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DEMONSTRATION METHODS VS. DISCOVERY LEARNING: TEACHING TOMATO PLANT CULTIVATION WITH HYDROPONICS AND CANVA

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ABSTRACT

Mobile devices are essential to improving student learning outcomes in hydroponic plant cultivation courses when used as a complementary tool and demonstration and discovery learning methods (also known as demons-disco learning). This course increases students' understanding and skills in cultivating plants, especially vegetables, using hydroponic techniques and mobile devices. Mobile-based applications offer new experiences in terms of information and communication technology and opportunities for students to engage in independent learning. The learning approach chosen includes providing understanding information, an overview of components and varieties, and an assessment through questions about hydroponic plant cultivation. So, a teacher must design learning by producing material to help students overcome problems in raising hydroponic plants. This research uses a research and development (R&D) approach in product creation, utilizing three of the four research phases: definition (identifying potential and problems, data collection), product design, and development (validating the design, refining the design, and testing the product). The trial was conducted on a small scale with 36 students through a discovery learning learning design. This article will discuss the research findings and the following implementation steps.

Keyword*s: Canva application, plant cultivation, discovery learning, learning results, hydroponics.*

INTRODUCTION

The advent of information technology has significantly transformed all facets of life (Yuniwati, 2020), including education (Kumar, 2022), particularly the process of learning (El-Jendoubi, 2014). The integration of information technology in education has empowered students to create and utilize diverse digital learning resources (Gericke, 1937; Yadav, 2020). The digitalization of mobile development offers numerous advantages (Cometti, 2008; Gilmour, 2019). M-Learning utilizes mobile phones as a medium to provide textual content (Tuberosa, 2002; Wang, 2019), visual representations (Landi, 2002), dynamic visual elements (Eridani, 2017), and audiovisual materials (Mia, 2010). Mobile or m-learning enables students to acquire knowledge anywhere and time (Reuveni, 2000). M-learning is extensively utilized in numerous educational institutions, leveraging Internet technologies. Technological advancements significantly impact the learning process, particularly in utilizing cutting-edge media for delivery systems (P. Astuti et al., 2023; Dahliani, 2005). Technology facilitates genuine learning (Rabêlo, 2018). Education employs applications such as Canva to facilitate students in uncovering their aptitudes and enhancing their comprehension of the learning process.

Canva, an internet-based visual communication and design platform, enables users to generate and distribute strategies from anywhere. Canva is an online platform that enables users to design various visual materials such as posters (Ronga, 2018), presentations (Landi, 2001),

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infographics (Aldrich, 2003), cards (Palaniswamy, 2004), and more. Canva enables educators to generate digital instructional materials using technology. Canva offers many aesthetically pleasing designs to captivate students and enhance their learning experience. Canva facilitates the creation of captivating educational resources by teachers to enhance the quality of instruction (Khoiriyah et al., 2022). Educational media has the potential to stimulate fresh aspirations (Schabas, 2023), enhance motivation, captivate pupils, and have a psychological effect on them (Haanurat et al., 2022; Wicaksono et al., 2021; Wijaya & Anggrianto, 2023). Educational media facilitates students' comprehension, examination, and streamlining of material. Canva employs hardware to facilitate the process of print and audio-based learning. Students derive advantages from utilizing media, particularly in hydroponic plant cultivation programs.

Tomato plants can be cultivated using hydroponics (Rufí-Salís, 2020; Yuniwati, 2020). Hydroponics is a method of cultivating plants without the use of soil. Hydroponics eliminates the need for plowing, dealing with unwanted plants, and using fertilizers, hence facilitating the efficient purification of water. Irrespective of the season, sustainable plant development improves quality, yield, and management (Karim & Zoker, 2023). Dahliani et al. (2023) stated that this plant is suitable for cultivation in limited or confined spaces. Teachers should be able to articulate the characteristics of objects (Cottle, 2008), occurrences, regulations, and procedural stages either by themselves or by using appropriate educational materials (Deliyannides, 2016). The Demonstration Method is an optimal choice for educators as a pedagogical approach. According to Winson et al. (2023), a demonstration displays or presents something. Pupils acquire a process via observing demonstrations conducted by either teachers or fellow pupils. The demonstration technique instructs individuals on the practical application of an instrument or the execution of a certain activity in real-world scenarios (Hamilton, 2018; Kleinwächter, 2019). Demonstration is an instructional technique when a teacher directly exhibits a subject or ability, enabling pupils to watch and comprehend it more effectively and enhancing memory retention (Harrigan, 2018; Jarroux, 2017). Implementing discovery-based learning can achieve this outcome.

