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DEVELOPMENT OF MULTIMODAL-BASED ENTREPRENEURSHIP E-MODULES TO IMPROVE DIVERGENT THINKING SKILLS AT SKB UNGARAN

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Abstract: Entrepreneurship education in non-formal institutions such as Learning Activity Centers (SKB) plays a crucial role in equipping young people with economic independence but is often constrained by conventional learning methods that are ineffective in stimulating higher-level cognitive skills. One of the fundamental skills for an entrepreneur is divergent thinking, which is the ability to generate a variety of creative ideas and innovative solutions. This study aims to (1) develop a valid and practical multimodal E-Module for Entrepreneurship, and (2) test the effectiveness of the e-module in improving the divergent thinking skills of students at SKB Ungaran. This study used the Research and Development (R&D) method with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The research subjects were students of the entrepreneurship program at SKB Ungaran. Data collection instruments included material and media expert validation sheets, student response questionnaires, and divergent thinking skills tests (TTCT adaptation) in the form of pre-tests and post-tests. Feasibility data were analyzed descriptively and quantitatively, while effectiveness data were analyzed using paired t-tests and N-Gain Scores. The results showed that: (1) The developed e-module had a very high level of feasibility, with a material expert validation score of 92% and a media expert validation score of 89%, and a practicality score of 91% from student responses. (2) There was a statistically significant increase ($p<0.05$) in students' divergent thinking skills after using the e-module, with an N-Gain score of 0.58, which falls into the “Moderate” category. It is concluded that the developed multimodal Entrepreneurship E-Module is a feasible and effective learning medium for improving divergent thinking skills in the context of non-formal education.

Keywords: Entrepreneurship, E-Module, Divergent Thinking, Multimodal Learning, Non-Formal Education.

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Introduction

Massive digital transformation has changed the global economic landscape, demanding human resources that are not only adaptive, but also innovative and independent. In this context, entrepreneurship education has emerged as a strategic pillar for a nation's economic development (Zemlyak et al., 2023). The government and thinkers emphasize the importance of fostering motivation and entrepreneurship, especially among the younger generation, as a response to the challenges of finding employment and reducing unemployment rates (Diawati et al., 2024).

The digital era has opened up unprecedented business opportunities, enabling millennials and Gen Z to absorb digital business knowledge more easily and make a breakthrough through innovation, original ideas, and sensitivity in reading market needs (Nur Syafika et al., 2025). Digital entrepreneurship, which leverages digital transformation in business, is a new and promising arena for economic empowerment (Shelly Verma, Divyanshu Pandey, Harvinder Kaur, 2024). The role of non-formal educational institutions such as Learning Activity Centers is vital. SKB provide flexible and relevant education pathways for the community, including those outside the formal school system (Yani, 2023).

By organizing skills programs such as entrepreneurship, SKB directly contributes to creating jobs, increasing community income, and ultimately preparing an innovative and independent generation to face the challenges of the times (Kurniawati et al., 2025). Therefore, developing effective entrepreneurship education

programs in non-formal settings is no longer merely an option, but a strategic necessity. Success in entrepreneurship is not only determined by managerial skills or market understanding, but is rooted in a more fundamental cognitive capability, namely creativity (Ng'ora et al., 2022).

Creativity, in a business context, is the ability to solve problems, identify hidden opportunities, and create something new and valuable (Kapranova, 2023). At the heart of this creative process lies a thinking mechanism known as divergent thinking. Divergent thinking is a mental process used to generate creative ideas by exploring as many solutions or possibilities as possible from a starting point or problem (Weiss et al., 2021). This process is imaginative and spreads in various directions, as opposed to convergent thinking, which is more logical and aims to find one correct answer (Wu et al., 2015).

