

# An Interactive Digital Module for Vocational Bakery Education: Integrating VARK Learning Styles in Angel Food and Chiffon Cake Preparation

Suhaizal Hashim<sup>1\*</sup>, Noremey Rasip<sup>1</sup>, Ameesha Meera Amran<sup>1</sup>, Nurul Nadwa Zulkifli<sup>2</sup>

<sup>1</sup>Universiti Tun Hussein Onn Malaysia

<sup>2</sup>Universiti Putra Malaysia

\*Corresponding author: Suhaizal Hashim (suhaizal@uthm.edu.my)

Received: 12 February 2026

Received in revised form: 15 April 2026

Accepted: 1 June 2026

Published: 10 July 2026

## ABSTRACT

In vocational bakery and pastry education, learning the preparation of Angel Food and Chiffon Cake poses considerable problems due to the high sensitivity of the procedures required, especially with egg white foam stability and the folding process. Traditional teacher-centred demonstrations frequently prove inadequate, as students find it challenging to perceive nuanced texture variations and lack adaptable learning materials for autonomous review. This project intends to create an interactive digital module utilizing the Visual, Aural, Read/Write, and Kinesthetic (VARK) learning paradigm, following the ASSURE instructional design framework to overcome existing restrictions. A Design and Development Research (DDR) methodology was utilized, with the module created using Canva. The module's functionality was appraised by five specialists, and its usability was reviewed by 30 Diploma Vokasional Malaysia (DVM) students. The findings indicated a strong consensus among experts over the module's functionality. Student usability findings demonstrated favourable acceptability across all VARK components, with the Read/Write element attaining the highest mean score ( $M = 3.65$ ), succeeded by Visual ( $M = 3.61$ ), Kinesthetic ( $M = 3.58$ ), and Aural ( $M = 3.53$ ). Furthermore, the efficacy of the module was corroborated by comprehension test outcomes, with 80% of students achieving scores of 70% or above. The findings indicate that the created interactive digital module successfully facilitates self-directed learning and improves students' technical comprehension in TVET culinary education.

## Keywords

Interactive digital module; VARK model; ASSURE model; TVET; Angel Food and Chiffon Cake

## Introduction

The swift progression of digital technology has catalysed a substantial revolution in the worldwide domain of Technical and Vocational Education and Training (TVET). As the industry evolves into the Fourth Industrial Revolution (IR 4.0), there is a growing necessity to provide the workforce with advanced technical capabilities via adaptable and accessible learning approaches. Integrating technology in vocational education is crucial for enabling students to develop capabilities through systematic and organized instruction (UNESCO, 2023). In Malaysia, initiatives like the Digital Education Policy and the execution of Digital TVET seek to improve the efficacy and inclusivity of education through the utilization of digital technologies and resources (Kementerian Pendidikan Malaysia, 2023). This paradigm shift highlights the transition from conventional, teacher-centred instruction to more dynamic techniques that employ digital resources to address modern educational needs (Razak et al., 2022).

Notwithstanding these technical developments, the implementation of digital pedagogy in numerous vocational colleges remains constrained. Traditional pedagogical approaches, such as lectures, written materials, and unidirectional demonstrations, remain prevalent, frequently leading to passive student involvement (Tang, 2023). These methods are especially inadequate for the contemporary cohort of TVET students, frequently termed "digital natives," who exhibit a greater receptiveness to visual, interactive, and immersive learning facilitated through smartphones and digital platforms (Shaikh, 2024; Qatrunnada et al., 2025). Dependence on passive hearing or static text devoid of multimedia resources may impede students' capacity to sustain attention and grasp intricate technical concepts efficiently (Vimbelo & Bayaga, 2023).

The challenges are particularly evident in vocational culinary education, exemplified by the DHB1243 Cake Making course. The making of Angel Food and Chiffon cakes requires meticulous accuracy and is extremely sensitive to slight inaccuracies. Successful results depend on the mastery of essential methods, such as egg white foam stability, the "folding" procedure, and accurate oven temperature regulation (Putri et al., 2025; Putra et al., 2025). The restricted demonstration duration and elevated student-to-teacher ratios in conventional workshop environments impede thorough observation of these intricate processes. As a result, students frequently face practical challenges, like sinking, cracking, or unstable cake structures, stemming from their inability to remember the demonstrated techniques during practical application (Putri et al., 2025).

## Literature Review

To address these pedagogical challenges, it is essential to adopt instructional designs that cater to diverse learning preferences. The VARK model, introduced by Fleming and Mills in 1992, classifies learning styles into four modalities, Visual (V), Aural (A), Read/Write (R), and Kinesthetic (K) (Subagja & Rubini, 2023). In the context of TVET, students often exhibit a dominance in visual and kinesthetic styles, preferring to learn through observation and practical application rather than text-heavy resources (Razali et al., 2021). Therefore, developing learning materials that integrate these multisensory elements such as video demonstrations for visual learners, audio narrations for aural learners, and interactive quizzes for kinesthetic learners can significantly enhance students' understanding and motivation (Jamil et al., 2024).