Discovery learning is an instructional approach. Discovery learning facilitates students' acquisition of problem-solving skills through active exploration and search for solutions (Zahroh et al., 2023). Teachers must motivate and stimulate children's desire to acquire knowledge. Active learning instead of passive listening will energize pupils (Dahliani et al., 2024). Discovery learning facilitates students' behavioral change by actively involving systematic, critical, and logical study and inquiry to uncover information, attitudes, and abilities (Boutrot, 2017; Hauser, 2017; Moffat, 2017). The demonstration technique incorporates the utilization of discovery learning. Demon-Disco: Exhibition and exploration The study integrates many instructional approaches to elucidate the teacher's function in implementing or illustrating tools (Darmayanti, 2023). Subsequently, students can enhance their discoverability for self-directed education, individuality, and competencies.

Preliminary findings at the Bogor Agricultural Institute (IPB) indicate that there has been a decline in the performance of agribusiness, food crops, and horticulture capacities, particularly in hydroponic crop production, in recent years (Martunis et al., 2023). Utilizing Canva-based learning material is highly efficient for enhancing students' understanding and vocational proficiency in hydroponic plant cultivation. Extensive research has been conducted using Canva as an educational tool for hydroponics. The configuration and use of media distinguish this research. In its fourth semester, The plant cultivation course utilizes Canva to enhance student learning. This learning strategy, known as the disco-devil approach, accomplishes this task. Smartphone applications based on Canva enhance learning results for students nurturing hydroponic plants. The material is furnished with visual aids and illustrative

examples. The software provides hydrotherapy instructions sequentially, accompanied by visual aids, enabling students to acquire knowledge autonomously. Both digital and tangible media can be utilized. This research employs 4-D development in the aftermath of the COVID-19 pandemic. Prior learning was conducted using online platforms utilizing PowerPoint presentations. The Borg & Gall development approach was employed solely for design purposes. The media produced in classroom action research is subjected to testing. Researchers and teaching personnel have not utilized Canva at IPB as a tool for learning. Their sole sources consist of PowerPoint or YouTube videos. Hence, it is imperative to conduct additional research. The Canva application was built to instruct 4th-semester students at the Bogor Agricultural Institute in hydroponic plant production. The in-app Disco-Demons Learning Method will be advantageous for these subjects.

METHOD

Research and development procedures, sometimes called R&D, are systematic approaches used to produce specific products and assess their effectiveness. Thiagarajan's research and development (R&D) plan consists of four clear steps, as shown in Figure 1 (Mubarok et al., 2023).

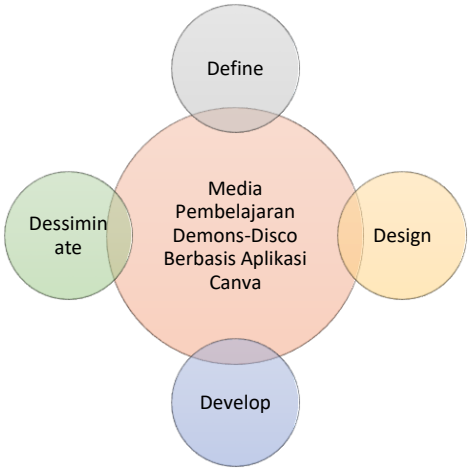

Figure 1. Flow Of The Stages Developing Demons-Disco Media Based On The Canva Application

Figure 1 depicts a linear product development process consisting of four distinct stages: define, design, create, and deploy. However, this research will only concentrate on the three initial stages of product development, starting from the definition stage. Prescribed steps include engaging in activities focused on assessing potential options and identifying concerns. This activity involves evaluating literature and examining existing ideas and related research findings from well-known publications such as SINTA, Garuda, and Scopus databases (Vedianty et al., 2023). An initial inspection was also conducted at the Bogor Agricultural Institute (IPB) research location. To obtain profiles and data and collect student academic evaluations on the theoretical and practical components of hydroponic plant development courses (Saleh et al., 2021).