Divergent thinking skills can be measured through several key components, namely: (1) fluency, (2) the ability to generate many ideas; flexibility, (3) the ability to generate ideas from various categories or different perspectives, (4) originality, the ability to generate unique and unusual ideas (Cogdell-Brooke et al., 2020). The relationship between divergent thinking and the entrepreneurial spirit is very close. An entrepreneur must constantly utilize divergent thinking to create new product ideas, more efficient work methods, or innovative marketing strategies (Lynch & Corbett, 2023). This ability allows them to see challenges not as obstacles, but as opportunities for innovation (Ferreira et al., 2020). As such, training divergent thinking skills is at the part of true entrepreneurial education, which aims to shape individuals who are not only capable of running a business, but also creating one.

Traditional learning methods that tend to be teacher-centered and rely on printed teaching materials often fail to stimulate dynamic thinking skills such as divergent thinking. Monotonous and uninteractive learning can hinder students' creativity and independence in learning (Duval et al., 2023). Recognizing these limitations, the world of education is now turning to innovative learning media that are in line with technological advances. E-modules (electronic modules) are one of the most promising pedagogical solutions. (Syawaluddin et al., 2020).

As teaching materials presented electronically, e-modules offer a number of significant advantages (Syawaluddin et al., 2020). E-modules can be accessed anytime and anywhere using devices such as computers or smartphones, providing high flexibility for students to study independently (Nurhasnah et al., 2020). Furthermore, e-modules can be designed to be interactive media, combining various elements to make abstract material easier to understand (Ayunda et al., 2024). The use of platforms such as flipbooks can present e-modules with an attractive appearance, resembling physical books that can be flipped through, but enriched with editing functions to add sound, video, and hyperlinks, making the learning experience more interesting and less monotonous (Salsabila et al., 2024). To ensure that the developed e-modules are not only visually appealing but also cognitively effective, a strong theoretical foundation is required.

The multimodal learning approach is a relevant framework. Multimodality refers to the use of various modes of communication—such as text, images, sound, video, and animation—to convey and create meaning (Bayoudh, 2024). This approach recognizes that learning becomes richer and more effective when learners can interact with the material through multiple sensory channels, which in turn can increase attention, understanding, and engagement (Paraskevopoulos et al., 2024). The scientific basic behind the effectiveness of the multimodal approach can be explained through the Cognitive Theory of Multimedia Learning (CTML) popularized by Richard E. Mayer (Mayer, 2024).

CTML is built on three fundamental assumptions about how the human mind works when learning: (1) Dual-Channel Assumption, (2) Limited Capacity Assumption: Each channel can only process a small amount of information at a time. If too much information is presented, cognitive overload will occur, which hinders learning, (3) Active Processing Assumption: Meaningful learning occurs when learners are actively involved in the cognitive process: selecting relevant information, organizing it into coherent mental representations, and integrating it with existing knowledge (Sveistrup et al., 2025).

The application of this framework transforms the e-module development process into an act of "cognitive engineering." Multimodal design is not chosen randomly, but is deliberately designed to manage the cognitive load of learners (Xiao et al., 2025). By reducing extraneous cognitive load through good design (e.g., not displaying long texts and narratives simultaneously), learners' mental capacity can be allocated to germane cognitive load, namely divergent thinking processes that are truly challenging (Panilov et al., 2024). Although entrepreneurship education is very important for economic independence and requires divergent thinking skills, its implementation in non-formal institutions such as SKB Ungaran still faces challenges.

Existing learning methods tend to be suboptimal in facilitating the development of these higher-order cognitive skills (Hwang et al., 2023). On the other hand, technological innovation offers solutions through e-modules. However, to be effective, an e-module must be designed based on a strong understanding of how human cognition works (Kismiati, 2020). The multimodal approach, based on Cognitive Theory of Multimedia Learning (CTML), offers a solid framework for designing learning media that can efficiently stimulate divergent thinking. Thus, there is an urgent need to develop and test a multimodal-based E-Module on Entrepreneurship specifically designed for this purpose.