The development of an interactive digital module serves as a potential solution to bridge the gap between traditional teaching limitations and modern learning requirements. Unlike static textbooks, digital modules allow students to engage in self-paced learning, offering the flexibility to access materials at any time (Khan et al., 2021). To ensure the effectiveness of such a module, a systematic instructional design framework is required. The ASSURE Model (Analyze learners, State objectives, select methods, utilize media, require participation and evaluate) provides a structured guide to developing technology-based instruction that is specifically aligned with learner characteristics and objectives (Smaldino et al., 2019). This model helps researchers plan instruction more systematically by identifying learner needs and selecting appropriate strategies and media (Heinich, 1996).

The VARK model, introduced by Fleming & Mills (1992), offers a framework for comprehending student learning preferences via four modalities: Visual (V), Aural (A), Read/Write (R), and Kinesthetic (K) (Subagja & Rubini, 2023). In TVET situations, students often have pronounced visual and kinesthetic preferences, prioritizing observation and practical application over text-dense materials (Razali et al., 2021). Consequently, creating educational materials that incorporate multimodal components—such as visual demonstrations for visual learners, auditory narrations for aural learners, and interactive activities for kinesthetic learners—can improve engagement, understanding, and proficiency in intricate technical tasks.

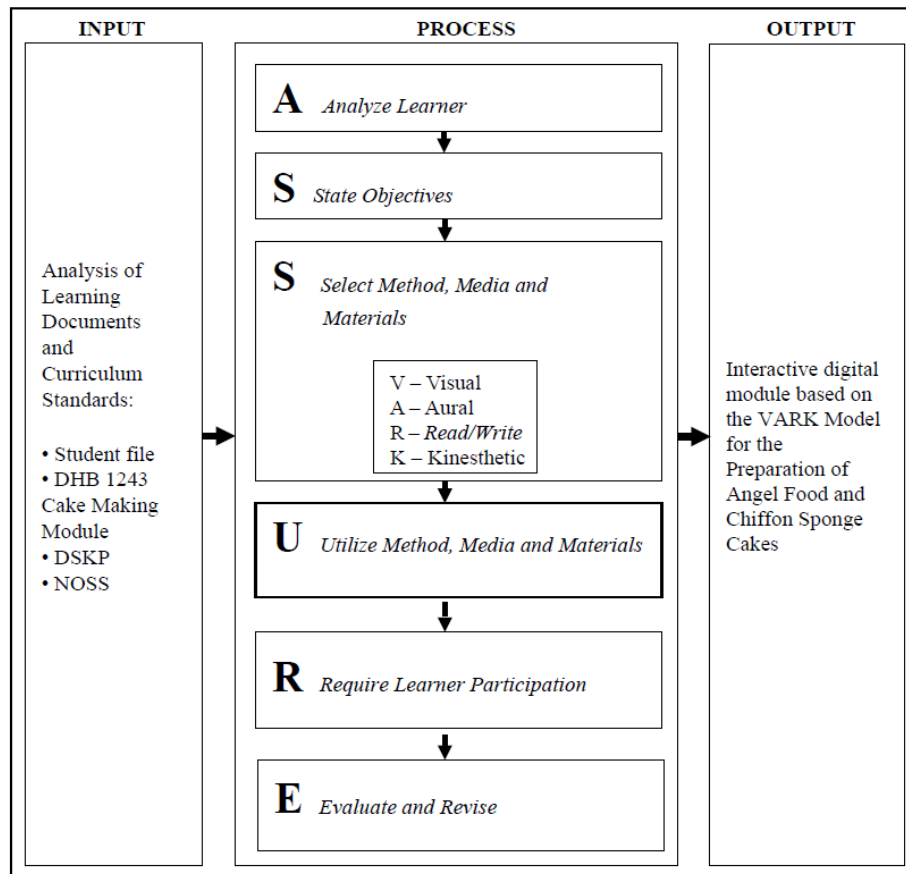
This study's conceptual framework was designed to elucidate the development process of an interactive digital module for learning sponge cake preparation utilizing the Angel Food and Chiffon techniques, grounded on the VARK Model and implemented through the ASSURE Model. This conceptual framework comprises three primary components: input, process, and output, which are systematically interrelated. This study's input component is derived from the examination of learning papers and curriculum standards pertinent to the preparation of sponge cakes. Document analysis encompasses student files, current learning modules, namely DHB 1243 Cake Making focusing on Angel Food and Chiffon, along with official curriculum materials like the Curriculum and Assessment Standard Document (DSKP) and the National Occupational Skills Standard (NOSS). This document analysis seeks to ascertain the learning content, topic organization, and skill prerequisites that underpin the creation of interactive digital modules.

The process component entails the creation of interactive digital modules utilizing the ASSURE Model, which comprises six primary phases: student analysis, establishing learning objectives, selecting methods, media, and materials, implementing methods, media, and materials, engaging users, and conducting evaluation and enhancement. This study incorporated the VARK Model throughout the selection phase of methods, media, and materials by integrating visual, aural, reading/writing, and kinesthetic components into the design of interactive digital modules. This technique seeks to guarantee that the created modules are engaging and appropriate for diverse learning types. The output component denotes the ultimate result of the study, specifically an interactive digital module grounded in the VARK Model for mastering sponge cake preparation utilizing the Angel Food and Chiffon techniques. This module

was methodically constructed based on document analysis findings and the application of the ASSURE Model, resulting in a planned and structured learning material. The conceptual framework depicted in Figure 1 illustrates a distinct relationship between document analysis as the input, the implementation of the ASSURE Model and the VARK Model as the process, and the creation of an interactive digital module as the study's outcome.

