

Mentoring for Digital Educational Game Development using Flash CS6 to Train Creative Thinking Skills of Students at SMA Negeri 10 Palembang

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Abstract: This community service program aims to improve students' creative thinking skills through mentoring in developing digital educational games using Adobe Flash CS6 at SMA Negeri 10 Palembang. The implementation was carried out through several stages, namely socialization, workshops, hands-on practice, and coaching clinic. A total of 24 students participated in both face-to-face and online sessions. Data were collected using pre-test, post-test, and a satisfaction questionnaire, and were analyzed quantitatively and qualitatively. The results showed a significant increase in students' cognitive abilities, indicated by the improvement of the average score from 69.16 in the pre-test to 90.41 in the post-test. The N-Gain analysis demonstrated high improvement in the indicators of game concept (0.95) and design basics (1.00), while coding skills were in the moderate category (0.61). Students' creative thinking skills also increased, particularly in fluency (83%), flexibility (74%), and originality (77%). In addition, the level of participant satisfaction reached 80–100% in all aspects assessed, indicating that the program was considered useful, easy to follow, and relevant to learning needs. Thus, mentoring in developing educational games with Adobe Flash CS6 is effective in enhancing digital literacy and creative thinking skills of high school students.

Keywords: Digital Educational Game, Creative Thinking, Adobe Flash CS6, Project-Based Learning, Digital Literacy.

Introduction

SMA Negeri 10 Palembang is one of the favorite schools in Palembang City, established on December 18, 1973, and currently has 1,719 students and 38 study groups. With adequate learning facilities and a vision of "Realizing a quality, religious, environmentally conscious, and artistic school," the school is committed to producing excellent graduates with strong character. In line with the demands of 21st-century competencies, the school has implemented the Merdeka Curriculum, which emphasizes project-based learning and the development of the Pancasila Student Profile (Gumilar et al., 2023). One of the key competencies that needs to be developed is creative thinking skills (Fitra, 2023).

Creative thinking is the ability to generate new and original ideas through a process of exploration and discovery (Kiraga, 2023). Guzál Islamovna (2025) asserts that creativity is not acquired through memorization, but through experience and research that enable students to find innovative solutions. Creativity-based learning not only strengthens understanding of the material, but also improves communication, collaboration, and problem solving (Pebriana & Imami, 2024). However, research shows that the creative thinking skills of high school students are still low and have not developed optimally (Windasari et al., 2021; Telaumbanua, 2022; Triyani & Azhar, 2021). Therefore, learning strategies that can systematically stimulate creativity are needed.

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One effective approach is Project Based Learning (PjBL), which encourages students to solve real-world problems through innovative projects (Ramadhan & Hindun, 2023). In the application of PjBL, the creation of digital educational games such as crossword puzzles or drag-and-drop games is a relevant alternative to improve creative thinking skills and digital literacy (Wicaksono et al., 2024). These projects help students understand the material more deeply and produce interactive works of educational value.

Adobe Flash CS6 was chosen as the game development medium because of its simple interface and suitability for beginners in learning the basics of programming and graphic design (Tralisno et al., 2025; Triyanti, 2022). Based on initial observations at SMA Negeri 10 Palembang, students still tend to be passive users of technology and do not yet have experience in creating educational digital content. Through guidance in creating educational games, students are expected to be able to develop their creativity, technological skills, and active involvement in learning.

Thus, the PjBL-based educational game development assistance program using Adobe Flash CS6 is a strategic step in supporting the implementation of the Merdeka Curriculum, while developing students' creative thinking skills through innovative, meaningful, and future-oriented learning.

Method

Implementation Method

1. Place and Time

The community engagement activity was conducted over a period of six months, commencing on September 15 and concluding on October 30, 2025. All sessions were held at SMA Negeri 10 Palembang, which is located at Jl. Sriwijaya Negara No.195, Bukit Lama, Kecamatan Ilir Barat I, Palembang City, South Sumatra 30138. This school was selected as the main partner due to its adequate facilities and a strong commitment to establishing innovative science learning methods. The activities were carried out offline (in-person) and tailored to the students' schedules and the availability of the school's digital space. The main offline activities included training sessions, socialization programs, and clinical mentoring. Meanwhile, online activities were utilized for continued assistance, discussion, and monitoring the learning outcomes of the participants.

2. Target

The primary target audience for this Community Engagement activity was the students of SMA Negeri 10 Palembang. A total of 25 participants were involved in the activity and participated actively in all training and mentoring sessions.