Based on this background, the research questions in this study are: (1) To describe the process of developing a multimodal-based E-Module on Entrepreneurship for students at SKB Ungaran, (2) To determine the feasibility (validity and practicality) of the multimodal Entrepreneurship E-Module developed according to expert assessment and student response, (3) Describing the use of the multimodal Entrepreneurship E-Module in effectively improving the divergent thinking skills of students at SKB Ungaran.

Research Method

This study uses the Research and Development (R&D) methodology. The R&D method is a process used to develop and validate educational products (Sugiyono, 2020). The goal is to create new products or improve existing ones through a series of systematic trials and revisions (Dileo et al., 2024). The R&D model chosen as the framework for this study is the ADDIE model.

The ADDIE model is a flexible and widely used instructional design framework because it provides systematic guidance in five stages: Analysis, Design, Development, Implementation, and Evaluation.(Spatioti et al., 2022).

This study was conducted at the Ungaran Learning Activity Center (SKB) in Semarang Regency. The research subjects were 30 students enrolled in the Package C equivalency education program with a focus on entrepreneurial skills. The subjects were selected using purposive sampling. To collect comprehensive data, this study used three types of instruments (1) Expert Validation Instrument in the form of a questionnaire addressed to one subject matter expert (lecturer in economics/entrepreneurship) and one media expert (lecturer in educational technology). This questionnaire used a Likert scale with 5 answer choices to assess the feasibility of the e-module in terms of content, language, presentation, and graphics (Widiastuti & Widayati, 2024).

Practicality Instrument (Student Response Questionnaire) in the form of a questionnaire given to students after using the e-module. This questionnaire aims to measure users' perceptions of the attractiveness, usability, and usefulness of the e-module in supporting independent learning (Meldrawati et al., 2023). This questionnaire also uses a Likert scale. The Divergent Thinking Skills Test instrument is the main instrument for measuring the dependent variable. The collected data was analyzed using techniques appropriate to the type of data, namely feasibility data analysis, in which quantitative data from expert validation questionnaires and student response questionnaires using the Likert scale was analyzed descriptively.

The total score of each respondent was converted into a percentage value using a formula adapted from similar studies (Montgomery et al., 2025). Effectiveness Data Analysis: Pre-test and post-test scores for divergent thinking skills were analyzed statistically using SPSS software with Normality Tests, Paired Samples t-tests, and Normalized Gain (N-Gain) Tests.

Results and Discussion

Final Product Description: Multimodal Entrepreneurship E-Module

This multimodal entrepreneurship e-module is packaged in a digital flipbook format that can be accessed through various devices. This product has several outstanding features that are specifically designed to achieve learning objectives. The main interface of the e-module is designed with simple and clear navigation, applying the Coherence Principle of CTML to minimize distractions and unnecessary cognitive load, so that students can focus on the material (Keshavarz et al., 2022). Each chapter begins with a short introductory video presented by a narrator using friendly conversational language (Personalization Principle), aimed at building social relationships and increasing student engagement (Santoso et al., 2021).

The core content is presented by integrating various modes. For example, in the “Product Innovation” material, an interactive infographic is presented that displays various types of waste. Learners can click on each type of waste to see examples of existing products, then they are challenged to drag and drop new ideas onto a virtual idea board. This activity directly applies the Multimedia Principle and the Segmenting Principle, where complex information is broken down into smaller parts and presented visually to facilitate processing (Tries Ellia Sandari et al., 2025).

The most crucial feature in stimulating divergent thinking is interactive activities that apply the Generative Activity Principle (Leroy et al., 2023). For example, after watching a case study video about social issues around them, students are presented with an interactive brainstorming column where they are asked to type in as many business solutions as possible. The system will provide simple feedback, such as counting the number of ideas entered to encourage fluency. This feature transforms students from passive consumers to active producers of knowledge.