**Figure 1**

*Conceptual Framework for the Development of Interactive Digital Modules Based on the VARK Model for the Preparation of Angel Food and Chiffon Sponge Cakes*



However, a review of existing literature reveals a scarcity of resources that specifically combine the VARK learning model with the ASSURE instructional design framework for the topic of Angel Food and Chiffon cake preparation in the Malaysian TVET context (Ariyanto et al., 2023; Dinanti et al., 2024). Most existing digital resources are generic e-modules or simple video repositories that do not systematically address individual learning styles. Consequently, there is a pressing need to design and develop a comprehensive interactive digital module that not only delivers content but also facilitates active learning and skill mastery. Thus, this study aims to design and develop an interactive digital module based on the VARK model using the ASSURE framework and subsequently evaluate its functionality and usability to support students in mastering these complex baking techniques (Ariyanto et al., 2023).

## Research Objectives

Accordingly, the research objectives of this design and development study are as follows:

1. To design and develop an interactive digital module using the ASSURE Model based on the VARK learning style approach for the topic of preparing sponge cakes using the Angel Food and Chiffon methods.
2. To evaluate the functionality of the interactive digital module based on the VARK learning style approach for the topic of preparing sponge cakes using the Angel Food and Chiffon methods.
3. To evaluate the usability of the interactive digital module developed based on the VARK learning style approach and learners' comprehension test performance for the topic of preparing sponge cakes using the Angel Food and Chiffon methods

## Research Questions

Based on the stated research objectives, the following research questions are formulated to guide this study:

- 1 How to design and develop the interactive digital module developed using the ASSURE Model based on the VARK learning style approach for the topic of preparing sponge cakes using the Angel Food and Chiffon methods?
- 2 What is the level of functionality of the interactive digital module developed based on the VARK learning style approach for the topic of preparing sponge cakes using the Angel Food and Chiffon methods?
- 3 What is the level of usability of the interactive digital module developed based on the VARK learning style approach, and its effect on learners' comprehension test performance for the topic of preparing sponge cakes using the Angel Food and Chiffon methods?

## Methodology

This study employed a Design and Development Research (DDR) approach to design, develop, and evaluate an interactive digital module for sponge cake preparation using the Angel Food and Chiffon methods in the context of Technical and Vocational Education and Training (TVET). DDR was selected because it is suitable for studies that focus on the systematic development of instructional products and the evaluation of their functionality and usability (Richey & Klein, 2014). This approach enables researchers to design educational materials based on identified needs and to validate the developed product through structured evaluation processes. The DDR approach applied in this study consisted of three main phases, needs analysis, design and development, and evaluation. The implementation of each phase was aligned with the objectives of the study and is summarised in Table 1.

**Table 1**  
*Implementation of DDR Phases*

| Phase                           | Method                                 |
|---------------------------------|----------------------------------------|
| Phase 1: Needs Analysis         | Literature Review                      |
|                                 | Document Analysis                      |
| Phase 2: Design and Development | ASSURE Model                           |
|                                 | VARK Model                             |
| Phase 3: Evaluation             | Expert evaluation on functionality     |
|                                 | Student feedback on usability          |
|                                 | Comprehension test for supporting data |

## Sampling

The sampling method used was purposive sampling. The respondents involved 30 Year 1 Diploma Vokasional Malaysia (DVM) students from the Bakery and Pastry program at Kolej Vokasional Datuk Seri Abu Zahar Isnin, Melaka. For

the expert evaluation, five experts were appointed, consisting of TVET teachers in bakery and culinary arts, Instructional Design and Technology (IDT) lecturers, and a multimedia lecturer.

## **Instruments**

The study utilized three main instruments to gather data for functionality and usability analysis. The first instrument was the Expert Questionnaire, which was distributed to five experts to evaluate the module's functionality based on content suitability, instructional design, and multimedia elements. The second instrument was the Student Questionnaire, designed to assess the module's usability from the perspective of the target users. This questionnaire consisted of items categorized according to the VARK learning styles (Visual, Aural, Read/Write, and Kinesthetic) and utilized a 4-point Likert scale to measure student agreement. The third instrument was a Comprehension Test, comprising 10 multiple-choice questions based on the course learning outcomes. This test served as supporting data to evaluate the students' understanding of the Angel Food and Chiffon cake preparation concepts after using the module. The validity of these instruments was verified by experts in language and instructional design to ensure the content was accurate and appropriate for the study's objectives. The instrument validity employed in this study is content validity, which was established through expert evaluation specialists in TVET education and instructional design to ensure the relevance and appropriateness of the items.