During the definition phase, data is collected to identify research goals (Pradana & Uthman, 2023), provide new ideas for progress, and assess required energy, time, and site resources. The second stage includes product design, emphasizing the procedure for creating educational resources for plant cultivation using Canva software. Design validation, the third

stage in the development process, seeks to evaluate product efficacy (Putra et al., 2023). The exam uses three separate questionnaires, each tailored for validators (design experts), students (media users) (Yuniwati et al., 2024), and teachers (material experts). The validation expert considers the assessment objective valid if it reaches a minimum of 75% of the total score for all questions. Design improvement techniques are carried out in the third step if the product results show that the researcher's initial design requires additional validation.

Therefore, researchers must refine the design until it is officially validated and certified as suitable for implementation. IPB conducted product trials in the fourth phase of the project. Design trials were conducted by classifying quantitative data from questionnaires to design and materials experts (Darmayanti et al., 2024). Participants in this Validator trial were classified into expert groups: professors from the Faculty of Agribusiness, Food Crops and Horticulture, multimedia professionals, and a limited group of 36 students in the fourth semester. The trial was carried out in an educational environment consisting of two cycles. The final semester exam for students in class 2021-B is based on the curriculum and consists of 36 questionnaires presented to the class. The data collected is the average final semester exam scores of students in class 2021-B from the curricular components.

HASIL DAN PEMBAHASAN

This study uses educational media to clarify principles, build and develop prototypes, and disseminate information related to hydroponic plant cultivation. Hydroponic cultivation techniques primarily center around tomato plants (Santiago et al., 2023). Tomatoes are a popular fruit product that can quickly grow in a hydroponic system. Hydroponic techniques are widely considered to produce higher yields of tomato plants than traditional growing methods. Contemporary agricultural technologies (Rahman, 2023), including tomatoes, can grow a variety of crop species. The focus of this tomato plant cultivation resource is not only on the terminology and creation of Canva teaching materials but also on examining how this medium is assessed in the classroom.

The learning media "Hydroponics" was created to teach plant cultivation on the Demons-Disco learning platform (Arif et al., 2023). The initial process in producing 4-D learning materials for the Demons-Disco "Hydroponics" study module in the plant culture course on Canva involved the following steps: These definitions were given priority when building Canva's learning media. Based on findings from informal initial observations, they carried out thorough observations. The goal of the observations was to closely examine this area (Nasiha et al., 2023), which poses difficulties for teachers when instructing on the complex topic of hydroponics.

This definition begins with checking with fellow instructors who teach courses on plant culture about their instructional materials and level of engagement in their classes. During the semester, frequently used assessment media included PowerPoint presentations and video lectures derived from YouTube searches conducted by others, which were then sent to students. Students face this challenge due to the requirement for video content to adapt to students' specific characteristics and needs in the classroom (da Silva Santiago et al., 2023). An educational tool that can help and facilitate students in solving specific problems, especially fourth-semester students' learning objectives, is needed to improve their understanding of hydroponics. Next steps: Examine analyzing discourse and gain Canva user expertise. This Canva discussion focuses on educational material for the IPB agriculture faculty: planting tomato plants using high-quality hydroponic techniques. This course introduces basic techniques for identifying and organizing graphs, enabling students to acquire specialized skills

effectively. The third stage involves analyzing learning objectives using indicators from teaching and learning materials and the curriculum to identify student objectives.

A group of skilled instructors specializing in plant cultivation were observed and interrogated to provide design terminology (Ahmed & Kumalasari, 2023). Follow these steps to create a Canva media design for a plant cultivation course. The design process begins by selecting the right media before creating instructional materials. Using Canva on mobile phones or other devices facilitates researchers' learning efforts this semester. Hence, it is portable and does not require a laptop to use. The URL www.canva.com directs users to Canva, a robust platform that provides various educational resources and instruction manuals. Technology provides students and teachers with accelerated access to various engaging educational resources.

The second stage is the Design Stage, where the teacher's instruction format is adapted to the learning material using the Canva tool. Canva's teaching materials are categorized based on several types of learning media. Instructors can now evaluate Canva learning designs. Teachers can choose not to use interactive templates in Canvas. The focal point of the implementation revolved around the Canva app interface. During the design process, it is necessary to use other hardware such as Google Chrome (Rahmawati et al., 2023), MS, and Canva APK as the primary tools for creating informative materials. It is necessary to conduct a thorough investigation and scan and store digital evidence safely. Next, conduct a thorough inspection and analysis using Fore to explore different materials. Resources are organized and collected in Canva, using carefully designed layouts, backgrounds, audio, and modifications to enhance visual appeal. Finally, the material was converted into Canva to improve the learning process—illegal digital technology.

