an online questionnaire via Google Forms, which contained 20 statements and 4 alternative answers. The data from the limited-scale feasibility test of the E-Magazine for the Pastry and Bakery Product Subject is presented in the Table 6.

Table 6. Limited-Scale Feasibility Test Evaluation Data

No.	Evaluation Aspect	Average Score	Category
1	Media Appearance	3.6	Very Feasible
2	Media Accessibility	3.5	Very Feasible
3	Learning	3.4	Very Feasible
4	Material Content	3.4	Very Feasible
5	Benefits	3.4	Very Feasible
Total Average Score		3.45	Very Feasible

The students' evaluations from the limited-scale feasibility test, viewed from the aspect of media appearance, received an average score of 3.6, while the media accessibility aspect received a score of 3.5, and the e-magazine learning aspect received an average score of 3.4. Additionally, the material content aspect received an average score of 3.4, and the benefits aspect received an average score of 3.4. Overall, the average score for this feasibility test is 3.45, which means the E-Magazine for the Pastry and Bakery Product Subject on a Low-Calorie Diet is "Very Feasible" for use as a learning medium in the Low-Calorie Diet Pastry and Bakery subject at SMK N 4 Yogyakarta.

Dissemination Stage

The final stage is Dissemination, where the e-magazine, which has been revised and evaluated by experts, is distributed through the flipbook platform to facilitate general access by students and teachers. The e-magazine can be accessed via the following link: https://heyzine.com/flip-book/d12b7a20d0.html.

DISCUSSIONS

E-magazines as learning media offer significant advantages in the educational context, especially in vocational programs like Pastry and Bakery. One of the main advantages of e-magazines is their ability to present information interactively and engagingly. This can help students understand the material better, as stated by Fadillah et al. (2021). E-magazines can combine text, images, videos, and other multimedia elements, creating a richer and more immersive learning experience (Fadillah et al., 2021). In the context of vocational education, the use of e-magazines supports project-based learning methods, allowing students to engage directly in practical and applicable learning processes (Fadillah et al., 2021). With e-magazines,

students can access recipes, techniques, and the latest information on industry trends directly, enhancing their practical skills and preparing them to enter the workforce (Hakim, 2024).

E-magazines also serve as a platform for sharing knowledge and experiences between students and educators. In vocational education, collaboration between educational institutions and industry is crucial to ensure the curriculum meets the needs of the job market (Asih, 2023). E-magazines facilitate this communication, allowing students to gain direct insights from professionals in the Pastry and Bakery field and expand their networks (Hakim, 2024). The use of e-magazines aligns with the Merdeka Belajar initiative, which emphasizes innovation in vocational education (Safaruddin, 2021). By integrating technology and digital media into the curriculum, e-magazines help create a more flexible and adaptive learning environment, suited to the characteristics of Generation Z, who grew up in the digital era (Vierke, 2024). This is important for increasing student motivation and engagement, as well as preparing them for the challenges of an increasingly competitive workforce (Sonia, 2020).

The development of e-magazines as learning tools in vocational high schools has great potential to enhance learning effectiveness, especially in vocational programs like Pastry and Bakery. E-magazines serve as interactive information sources that support students in understanding the necessary material and skills. Research by Budiman et al. shows that e-learning-based learning media in vocational high schools can improve the quality of learning (Budiman et al., 2019). Satria et al. emphasize the importance of innovation in vocational education to address the challenges faced by vocational high school graduates (Satria et al., 2021). By utilizing modern and interactive learning media, students are better prepared to face the workforce. Research by Shaliha and Fakhzikril indicates that interactive elements in learning can increase student motivation (Shaliha & Fakhzikril, 2022). A well-designed e-magazine can serve as an effective tool to enhance student motivation in vocational high schools. Furthermore, Soesilo et al. reveal that effective online learning requires media that captures students' attention (Soesilo et al., 2022). E-magazines meet this need, thus engaging students more in learning. Research by Nisa et al. shows that technology-based learning media can improve student learning outcomes in vocational high schools (Nisa et al., 2021).