3. Tools and Materials

The tools and resources utilized in the activities included computers and laptops for creating the "word guessing" game, supplementary applications, Flash CS6, and the school's internet network with a speed of 20 Mbps to maximize access to digital content. Furthermore, an LCD projector, camera, and tripod were used to support the training activities and documentation of the results. The main software employed for developing the interactive digital game and for publication was Flash CS6, along with Canva for creating the game design. Since all of these resources were readily available, the program was freely accessible. This allowed students to access and operate the applications independently without additional costs. This availability also ensures that the technology will continue to be used even after the community engagement program concludes.

4. Socialization to School Partners

The students at SMA Negeri 10 Palembang, Ilir Barat I sub-district, still face difficulties in mastering digital-based learning technology, particularly interactive games. Therefore, the implementation methods for this community engagement activity were designed systematically to meet the partner's needs. The activities were carried out using a participatory approach and direct practical application (hands-on practice), emphasizing teamwork. Socialization with the school partners was carried out to align the perceptions of the community service team and the school regarding the objectives, benefits, and stages of program implementation. The socialization was conducted through a face-to-face meeting with the school principal, the science students, and representatives of the Sriwijaya University community engagement team. During this session, the team introduced the basic concepts of digital games and explained the paramount importance for students to master digital literacy in the 21st-century learning era. They also carried out an initial mapping of students' capabilities in utilizing digital media and identified specific training needs. This process successfully resulted in the agreement on the activity schedule, the commitment of participants to engage, and the school's full support for the program.

5. Training and Mentoring Workshops Digital Educational Game Development

Training and workshops on game development Digital Educational Game Development: The training and workshop focused on game development using Flash CS6. This activity was crucial for the capacity building of the participants. Additionally, a baseline survey instrument, also known as the pre-test, was administered to measure students' digital literacy

levels and their initial understanding of game media utilization using Flash CS6. The training commenced with an introduction to the fundamental theories of digital educational games, principles of digital learning design, and the capability of Flash CS6 to visualize abstract scientific concepts. Following the theoretical session, students proceeded to hands-on practice using user-friendly applications such as Canva. During the technical mentoring phase, participants learned to create storyboards, design learning content, and integrate these elements into the digital educational games developed using Canva. Each participant was required to produce at least one educational game prototype aligned with their interests. The workshop method was conducted in a collaborative and project-based manner to allow students to learn directly and engage in peer discussions. Following the training, the participants received individualized and small-group specialized mentoring to refine their digital educational games. These clinic sessions were conducted periodically and focused on content refinement, addressing technical issues, and implementing the e-modules in the classroom learning process. Furthermore, the mentoring included basic assistance in digital literacy, such as time management, publication of their creative works, and the creation of self-study guidelines. In addition to conducting observation, the community engagement team provided direct feedback on the products demonstrated by the students.

Data Collection and Analysis Techniques

In this community engagement activity, tests and questionnaires (surveys) were employed to collect data to measure the increase in competence and the level of participant satisfaction with the activities conducted. A total of 25 students from grades X and XI participated in the program. The students' abilities were evaluated using a pre-test and post-test, each consisting of ten questions related to understanding the concept of digital educational games used in learning with Flash CS6. The initial test, or pre-test, was administered before the training activities to measure the participants' baseline capabilities. The final test, or post-test, was administered after the entire series of activities was completed to measure the extent to which the participants' abilities had improved. Furthermore, closed and open-ended questionnaires (surveys) were administered to the participants to assess user satisfaction. The questionnaire included aspects such as the suitability of the training materials, the clarity of the instructor's delivery, the ease of application use (usability), the benefits of the activity on learning practices, and the

participants' level of willingness to utilize the digital educational game in class.

In addition to calculating the increase in the average scores of the pre-test and post-test results, qualitative and descriptive analysis was performed on the data obtained. The results of this analysis were used to assess the effectiveness of the program and provide ideas for similar mentoring activities in the future. Furthermore, a paired sample *t*-test was employed using SPSS Version 27 (IBM Statistics) to statistically evaluate the effectiveness of the activity. This involved examining the *t*-value, the *p*-value, and the effect size to determine the significance of the improvement in students' abilities after the training.

Results and Discussion

Result

The mentoring activity for creating educational games using Adobe Flash CS6 for students at SMA Negeri 10 Palembang aims to improve students' creative thinking skills through the use of technology in the development of learning media. This program is a solution to the problems of low student skills in designing digital media, lack of experience in creating CS6-based educational games, and the high interest and need of students to participate in mentoring activities that are directly practical.