Demons-Disco produces instructional materials about plant culture called "Hydroponic" on Canva. Buttons are created using the ellipse and horizontal tools (Pratama et al., 2023). Generate submaterial with the Magic Wand and Horizontal Type tools. Create content icons, meet survey objectives, and conclude using a 3D Blender. Logo icons in 3D Blender can be created by manipulating meshes and cubes and arranging them using the Extrude function (Nisa, Setiawan, et al., 2023). Animating text on a timeline involves moving the “Add text” feature around. PNG is generated from text data. The Extrude tool in 3D Blender is used to change the shape of meshes and cubes to create designs for material icons, practice questions, outs, and other icons. The timeline achieves Animated text by moving the "Add Text" feature.

Additionally, PNG can produce animated text. 3D Blender produces 3D sub-material icon designs based on photos (T. Astuti et al., 2023). Extrusion changes the thickness of the design. The animation is generated after the timeline moves. The PNG design is complete. This educational media was created using Notepad++, Photoshop, Audition, 3D Blender, Coreldraw, and MySQL. Project deliverables include image designs created using Adobe Photoshop CS6, material icon images (Karyadi & Jannah, 2023), problem-solving and simulation exercises using 3D Blender, and conversion assignments. GIF makes PNG files into GIFs. Drive D categorizes files using folders labeled "denied." This directory includes audio files, graphic symbols, and brand logos (Noor et al., 2023; Putri, 2022).

Furthermore, Notepad++ was used to write code and generate hydroponic learning questions using the PhpAdmin SQL function. Command Prompt is the leading software used to create APKs, which combines Cordova commands into one in the Canva APK tool. After that, the media that has been designed will then be validated in the third stage by professionals in the field, including media professionals, topic specialists, and experienced hydroponic plant cultivation lecturers. Development is the penultimate phase in creating a 4D instruction tool. Product development is creating new products (Farhin et al., 2023). This method involves expert

evaluation, changes, and development testing. Expert judgment: Experts recommend changes to the instructional materials—revision of integrated learning media with recommendations from experts (N. D. Safitri et al., 2023). Expertise is needed to improve learning content by making it more accurate, effective, tested, and technologically advanced. Development trials collect data about the effectiveness of educational materials from students and observers (Lestariet al., 2023). To ensure effectiveness, educational materials are frequently assessed and modified. The development process involves the following stages:

Validation evaluates the suitability of the material. Receiving a professional assessment will improve the quality and effectiveness of the media. Comprehensive verification of expert content: An educational specialist in the agricultural sector (Kurniawati et al., 2023), especially in tomato cultivation using hydroponic techniques from the Bogor Agricultural Institute (IPB) (Mukaromah et al., 2023), who uses an Android device (Farida et al., 2023), validates digital learning media for plant cultivation. Produce materials, undergo evaluation, and receive guidance from subject experts. We combine information on reproductive health, improve indicators to match learning objectives, and provide visual resources to enhance indicator improvement. After verification with topic specialists and valuable feedback, the researchers implemented suggestions from media specialists to improve the cultivation medium of these plants.

To verify accuracy, subject specialists filled out questionnaires after changes in media. The validation report consists of five Likert categories: agree with (SA Media), agree (A), neutral (N), disagree (D), and strongly disagree. The content experiment validation survey comprised 15 indicators (E. Safitri et al., 2023). Data-driven material has the potential to achieve higher scores. This instructional media can use the content of this media. Based on the validity results, this value is by reference data in the range 4.21–5.00 (Segara et al., 2023). The responsibility for validating digital input media lies with the "media expert." IPB offers a program for cultivating tomato plants using hydroponic techniques by designing lessons using the Canva application, which uses the demons-disco learning method taught by Dr Lili Dahliani.