## **Data Analysis**

The data obtained in this study were analysed quantitatively using descriptive statistics to evaluate the functionality and usability of the interactive digital module. Data from the expert questionnaires regarding module functionality were analysed using Microsoft Excel to calculate frequencies and percentages to determine the level of expert consensus. Meanwhile, data from the student questionnaires regarding usability based on VARK elements were processed using IBM SPSS Statistics version 31 to determine the mean score, standard deviation, frequency, and percentage. The interpretation of mean scores was classified based on the scale by Landell (1997), where a mean score between 3.80 and 5.00 indicates a high level of usability. Additionally, the instrument's reliability was verified through a pilot study yielding a Cronbach's Alpha value of 0.751, while the comprehension test data served as supporting evidence and was analysed based on score percentages to assess students' understanding of the Angel Food and Chiffon cake preparation techniques.

## **The Design and Development of the Interactive Digital Module**

The design and development of the interactive digital module were meticulously guided by the ASSURE Model, a systematic instructional design framework introduced by Heinich et al. which ensures a strategic alignment between learner characteristics, pedagogical objectives, and the selection of appropriate media technology (Heinich, 1996; Smaldino et al., 2019). This model comprising six distinct phases namely Analyse Learners, State Standards and Objectives, Select Strategies, Technology, Media and Materials, Utilize Technology, Media and Materials, Require Learner Participation, and Evaluate and Revise served as the comprehensive roadmap for structuring the module's content to cater to the diverse visual, aural, read or write, and kinesthetic learning styles identified in the VARK model (Fleming & Mills, 1992; Smaldino et al., 2019). By employing this learner centred approach, the development process began with a thorough analysis of TVET students' needs and prior knowledge regarding DHB1243 Cake Making followed by the formulation of clear cognitive and psychomotor objectives, the selection of digital tools such as Canva and CapCut for content creation and the implementation of interactive activities to foster active engagement, culminating in a rigorous evaluation phase to ensure functionality and usability as illustrated in the process flow shown in Figure 2 (Heinich et al., 1996).

**Figure 2**

*The ASSURE Model (Heinich et al., 1996)*



The selection of the ASSURE Model as the instructional design framework is driven by its systematic approach to integrating technology into the learning process, ensuring that the instructional media is not just decorative but pedagogically functional. As depicted in Figure 1, the workflow begins with understanding the specific needs of TVET students and progresses through a structured selection of media materials to ensure alignment with the DHB1243 Cake Making curriculum. This model is particularly significant for this study as it facilitates the seamless integration of VARK learning styles into the digital module, ensuring that visual, aural, read/write, and kinesthetic elements are strategically utilized to help students master the sensitive techniques of Angel Food and Chiffon cake preparation.

### ***Analyse Learners***

The instructional design process commenced with the Analyse Learners phase, where the target audience was identified as Year 1 Diploma Vokasional Malaysia (DVM) students in the Bakery and Pastry program at Kolej Vokasional Datuk Seri Abu Zahar Isnin. Through a detailed analysis of curriculum documents, specifically the *Dokumen Standard Kurikulum dan Pentaksiran* (DSKP) and National Occupational Skills Standard (NOSS), it was determined that students often struggle to master intricate techniques such as egg white foam stability and the "folding" (*kaup balik*) method due to the limitations of traditional, one-time live demonstrations (Bahagian Pendidikan dan Latihan Teknikal Vokasional, 2025; Jabatan Pendidikan Perak, 2024). Consequently, the analysis highlighted a critical need for supplementary digital learning materials that cater to the students' visual and kinesthetic learning preferences, allowing them to revisit complex technical procedures at their own pace outside of the workshop environment (Razali et al., 2021).

### ***State Standard and Objectives***

In the State Standards and Objectives phase, specific learning outcomes were formulated based on the DHB1243 Cake Making course syllabus to ensure alignment with the national vocational curriculum (Bahagian Pendidikan dan Latihan Teknikal Vokasional, 2025). The objectives were designed to cover both cognitive and technical competencies, requiring that by the end of the module, students must be able to explain the precise definitions of Angel Food and Chiffon cakes, describe the distinct preparation methods for each, and identify quality attributes as well as common production faults (Hasanah, 2023). These objectives served as the foundational guide for structuring the module's content and assessment activities, ensuring that every digital intervention directly supports the mastery of essential culinary skills required by the industry.

## Select Methods, Media, and Materials

The third phase, Select Strategies, Technology, Media, and Materials, focused on choosing the most effective digital tools to systematically integrate VARK learning styles into the module (Smaldino et al., 2019). The interactive module was developed using Canva as the primary hosting platform due to its versatility in combining text and graphics, while CapCut was utilized to edit high-definition demonstration videos to support visual learners (Ameesha, 2026). To cater to aural learners, ElevenLabs AI was employed to generate clear, consistent audio narrations, and for kinesthetic engagement, interactive navigation buttons and gamified quizzes via ZEP Quiz were selected to foster active participation. The specific mapping of these selected media materials to the respective VARK learning styles is detailed in Table 2.