This mentoring activity was aimed at 24 students of SMA Negeri 10 Palembang. The activity was carried out in three face-to-face meetings, namely on October 8, October 11, and October 18, which took place from 8:00 a.m. to 12:00 pm., as well as three online meetings on October 15, October 22, and October 25. The online meetings focused on refining game designs, testing features, and completing final projects before the closing ceremony.

The mentoring session on October 8 began with an initial explanation of the objectives of the activity and a simple assessment to determine the students' level of ability and experience in using Adobe Flash CS6 and their understanding of the concept of educational games. This assessment was conducted for 15 minutes through short questions about the students' technical abilities and creativity. After that, the facilitator ensured that the equipment was ready and checked that the students were ready to participate in the mentoring session. The mentoring activity began after all students were ready and understood the flow of the activity. The mentoring material presented can be seen in Table 1.

Table 1. Training Material on Creating Digital Educational Games Using Adobe Flash CS6

No	Material
1	Educational Games
2	Introduction to design and animation applications
3	Educational Game Design Techniques
4	Presentation of educational game designs using Canva
5	Practical experience in creating educational games
6	Presentation of Educational Games using Adobe Flash CS6

The mentoring material begins with a basic understanding of educational games as interactive learning media that can increase student motivation and creativity. The facilitator explains how games can be used as a means of delivering learning concepts in a more interesting, communicative, and easy-to-understand manner, as shown in Figure 1.



Figure 1. The facilitator explains about educational games

After understanding the basic concepts of educational games, students move on to learning about design and animation applications. At this stage, the facilitator introduces Canva as an initial platform for creating game visuals and provides a basic overview of the animation principles that will be used in game development. Students are introduced to Canva's features for creating graphic elements, such as interfaces, character illustrations, game backgrounds, button icons, and other visual objects, while also understanding how these elements can be animated in the next stage.

Next, the activity continued with educational game design techniques, where students began to apply good visual design principles in the context of game development. The facilitator explained the steps for creating a storyboard, determining the game flow, arranging visual composition, selecting colors and typography, and ensuring that each visual element supports the learning objectives. Through this activity, students not only produced attractive designs, but also understood how these designs function effectively in the educational games that would be developed later. After the initial design was completed, students presented

their storyboards or game flow designs. The purpose of these presentations was to train students' ability to explain the concepts, features, and direction of game development, while also providing an opportunity for facilitators to give feedback so that the resulting designs would be more focused and in line with the learning objectives, as shown in Figure 2.

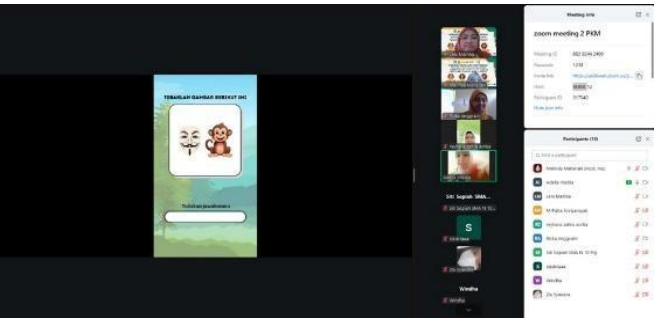


Figure 2. Students present their game design results

The next step is the process of creating and publishing educational games using Adobe Flash CS6. In this practical session, students learn to import designs from Canva, create basic animations, set up button navigation, and add simple ActionScript to run interactive functions in the game, as shown in Figure 3.



Figure 3. The facilitator assists students in the process of practicing using Adobe Flash CS6

Adobe Flash CS6 is used as the main training medium because its interface is relatively easy for beginners to understand. In addition, the facilitator also explained that Adobe Flash CS6 is older generation software that has now been updated to Adobe Animate. Adobe Animate offers more modern features, supports a wider variety of formats, and is compatible for more professional multimedia production. Therefore, students are encouraged to use Adobe Animate if they want to develop advanced educational games or produce higher quality products.

The entire series of activities ended with a presentation of the educational game developed using Adobe Flash CS6, which can be seen in Figure 4. At this stage, students showcased the features that had been

successfully implemented and demonstrated how the game worked according to the planned design. The facilitator then provided technical and aesthetic evaluations as part of the student skills assessment.