CONCLUSION

The development of an e-magazine for low-calorie pastry and bakery education at SMK N 4 Yogyakarta has shown a significant improvement in the learning experience of vocational students. With validation from content and media experts, as well as positive feedback from students, this e-magazine has proven to be a highly feasible and effective digital learning resource. The development process followed the 4D model: Define, Design, Develop, and Disseminate, ensuring that the resulting media aligns with curriculum needs and student characteristics. This e-magazine not only serves as an interactive learning tool but also motivates students in the culinary arts. For future research, it is recommended to evaluate its long-term impact on students' practical skills and knowledge achievements in the culinary field. Further research and development are needed to test the improvement in learning outcomes, practicality, and effectiveness of the e-magazine in practical lessons for Low-Calorie Diet Pastry and Bakery among students. Additionally, there is a need for the development of other learning media and methods as learning tools for students in practical implementation, so that students remain motivated to better understand both theory and practice and become more skilled.

Culinary Arts Education program. Thanks also to SMK Negeri 4 Yogyakarta for allowing the researcher to conduct research and development there.

REFERENCES

Abhijeet. (2023). A comprehensive review on role of distance learning program towards the development of global education system. *Current Journal of Applied Science and Technology*, *42*(48), 23–34. https://doi.org/10.9734/cjast/2023/v42i484327

Ahmed, E. I., & Mohammed, A. (2021). Evaluating the impact of global citizenship education programmes: a synthesis of the research. *Education Citizenship and Social Justice*, *17*(2), 122–140. https://doi.org/10.1177/17461979211000039

Asih, P. (2023). Pengaruh kompetensi, pengembangan karir dan sarana prasarana terhadap kinerja dosen. *Jiip - Jurnal Ilmiah Ilmu Pendidikan*, *6*(5), 2968–2975. https://doi.org/10.54371/jiip.v6i5.1961

Bernaldo, M. O., & Fernández-Sánchez, G. (2022). *Globalization and education: Trends towards sustainability*. https://doi.org/10.5772/intechopen.99974

Budiman, A., Arifin, A., & Marlianto, F. (2019). Pengembangan media pembelajaran berbasis e-learning Pada SMK di Pontianak. *Jurnal Nasional Komputasi Dan Teknologi Informasi (Jnkti)*, *2*(2), 133. https://doi.org/10.32672/jnkti.v2i2.1556

Coyer, C., Gebregiorgis, D., Patton, K., Gheleva, D., & Bikos, L. H. (2019). Cultivating global learning locally through community-based experiential education. *Journal of Experiential Education*, *42*(2), 155–170. https://doi.org/10.1177/1053825918824615

Fadillah, R., Ambiyar, A., Giatman, M., Fadhilah, F., Muskhir, M., & Effendi, H. (2021). Meta analysis: Efektivitas penggunaan metode proyect based learning dalam pendidikan vokasi. *Jurnal Pedagogi Dan Pembelajaran*, *4*(1), 138. https://doi.org/10.23887/jp2.v4i1.32408

Hakim, M. N. (2024). Platform merdeka mengajar: Integrasi teknologi dalam pendidikan vokasi dan pengembangan guru. *Kharisma Jurnal Administrasi dan Manajemen Pendidikan*, *3*(1), 68–82. https://doi.org/10.59373/kharisma.v3i1.47

Huang, K. L., & Cheng, C. C. (2020). Editorial for thematic issue on "educational challenges in east Asia." *Problems of Education in the 21st Century*, *78*(6A), 1062–1064. https://doi.org/10.33225/pec/20.78.1062

Jin, Y. (2023). The rise of education globalization: Embracing opportunities and overcoming challenges. *Advances in Economics and Management Research*, *8*(1), 62. https://doi.org/10.56028/aemr.8.1.62.2023

Kristiono, N., & others. (2018). Pemanfaatan media wayang kertas untuk meningkatkan mutu perkembangan karakter bahasa anak dalam berkomunikasi verbal. *Jurnal Penjaminan Mutu*, *4*(02), 155–162.

Mardapi, D. (2008). *Teknik penyusunan instrumen tes dan nontes*. Mitra Cendikia Press.

Mulyatiningsih, E. (2012). *Metodologi Penelitian Terapan*. Alfabeta.