Analysis of the ADDIE Model on Development of Multimodal-Based Entrepreneurship E-Modules to Improve Divergent Thinking Skills

The analysis stage is the foundation of the entire development process, where information is gathered to identify needs and set goals. Analysis of Student Needs and Context An analysis was conducted on students in the SKB Ungaran entrepreneurship program. Through observation and initial interviews (simulations), it was identified that students had diverse backgrounds, required practical and relevant material, and showed a high interest in technology-based learning (Pakaja & Wafa, 2023). It was also found that the existing teaching materials were still conventional (printed modules) and lacked interactivity.

Curriculum and Material Analysis An analysis of the entrepreneurship curriculum used in non-formal education was conducted to determine the essential topics to be included in the e-module (Debarliev et al., 2022). The selected topics include Business Opportunity Identification, Product Innovation, Business Model Canvas, and Digital Marketing. Cognitive Task Analysis An in-depth analysis of divergent thinking skills was conducted. These skills were broken down into measurable indicators, namely fluency, flexibility, originality, and elaboration, which then became the specific targets of each activity in the e-module (Widodo et al., 2024).

At this design stage, a blueprint for the e-module is created. All aspects of learning and media are planned in detail before the production process begins. (1) Learning Design by formulating specific learning objectives for each topic, designing the learning flow (storyboard), and determining formative (interactive quizzes) and summative (final project) evaluation methods. (2) Multimodal Media Design This is the core of the design stage. Based on the Cognitive Theory of Multimedia Learning (CTML) framework, the most effective mode is selected for each segment of material. For example, abstract concepts are explained through animation, case studies are presented in video format, data is presented in interactive infographics, and instructions are given through audio narration.

The user interface (UI) and user experience (UX) are designed to be intuitive and not cognitively demanding (Mishra et al., 2025). The relationship between topics, cognitive objectives, activities, and theoretical foundations is systematically mapped in a design matrix, as shown in Table 1. This matrix serves as a guide to ensure that each design element has a clear pedagogical purpose and is supported by theory, transforming development from a mere compilation of features into a coherent learning system.

Table 1. *Multimodal Entrepreneurship E-Module Design Matrix*

Entrepreneurship Topics	**Divergent Thinking Components**	**Multimodal E-Module Activities**	**CTML Principles Applied**
Identifying Business Opportunities	Fluency	Students watched a case study video about plastic waste issues in the surrounding environment. After that, an interactive prompt appeared asking them to write down as many business ideas as possible that could arise from this issue.	Multimedia, Generative Activity, Temporal Contiguity
Product Innovation	Flexibility	An interactive infographic is presented, displaying various types of waste (scraps of fabric, plastic bottles, used tires). Students are asked to drag and drop product ideas into different categories (e.g., fashion products, household furniture, children's toys).	Spatial Contiguity, Segmenting, Coherence
Business Canvas Model	Originality	Students fill out a digital business model canvas simulation. For each column filled out, there is a "Ask for Advice" button which, when clicked, plays an audio clip from a "virtual mentor" who asks leading questions to encourage more unique and out-of-the-box ideas.	Personalization, Voice, Modality
Digital Marketing	Elaboration	A social media content draft template is provided. Students are asked to develop a simple post idea into a detailed mini-campaign, adding descriptions, hashtags, and visual ideas, aided by tooltips and visual examples.	Signalling, Multimedia

The development stage is the realization of the blueprint that has been designed. The e-module and all its components are produced. The e-module is developed using Flip PDF Professional and Canva software to create an interactive and visually appealing flipbook format (Novita Wulandari et al., 2024). All multimedia assets were created, including recording clear audio narration, producing short case study videos, designing infographics and animations, and composing text in communicative language in accordance with the principle of personalization (Zulkan et al., 2023).

The e-module product that has been developed and validated is then implemented in a real learning situation. The e-module was tested on research subjects at SKB Ungaran. The implementation process included: (1) Conducting a pre-test to measure initial divergent thinking skills. (2) Learning intervention, where students learned independently using the multimodal Entrepreneurship E-Module for a specified period of time. (3) Conducting a post-test to measure final skills after the intervention.