**Table 2**  
*Integration of VARK Learning Styles in the Module*

| Learning Style | Elements in Module                                                                                                 | Module Interface                                                                     |
|----------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Visual         | <p>Illustrations, graphics, and visual layouts.</p> <p>Standard Recipe with ingredient images and infographics</p> |   |
| Aural          | <p>Audio and video narration</p> <p>Demonstration video with voice-overs generated by AI</p>                       |  |

|             |                                                                                                                              |                                                                                     |
|-------------|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Read/Write  | Text notes, procedure lists, and explanations<br><br>Step by step text instructions                                          |   |
| Kinesthetic | Interactive clicks, menu navigation, and matching activities<br><br>Interactive buttons, navigation menus and ZEP Quiz games |  |

### ***Utilise Methods, Media, and Materials***

The implementation of the module was executed through a web-based learning approach where the content hosted on Canva was shared via a specific link, making it easily accessible to students on both laptops and smartphones. To ensure the effective utilization of the materials, a synchronous session was conducted via Google Meet, during which the researcher facilitated the learning process by guiding students on how to navigate the interface, instructing them to watch the step-by-step demonstration videos edited with CapCut, and ensuring they listened to the AI-generated audio explanations for clarity. This phase was critical in transitioning the planned materials into an actual learning environment, ensuring that the students could access the digital resources seamlessly and interact with the multimedia elements as intended by the instructional design.

### ***Require Learner Participation***

To foster active engagement rather than passive observation, the module was designed to require continuous learner participation through self-directed exploration and interactive assessment. Students actively engaged with the learning material by independently navigating through the structured topics, watching the instructional videos, and subsequently reinforcing their knowledge by answering interactive gamified quizzes on the ZEP Quiz platform. Furthermore, learner participation was formalized through the completion of a comprehension test and a usability questionnaire via Google



Forms immediately after the session, ensuring that students not only consumed the content but also demonstrated their understanding of the Angel Food and Chiffon cake preparation techniques.

### ***Evaluate and Revise***

The final phase focused on evaluating the module's functionality through a rigorous assessment by a panel of five experts, whose feedback provided the basis for essential revisions to enhance the module's quality. Based on the expert recommendations, significant improvements were made, including replacing third-party video content with self-recorded demonstrations to ensure authenticity and correcting specific technical terminology, such as changing the term "folding" to "kaup balik" and rectifying the colour description of Chiffon cake to "pale yellow" for accuracy. These revisions also extended to optimizing the visual layout and navigation buttons, ensuring that the final version of the module was functionally robust, accurate, and user-friendly for TVET learners.

## **Results**

The results of this study are categorized into three main sections: expert evaluation regarding the module's functionality, student evaluation concerning usability, and comprehension test scores which serve as supporting data.

### **Level of Functionality**

The functionality of the interactive digital module was evaluated by a panel of five experts comprising subject matter experts in bakery and pastry, Instructional Design and Technology (IDT) lecturers, and a multimedia specialist using a quantitative approach based on frequency and percentage analysis. The findings indicated a high level of expert consensus across the four VARK elements, where the visual aspect received positive feedback for its clear and relevant usage of graphics and colours which effectively depicted the cake preparation sequence. As summarized in Table 3, the evaluation results demonstrate a consistent pattern of high agreement among the experts regarding the module's effectiveness. Similarly, the aural and read or write elements achieved a high agreement rate, with experts confirming that the audio narrations were clear and the structured text served as an effective reference for students. Although the kinesthetic aspect received a majority agreement regarding the module's ability to foster active participation and navigation control, the overall quantitative analysis confirmed that the module functions effectively as a support tool for teaching and learning in a TVET setting.

**Table 3**  
*Expert Evaluation on Module Functionality Based on VARK*

| Aspect      | Item Evaluated                                                  | Percentage of Agreement (%) | Interpretation |
|-------------|-----------------------------------------------------------------|-----------------------------|----------------|
| Visual      | Clarity, use of colour, sequence of process, relevance          | 100                         | High Consensus |
| Aural       | Audio clarity, narration effectiveness, repetition capability   | 100                         | High Consensus |
| Read/Write  | Structured notes, text clarity, reference suitability           | 100                         | High Consensus |
| Kinesthetic | Active participation, interactive navigation, gamified quizzes. | 100                         | High Consensus |

Based on the findings in Table 3, the analysis reveals a high level of consensus among the experts regarding the functionality of the module across all VARK elements. For the Visual aspect, the experts unanimously agreed that the use of graphics, colours and the sequence of cake preparation steps were clear and effective in supporting student understanding. Similarly, the Aural and Read/Write elements received positive feedback, with experts confirming that the audio narrations were distinct and the structured text served as a suitable reference for students. Although the Kinesthetic aspect received varied feedback on specific items, the overall consensus indicates that the module successfully encourages active learner participation through interactive navigation and digital quizzes, making it a functional tool for TVET learning.

## Level of Usability

Following the expert validation phase, the usability of the interactive digital module was quantitatively evaluated by 30 Diploma Vokasional Malaysia (DVM) students from the Bakery and Pastry program using a structured questionnaire designed to measure user experience across the Visual, Aural, Read/Write, and Kinesthetic (VARK) learning styles. The data collected were analysed using descriptive statistics to determine the mean scores and standard deviations for each aspect, as summarized in Table 4, which indicates a positive reception across all constructs with mean scores ranging from 3.53 to 3.65. Specifically, the Read/Write aspect recorded the highest mean score ( $M=3.65$ ,  $SD=0.430$ ), suggesting that the module's structured notes and step-by-step text instructions were highly effective in helping students grasp the technical procedures of cake making, while the Visual aspect ( $M=3.61$ ,  $SD=0.442$ ) and Kinesthetic aspect ( $M=3.58$ ,  $SD=0.441$ ) also received high ratings, confirming that the integration of clear graphics, colour coding, and interactive navigation successfully fostered active engagement and clarified the sequence of Angel Food and Chiffon cake preparation. Although the Aural aspect recorded the lowest mean among the four ( $M=3.53$ ,  $SD=0.494$ ), it still falls within a satisfactory range, demonstrating that while the AI-generated audio narration supported learning, the students were particularly responsive to the visual and text-based components of the module.