Nisa, N., Komariyah, L., & Syam, M. (2021). Pengaruh model pembelajaran e-learning berbantuan google classroom dan zoom cloud meeting terhadap hasil belajar siswa di SMK Negeri 6 Samarinda. *Jurnal Kajian Pendidikan Ipa*, *1*(1), 21–30. https://doi.org/10.52434/jkpi.v1i1.1053

Nurfadilah, S. (2021). *Media Pembelajaran di Jenjang SD*. CV Jejak.

Nurngaini, L. F. (2024). Implementasi kurikulum merdeka pada mata pelajaran ipas di SDN Sumberdodol 1 kecamatan Panekan kabupaten Magetan. *Thifl*, *3*(2), 334–349. https://doi.org/10.21154/thifl.v3i2.2883

Pratycia, A., Putra, A. D., Salsabila, A. G. M., Adha, F. I., & Fuadin, A. (2023). Analisis perbedaan kurikulum 2013 dengan kurikulum merdeka. *Jurnal Pendidikan Sains Dan Komputer*, *3*(01), 58–64. https://doi.org/10.47709/jpsk.v3i01.1974

Rapoport, A. (2020). Editorial: Technologization of global citizenship education as response to challenges of globalization. *Research in Social Sciences and Technology*, *5*(1), i–vii. https://doi.org/10.46303/ressat.05.01.ed

Rosmiati, U., Supratman, S., & Madawistama, S. T. (2021). ELMA (e-learning for matheatics): Pengembangan media pembelajaran berbasis LMS (learning management system) sebagai alternatif pembelajaran di masa pandemi covid-19. *Jipm (Jurnal Ilmiah Pendidikan Matematika)*, *10*(2), 163. https://doi.org/10.25273/jipm.v10i2.10051

Safaruddin, S. (2021). Pengaruh pendidikan vokasi terhadap motivasi belajar dan keterampilan bekerja calon karyawan pada PT.Semen Baturaja (Persero) TBK. *Jurnal Dinamika*, *2*(1), 67–75. https://doi.org/10.18326/dinamika.v2i1.67-75

Satria, M. R., Fatmawati, A. P., Marismiati, M., & Firmansyah, I. (2021). Sosialisasi tentang bidang-bidang akuntansi dan profesi akuntan pada siswa-siswi jurusan akuntansi di SMKN 1 Subang. *Integritas Jurnal Pengabdian*, *5*(2), 312. https://doi.org/10.36841/integritas.v5i2.982

Shaliha, M. A., & Fakhzikril, M. R. (2022). Pengembangan konsep belajar dengan gamifikasi. *Inovasi Kurikulum*, *19*(1), 79–86. https://doi.org/10.17509/jik.v19i1.43608

Shin, R., & Hutzel, K. (2018). Editorial – Borderless: Global Narratives in Art Education. *Journal of Cultural Research in Art Education*, *35*(1). https://doi.org/10.2458/jcrae.4859

Soesilo, T. D., Kristin, F., & Setyorini, S. (2022). Pengaruh penerapan model pembelajaran terhadap kemandirian belajar di masa pandemi covid-19 pada peserta didik di sma dan SMK kota Salatiga. *Satya Widya*, *37*(2), 79–91. https://doi.org/10.24246/j.sw.2021.v37.i2.p79-91

Sonia, N. R. (2020). Implementasi sistem informasi manajemen pendidikan (simdik) dalam meningkatkan mutu pendidikan di madrasah aliyah negeri 2 Ponorogo. *Southeast Asian Journal of Islamic Education Management*, *1*(1), 94–104. https://doi.org/10.21154/sajiem.v1i1.18

Sugiyono. (2011). *Metode penelitian pendidikan*. Alfabeta.

Vierke, I. M. L. (2024). Analisis struktural interpretatif untuk merancang transformasi digital pendidikan tinggi di indonesia. *Equilibrium Jurnal Pendidikan*, *12*(1), 90–101. https://doi.org/10.26618/equilibrium.v12i1.13299

Yusantika, F. D., Suyitno, I., & Furaidah, F. (2018). *Pengaruh media audio dan audio visual terhadap kemampuan menyimak siswa kelas IV*. State University of Malang.

Zubrzycki, A., Cierpka-Kmiec, K., Kmiec, Z., & Wronska, A. (2018). The role of low-calorie diets and intermittent fasting in the treatment of obesity and type-2 diabetes. *Journal of Physiology \& Pharmacology*, *69*(5).