Evaluations are conducted continuously at each stage (formative evaluation) and at the end of the process (summative evaluation) to measure the success of the product. Formative evaluation is conducted through validation tests by subject matter experts and media experts (Novianti Sofyan et al., 2025). Input and suggestions from experts are used to revise and refine the product before implementation. Summative evaluation is conducted after implementation to determine the effectiveness of the product. This involves analyzing pre-test and post-test data to see whether the e-module has succeeded in achieving its goal of improving divergent thinking skills (Dermawan et al., 2025).

E-Module Feasibility Analysis

The feasibility of the e-module was assessed based on two main aspects: validity (according to subject matter and media experts) and practicality (according to student responses). The quantitative assessment results are summarized in Table 2.

Table 2. Results of Expert Validation Test and Student Practicality Test

Assessment Aspects	**Validator**	**Average Score (%)**	**Category**
Content Suitability	Subject Matter Expert	92%	Highly desirable
Media Suitability	Media Expert	89%	Highly desirable
Practicality	Students (Test)	91%	very practical

The results of validation by subject matter experts show a score of 92% (Highly Suitable), indicating that the entrepreneurship content in the e-module is accurate, relevant to the curriculum, and in-depth. Media experts gave a score of 89% (Very Good), confirming that the interface design, media selection, audio-visual quality, and navigation have been well designed and are in line with the principles of multimedia learning design. This high score is in line with the findings of other e-module development studies, which also achieved a level of suitability above 85% (Febrianty et al., 2021).

From the user's perspective, the practicality test involving 30 students resulted in an average score of 91% with the interpretation "Very Practical." These results indicate that students view the e-module as an engaging, easy-to-use, and useful medium for their learning process. Qualitative data from the comments section of the response questionnaire enriches these findings. Many students stated that "videos and animations make difficult material easier to understand" and that they "feel more motivated to learn because it can be accessed anytime." (Raj et al., 2022). This positive response confirms that the e-module developed is not only theoretically valid but also well received and functional in a real learning environment.

Analysis of the Effectiveness of E-Modules on Divergent Thinking Skills

The culmination of this study is to measure the effectiveness of the e-module in achieving its main objective, which is to improve divergent thinking skills. The analysis of pre-test and post-test data from 30 students is presented in Table 3.

Table 3. Comparative Analysis and N-Gain Scores for Divergent Thinking Skills

Components of Divergent Thinking	**Average Pre-test Score**	**Avergae Post-test Score**	**N-Gain Score (g)**	**N-Gain Category**
Fluency	45.2	78.5	0.61	Currently
Flexibility	42.1	75.3	0.57	Currently
Originality	38.5	72.8	0.56	Currently
Total Score	**41.9**	**75.5**	**0.58**	**Currently**

The analysis results show an increase in the average total divergent thinking score from 41.9 on the pre-test to 75.5 on the post-test. The paired t-test confirmed that this increase was statistically significant ($p=0.000<0.05$), which means that Ho was rejected and H1 was accepted. This shows that the intervention using multimodal e-modules had a real impact on the divergent thinking skills of the students (Zhang et al., 2025). To determine the magnitude of the impact, the N-Gain score was calculated. The total N-Gain score of 0.58 falls into the "Moderate" category ($0.3 \leq g \leq 0.7$). This finding is consistent with similar studies that also found moderate effectiveness of e-module-based interventions in improving creative thinking skills.51 The highest increase occurred in the fluency component ($g=0.61$), indicating that e-modules are very effective in training students to generate a large number of ideas. Improvements in flexibility ($g=0.57$) and originality ($g=0.56$) also showed positive effects, although they required more complex stimulation (Susanti et al., 2023).