**Table 4**  
*Student Evaluation on Module Usability Based on VARK Elements*

| Aspect      | Mean Score (M) | Standard Deviation (SD) | Interpretation |
|-------------|----------------|-------------------------|----------------|
| Visual      | 3.61           | 0.442                   | Moderate       |
| Aural       | 3.53           | 0.494                   | Moderate       |
| Read/Write  | 3.65           | 0.430                   | Moderate       |
| Kinesthetic | 3.58           | 0.441                   | Moderate       |

Based on the results in Table 4, the findings indicate that students responded positively to all elements integrated into the module. The Read/Write aspect recorded the highest mean score ( $M=3.65$ ,  $SD=0.430$ ), suggesting that the structured notes and step-by-step text instructions were highly effective in helping students understand the technical procedures of cake making. The Visual aspect also received a high rating ( $M=3.61$ ), confirming that the use of images, graphics, and colour coding effectively differentiated the learning sections. Although the Aural aspect recorded the lowest mean among the four ( $M=3.53$ ), it still falls within a satisfactory range, indicating that the AI-generated audio narration and video demonstrations were helpful but could be further optimized. Overall, the consistent mean scores across all constructs demonstrate that the module is user-friendly and successfully caters to the diverse learning styles of TVET students.

## Usability of the Interactive Digital Module Based on Learners' Comprehension Test Performance

To substantiate the usability findings with empirical data on learning transfer, a comprehension test comprising 10 multiple-choice questions derived from the DHB1243 Cake Making learning outcomes was administered to the 30 respondents immediately after the module exploration session. The results, as presented in Table 5, reveal a highly positive distribution of scores ranging from a minimum of 50% to a maximum of 100%, where a significant majority of the students (80%) successfully achieved marks of 70% and above. Specifically, 33.3% of the students attained excellent scores in the 90–100% range, while another 46.7% scored between 70–89%, and although 20% of the students scored in the moderate range of 50–69%, no failures were recorded, indicating that the interactive digital module effectively facilitated the students' cognitive grasp of the critical technical concepts and procedures in Angel Food and Chiffon cake preparation, thereby validating the module's role as a functional and pedagogically sound support tool.

**Table 5**  
*Student Comprehension Test Results*

| Score Range (%) | Number of Students | Percentage (%) |
|-----------------|--------------------|----------------|
| 90 - 100        | 10                 | 33.3           |
| 70 - 89         | 14                 | 46.7           |

|         |    |     |
|---------|----|-----|
| 50 - 69 | 6  | 20  |
| Total   | 30 | 100 |

The results in Table 5 show that 80% of the students scored 70% and above, with 33.3% achieving excellent marks in the range of 90-100%. Only a small fraction (20%) scored between 50-69%, and no student failed the test. These findings suggest that the interactive digital module is effective in transferring knowledge and helping students grasp the critical techniques of cake preparation, such as the "folding" method and egg white stability, which are often difficult to master through traditional lectures alone.

## Discussion

The primary objective of this study was to design and develop an interactive digital module for the topic of Angel Food and Chiffon cake preparation integrated with VARK learning styles and guided by the ASSURE model. Based on the results and analysis, the development process has been proven successful and impactful. The module which was developed using Canva as the hosting platform and integrated with various multimedia tools such as CapCut for video editing and ZEP Quiz for assessment has demonstrated its suitability for Diploma Vokasional Malaysia students. The systematic application of the ASSURE model from analysing learner characteristics to evaluating and revising the content ensured that the instructional media was not merely decorative but pedagogically functional aligning with the principles of effective instructional design which emphasize the necessity of structured planning in technology-based learning (Smaldino et al., 2019).

In terms of functionality, the expert evaluation findings confirm that the module possesses a high level of technical and pedagogical quality. The experts reached a strong consensus regarding the suitability of the content, the clarity of the interface, and the effectiveness of the multimedia integration. This aligns with the findings of Akmal et al. (2024) who noted that digital modules in culinary arts must undergo rigorous expert validation to ensure technical accuracy. The iterative revision process was crucial particularly the correction of technical terminology such as changing folding to *kaup balik* and rectifying the colour description of Chiffon cake. These refinements ensure that the module serves as an authentic reference source addressing the specific challenges in culinary education where precise technical understanding is mandatory to avoid common product failures like cake sinking or unstable structures (Putri et al., 2025).