Validation involves the process of checking boxes in a questionnaire. Researchers found video footage with inadequate contrast, brightness, lighting, and a lack of meaningful substance (Elsayed, 2020; Fuentes, 2018; Yuan, 2019). It is important to include or encourage the establishment of score feedback mechanisms to evaluate student assessments. Enhanced media offers expert explanations in response to modifications and assistance. The diagram below is depicted clearly. After media revision, a media professional completes a questionnaire according to specified parameters to verify its validity.

Canva can function as a demonstrative and interactive learning tool for hydroponic plant cultivation at IPB after validation from media and materials specialists and user validation in product tests. The media experts' validation results were assessed using a ten-question questionnaire. A score of 2.9 comes within the specified range of 2.1–3.0 for this criterion. This presentation aid is effective (Lestari et al., 2023). The material experts checked the questionnaire, which consisted of 10 questions. Validity was 3.6, with a range from 3.57 to 4.00. This categorizes aid as legitimate and highly profitable (Wati et al., 2023). After the media has been declared suitable, the next step is to carry out trials on the media.

The Canvas assessment can facilitate the learning process of "breeding tomatoes using hydroponic techniques" for students. The efficiency of Canva's hydroponic tomato plant guide was assessed during the design phase. Hydroponic methods have been proven effective in growing tomato plants, with Canva being a valuable tool for learning. A study was conducted to evaluate the effectiveness of tomato cultivation media using the Canva hydroponic media technique (Nisa, Choirudin, et al., 2023). At this stage, students assess their enjoyment and

understanding of the learning material through surveys. Canva is used for additional research resources, such as this survey. There were 36 participants in the survey.

This research determined that Canva is a productive tool for writing instruction. These findings are consistent with studies conducted by (Sari et al., 2023). Canva users claim that writing becomes more accessible, more stimulating, and relieves anxiety. Training in language acquisition technology is also provided. Marco (2018) suggests using Canva as a tool for learning Discovery to improve writing skills and motivation. Students are allowed to gain knowledge in dictionaries, idioms, and terminology. The following is an example of the main display of the learning media for cultivating tomato plants hydroponically using the demons-disco strategy and some documentation when practical activities are carried out outside the classroom, which can be seen in Figure 2.

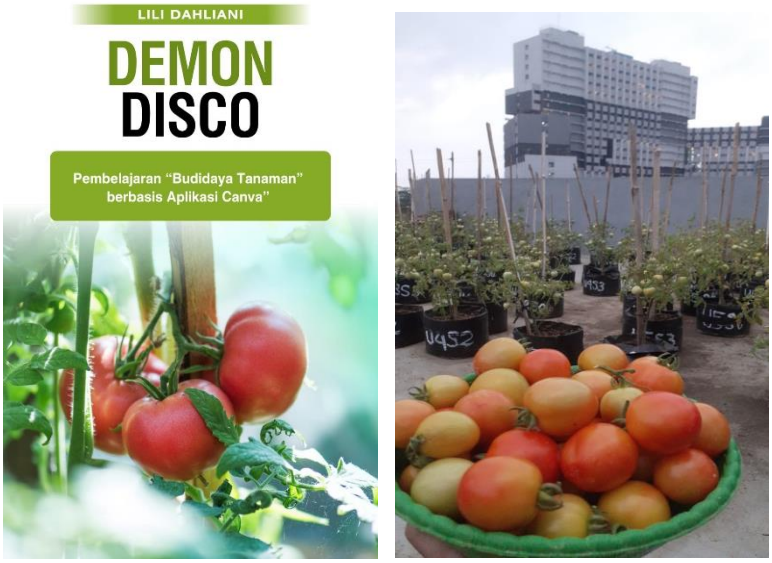

Figure 2. Documentation of Demos-Disco learning activities

CONCLUSION

Teaching and learning have been greatly impacted by technology integration in education. Thanks to digital technology, text, graphics, animation, and video are now available to pupils. Mobile and m-learning are utilized daily in schools to improve learning. Education uses Canva to help students analyze their learning process and improve their learning. Canva lets users create posters, presentations, infographics, and other learning tools. Educational media can help students learn, analyze, and communicate. Data will be collected to identify research topics, suggest new study concepts, and estimate energy, time, and resources. The focus is the "Hydroponics" platform, designed to teach hydroponic horticulture interactively. This course analyzes hydroponic culture and its impact on pedagogy. According to research, Canva media can improve students' hydroponic cultural knowledge and learning experience. This study emphasizes using Canva technology in education and the need for improvement.

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