The research results showing the high feasibility and moderate effectiveness of this e-module are not a coincidence, but rather the result of a deliberate "cognitive engineering" process. The success of this e-module does not lie in its status as a "digital" product, but in its multimodal architecture, which is fundamentally designed to optimize the cognitive learning environment for the development of divergent thinking skills. The significant improvement in divergent thinking scores (Table 3) can be directly attributed to the instructional design outlined in Table 1.

For example, a significant increase in fluency scores ($N-Gain=0.61$) correlates strongly with video-based activities and interactive brainstorming prompts. In accordance with the Multimedia Principle, presenting problems through video provides rich and contextual stimuli. Then, the Generative Activity Principle is implemented through prompts that explicitly ask learners to generate as many ideas as possible. This combination effectively trains aspects of fluency in thinking (Fiorella, 2023). Similarly, improvements in flexibility are driven by visual categorization activities in interactive infographics, which force learners to view a single issue from multiple perspectives. (Servajean & Wiese, 2024).

More deeply, the effectiveness of this e-module can be understood through its role as a cognitive scaffold. Learners, especially in non-formal contexts, may not be familiar with structured creative thinking processes (Nurrijal et al., 2023). This e-module serves as a support by breaking down complex cognitive tasks (divergent thinking) into smaller, more manageable activities (e.g., fluency tasks, then flexibility tasks) (Ferdiani & Harianto, 2024). Each activity is supported by rich media and clear instructions, which are consistent with the Principles of Coherence and Modality, serving to reduce foreign cognitive load (Eesee et al., 2025).

By minimizing cognitive "noise," e-modules free up learners' mental resources to focus entirely on the creative thinking task itself (Fiorella & Mayer, 2021). Over time, with repeated practice, learners begin to internalize this process, enabling them to think divergently independently without the help of e-modules. In other words, e-modules not only present content, but also model and train a cognitive procedure (Skulmowski & Rey, 2020). This

finding also has important implications for the role of educators. The presence of effective e-modules for handling direct instruction and structured skills practice allows the role of educators to shift (Li et al., 2024).

Educators are no longer the sole source of knowledge (sage on the stage), but have transformed into facilitators, mentors, and coaches (guide on the side) (Yakob et al., 2025). Their valuable time can be allocated to activities that cannot be replaced by technology, such as providing personal and in-depth feedback on students' business ideas, facilitating group discussions, and fostering non-cognitive aspects of entrepreneurship such as resilience, risk-taking, and social networking (Paganin et al., 2025).

This blended learning model, in which e-modules handle measurable cognitive training and educators handle personalized human guidance, is a highly efficient and powerful model, especially for institutions with limited resources such as SKB. Although the results are very positive, it is necessary to acknowledge the challenges inherent in technology-based learning, such as the need for adequate facilities and time management on the part of students (Meng et al., 2023). However, the self-paced nature of e-modules and their accessibility across various devices help mitigate some of these challenges, providing greater flexibility compared to synchronous learning (Zeng & Luo, 2024)

Conclusion

The development process of the multimodal Entrepreneurship E-Module using the ADDIE model has successfully produced a structured, systematic digital learning product based on strong cognitive theory. The developed E-module has proven to be highly suitable for use as a learning medium. This is based on the results of validation by subject matter experts (92%) and media experts (89%), both of which fall into the "Highly Suitable" category, as well as the results of practicality tests by students (91%), which fall into the "Highly Practical" category. The use of the multimodal Entrepreneurship E-Module has proven effective in improving the divergent thinking skills of students at SKB Ungaran. This is demonstrated by a statistically significant increase ($p<0.05$) in scores between the pre-test and post-test, with an N-Gain value of 0.58, which falls into the "Moderate" effectiveness category.

For educators and administrators at SKB and other non-formal educational institutions, it is recommended to adopt and implement multimodal e-modules designed based on cognitive principles such as CTML. These e-modules should not be used as a total replacement for the role of educators, but rather as a tool within a blended learning framework, where educators act as facilitators and mentors to deepen understanding and provide a personal touch.

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