Regarding usability, the positive feedback from the student evaluation indicates that the integration of VARK learning styles namely Visual, Aural, Read or Write, and Kinesthetic successfully catered to the diverse needs of TVET students. The data revealed that while students appreciated the visual and kinesthetic elements such as demonstration videos and interactive navigation, the Read or Write aspect recorded the highest mean score. This suggests that despite being digital natives TVET students still highly value structured text and organized notes to reinforce their understanding of complex procedures. This finding supports the study by Razali et al. (2021) which highlights that while TVET students are often kinesthetic a multi modal approach that includes clear text references is essential for cognitive retention in technical subjects.

Furthermore, the effectiveness of the module is substantiated by the comprehension test results which served as supporting data. With a significant majority of the students achieving scores of 70 percent and above, the study demonstrates that the interactive module facilitates actual cognitive transfer and is not merely an engaging novelty. The ability of students to correctly answer questions regarding the folding method and ingredient functions indicates that the module successfully addresses the limitations of traditional demonstrations where students often miss critical details due to viewing angles or lack of repetition (Tarigan et al., 2021). By allowing self-paced repetition of video demonstrations and audio explanations the module empowers students to master sensitive baking techniques that are otherwise difficult to grasp in a single live workshop session (Dwi et al., 2023).

## Conclusion

In conclusion, this study has successfully achieved its objective to design and develop a functional and usable interactive digital module for Angel Food and Chiffon cake preparation grounded in the systematic ASSURE

instructional design framework and the VARK learning style model. The findings from both expert and student evaluations confirm that the module effectively bridges the gap between traditional teacher centred demonstrations and the modern need for flexible and student-centred digital learning materials. By strategically integrating high-definition demonstration videos AI generated audio narrations and interactive gamified quizzes the module successfully caters to the visual aural read or write and kinesthetic preferences of TVET students thereby facilitating a deeper understanding of critical culinary techniques such as egg white foam stability and the folding method. The implication of this study is significant for the advancement of Digital TVET in Malaysia as it provides a scalable model for developing technical competencies through technology however future research should expand on this work by employing experimental designs to empirically measure learning gains and extending the scope to cover broader bakery competencies to further validate the impact of the module on student achievement.

### Limitations and Future Studies

This study has several limitations. The sample size was small and limited to 30 students from a single institution, which affects generalizability. The evaluation focused mainly on short-term comprehension and student perceptions, without assessing long-term retention or actual hands-on skills such as foam stability and folding techniques. The module was also developed using a single platform (Canva), which may limit advanced interactivity, and no comparison was made with other teaching methods. Future studies should involve larger and more diverse samples, use experimental designs to compare different instructional approaches, and examine long-term skill development in real kitchen settings. Further improvements could include integrating advanced technologies such as interactive simulations, 3D videos, or augmented reality, and expanding the module to other topics in TVET culinary education.

### Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

### Acknowledgment

This research was supported by Universiti Tun Hussein Onn Malaysia (UTHM) through GPPS (Vot J066).

### References

- Akmal, N., Putri, Y. E., & Sutanti, S. (2024). Android-based e-module on food services subjects for culinary students. *Journal of Education Technology*, 8(1), 12–21. <https://doi.org/10.23887/jet.v8i1.70115>
- Ariyanto, E. W., Sutiadiningsih, A., Handajani, S., & Widagdo, A. (2023). Pengembangan e-modul untuk kompetensi dasar menerapkan plain cake bagi siswa SMKN 1 Cerme Gresik. *Jurnal Kajian Penelitian Pendidikan dan Kebudayaan*, 1(3). <https://doi.org/10.59031/jkppk.v1i3.290>
- Bahagian Pendidikan dan Latihan Teknikal Vokasional. (2025). *Diploma bakeri dan pastri*. <https://bpltv.moe.gov.my/diploma-bakeri-dan-pastri/>
- Campbell, G. (2020). *Angel food cake*. Bloomsbury Publishing.
- Creswell, J. W., & Guetterman, T. R. (2018). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (6th ed.). Pearson.
- Dinanti, P. Z., Artanti, G. D., & Febriana, R. (2024). Pengembangan media pembelajaran flipbook digital pembuatan chiffon cake. *Jurnal Ilmiah Wahana Pendidikan*, 10(23), 569–579. <https://doi.org/10.5281/zenodo.14573564>
- Fleming, N. D., & Mills, C. (1992). *Not another inventory, rather a catalyst for reflection*. *To Improve the Academy*, 11, 137–149. <https://doi.org/10.3998/tia.17063888.0011.014>
- Hasanah, F. (2023). Penerapan model pembelajaran ASSURE dalam analisis materi pembelajaran tematik. *IJIT: Indonesian Journal of Islamic Teaching*, 6(1), 81–90. <https://doi.org/10.35719/ijit.v6i1.1765>