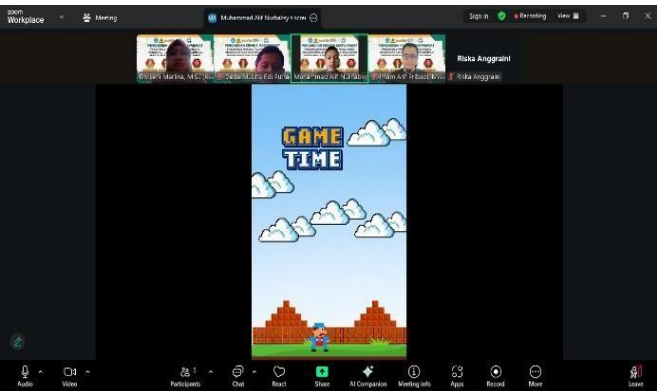


Figure 4. Students presented the results of games they had developed using Adobe Flash CS6

As a follow-up, students were asked to collect the final products of their educational games and fill out a post-test questionnaire to assess their skill improvement, as well as a satisfaction questionnaire to evaluate the effectiveness of the mentoring program. Through this series of activities, the students' ability to combine design creativity with technical skills in creating educational games was assessed to have improved significantly. The analysis of the students' pre- test and post-test results can be seen in Figures 5, 6, 7, and 8.

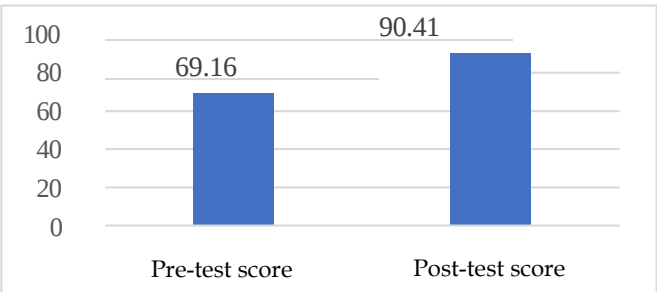


Figure 5. Comparison of Students' Average Pre-test and Post-test Scores

Based on the data in Figure 5, the average pretest score obtained by students was 69.16. After participating in the educational game development mentoring activity, the average posttest score increased to 90.41. The graph shows a significant difference between the scores before and after the activity, with the posttest score appearing higher than the pretest score. This improvement was then analyzed further based on three main indicators, namely understanding of basic game concepts, design basics, and coding basics. These three indicators were used as a basis for assessing the extent of student competency development after participating

in the mentoring, which was then presented in the form of a percentage comparison between the pretest and posttest scores for each indicator, as shown in Figure 6.

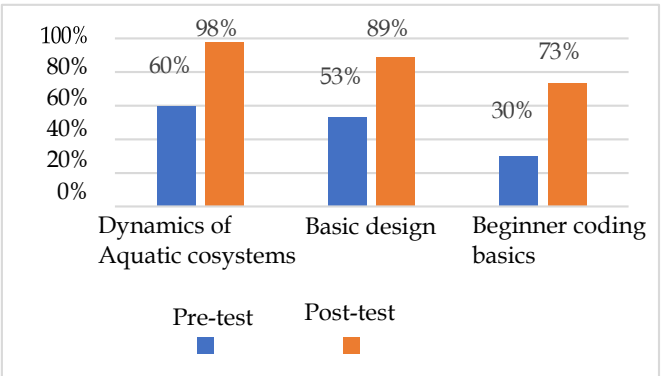


Figure 6. Percentage Comparison of Students' Pre-Test and Post-Test Scores in Each Indicator

The graph in Figure 6 shows a comparison of the percentage of pre-test and post-test scores on three main indicators. For the Educational Game Concept indicator, the graph shows a pre-test score of 60% and a post-test score of 98%. For the Design Basics indicator, the graph shows a pre-test score of 53% and a post-test score of 89%. Meanwhile, for the Beginner Coding Basics indicator, the graph shows a pre-test score of 30% and a post-test score of 73%. Each bar on the graph illustrates the percentage difference between the scores before and after the activity for each indicator. In addition, the data in Figure 6 was then used to calculate the N-Gain value for each indicator, so that the increase in student ability based on the change in scores from the pre-test to the post-test could be seen in Figure 7.