- Heinich, R., Molenda, M., Russell, J. D., & Smaldino, S. E. (1996). *Instructional media and technologies for learning*. Merrill.
- Jabatan Pendidikan Perak. (2024). *Portal rasmi Jabatan Pendidikan Perak—NOSS Pastrri*. <https://jpnperak.moe.gov.my>
- Jamil, M. R. M., Putra, Z. H., Zalli, M. M. M., Rakami, N. M. H. N., & Idris, N. (2024). Transforming inclusive digital pedagogy in Malaysian tertiary TVET: Adapting to a new educational landscape. *The Journal of Technical Education and Training*, 16(2). <https://doi.org/10.30880/jtet.2024.16.02.014>
- Khan, M. S., Shamim, M. R., & Nambobi, M. (2021). Learning styles and online tools. In *Research Anthology on Developing Effective Online Learning Courses*. <https://doi.org/10.4018/978-1-7998-8047-9.ch033>
- Landell, K. (1997). *Management by menu*. Wiley.
- Lubis, V. R., Akmal, N., Ingtyas, F. T., & Sutrisno. (2024). Android-based e-module in basic culinary arts for vocational high school students. *Jurnal Edutech Undiksha*, 12(2). <https://doi.org/10.23887/jeu.v12i2.76634>
- Nguyen, H.-H., Do Trung, K., Nguyen Duc, L., Dang Hoang, L., Tran Ba, P., & Nguyen, V. A. (2024). A model to create a personalized online course based on the student's learning styles. *Education and Information Technologies*, 29, 571–593. <https://doi.org/10.1007/s10639-023-12287-2>
- Putra, P. A. P., Marsiti, C. I. R., & Masdarini, L. (2025). Pengembangan media video pembelajaran chiffon cake motif zebra pada mata kuliah pastry. *Jurnal Pendidikan Teknologi dan Kejuruan*, 22(1), 93–102. <https://doi.org/10.23887/jptkuniksha.v22i1.87287>
- Putri, A. S., Purwidiani, N., Pangesthi, L. T., Sulandari, L. (2025). Penerapan kontrol kualitas produk sponge cake di pastry section Harris Hotel & Conventions Bundaran Satelit Surabaya. *ALFIHRIS: Jurnal Inspirasi Pendidikan*, 3(1), 216–227. <https://doi.org/10.59246/alfihris.v3i1.1237>
- Qatrunnada, A., Agustina, E., & Rahmat, S. (2025). Gen Z's preference for English digital learning media. *International Journal of English Education and Linguistics (IJoEEL)*, 7, 183–201. <https://doi.org/10.33650/ijoeel.v7i2.11901>
- Razli, N. S. M., Ahmad, F., Hamzah, N., Wan Hassan, W. A. S., & Baharudin, S. M. (2021). Learning style tendencies based on Fleming's VARK learning style among TVET students. *AIP Conference Proceedings*, 2347(1), 020023. <https://doi.org/10.1063/5.0053050>
- Richey, R. C., & Klein, J. D. (2007). *Design and development research: Methods, strategies, and issues*. Lawrence Erlbaum Associates.
- Sayed, W. S., Noeman, A. M., Abdellatif, A., Badawy, M. G., El-Tantawy, S., Hamed, A., & Abdelrazek, M. (2022). AI-based adaptive personalized content presentation and exercises navigation for an effective and engaging e-learning platform. *Multimedia Tools and Applications*, 82, 3303–3333. <https://doi.org/10.1007/s11042-022-13076-8>
- Shaikh, F. (2024, August 12). *Exploring the psychology of digital natives: How Gen Z learns differently*. *eLearning Industry*. <https://elearningindustry.com/exploring-the-psychology-of-digital-natives-how-gen-z-learns-differently>
- Smaldino, S. E., Lowther, D. L., Mims, C., & Russell, J. D. (2019). *Instructional technology and media for learning* (12th ed.). Pearson Education, Inc.
- Subagja, S., & Rubini, B. (2023). Analysis of student learning styles using Fleming's VARK model in science subject. *Jurnal Pembelajaran dan Biologi Nukleus*, 9(1). <https://doi.org/10.36987/jpbn.v9i1.3752>
- Tang, K. H. D. (2023). Student-centered approach in teaching and learning: What does it really mean? *Acta Pedagogica Asiana*, 2(2). <https://doi.org/10.53623/apga.v2i2.218>
- Tarigan, W., Sipahutar, H., & Harahap, F. (2021). The effect of interactive digital learning module on student's learning activity and autonomy. *Bioedukasi: Jurnal Pendidikan Biologi*, 14, 196–205. <https://doi.org/10.20961/bioedukasi-uns.v14i2.49366>
- UNESCO. (2023). *Enhancing TVET through digital transformation in developing countries—UNESCO Digital Library*. UNESDOC Digital Library. <https://unesdoc.unesco.org/ark:/48223/pf0000385988>
- Vimbelo, S., & Bayaga, A. (2023). Current pedagogical practices employed by Technical Vocational Education and Training college's mathematics lecturers. *South African Journal of Higher Education*, 37(4). <https://doi.org/10.20853/37-4-5292>
- Dwi, M. A., Salam, U., & Warneri, W. (2023). Pengembangan e-modul berbasis PjBL dalam pembuatan multimedia interaktif. *Academy of Education Journal*, 14(2), 714–726. <https://doi.org/10.47200/aocj.v14i2.1885>
- Zulkifli, Z. A., Sharip, A. A., Md Zain, S. M., Abdul Rashid, N. N. A. R., Saidi, R. M., Md Rashid, N. A., & Geigiana, A. (2022). Integration of instructional models and learning styles for open and distance learning environment. *World Journal of English Language*, 12(2), 226. <https://doi.org/10.5430/wjel.v12n2p226>