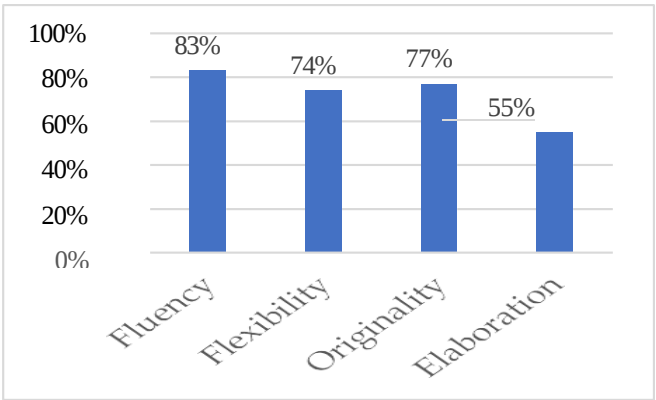


Figure 7. N-Gain value in each indicator

The graph in Figure 7 shows the N-Gain values for each indicator measured after the implementation of the mentoring activities. For the Educational Game Concept indicator, the graph shows an N-Gain value of 0.95, which is in the high category. For the Basic Design indicator, the N-Gain value reaches 1, which is also in

the high category. Meanwhile, for the Basic Beginner Coding indicator, the graph shows an N-Gain value of 0.61, which is in the moderate category. Each bar on the graph illustrates the level of improvement in students' abilities based on the N-Gain calculation for each indicator. In addition, during the process, the facilitator also assessed the students' creativity skills in designing and publishing educational games. The creativity aspects observed included the ability to generate visual ideas, develop game elements, organize interactive flows, and harmoniously combine design and function. The results of the creativity skills analysis are shown in the graph in Figure 8.

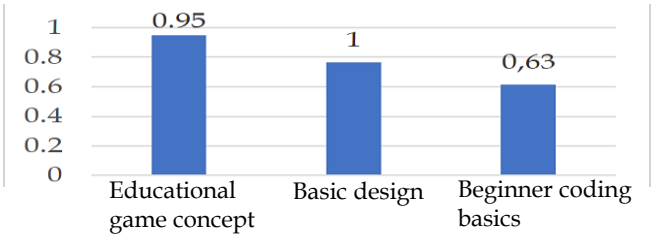


Figure 8. Students' critical thinking skills in creating educational games using CS6

Figure 8 shows the students' creativity skills, which consist of four main indicators. For the Fluency indicator, the percentage shown is 83%, indicating the students' fluency in generating various ideas during the game design process. The Flexibility indicator reached 74%, which describes the students' ability to change their design approach and adjust visual concepts according to the game's needs. The Originality indicator is recorded at 77%, showing students' ability to present unique and different ideas in the educational game design they developed. Meanwhile, the Elaboration indicator has a percentage of 55%, which illustrates students' ability to develop design details and refine visual elements in the game.

Table 2. Data on Participant Satisfaction with Training Activities

Indicator	Question item	Percentage
Clarity	(1)	100%
Ease of use	(2), (3)	80%
Accessibility	(4)	96%
Suitability	(5)	96%
Appearance	(6)	100%
Usefulness	(7)	100%

Table 2 presents the percentage of training participant satisfaction based on six assessment indicators. On the Clarity indicator, the items (Febriningrum et al., 2022) received a satisfaction percentage of 100%, indicating that all participants found the material presented easy to understand. The

Ease indicator, which consists of the items (Putri et al., 2025) and (Putri et al., 2024), obtained a percentage of 80%, reflecting that most participants felt that the training activities were easy to follow. The Helpfulness indicator in the questions (Febriningrum et al., 2022) showed a percentage of 96%, indicating that the material and assistance provided were very helpful to participants during the activity. The Suitability indicator on the item (Garris, 2020) also obtained a score of 96%, which illustrates that participants felt the training material was suitable for the needs and objectives of the activity. On the Display indicator, the item (Wiyono, 2024) obtained a satisfaction percentage of 100%, indicating that the display of the material and media used was very good in the eyes of the participants. Finally, the usefulness indicator for the questions (Utami et al., 2024) showed a percentage of 100%, indicating that all participants felt that the training provided real benefits for improving their abilities.

Discussion

The implementation of educational game development mentoring using Adobe Flash CS6 had a positive impact on improving the abilities of students at SMA Negeri 10 Palembang in terms of cognitive, technical, and creativity aspects. The results of the pre-test and post-test showed a significant increase in students' understanding of the basic concepts of educational games, design skills, and beginner-level coding skills. These findings reinforce that a hands-on approach to digital media development can improve students' technological literacy and creative thinking skills.

The increase in student knowledge was evident in the post-test average score of 90.41, which was much higher than the pre-test average of 69.16. This difference in scores indicates that the mentoring material, which included understanding educational games, visual design using Canva, and creating simple games using Adobe Flash CS6, has encouraged an increase in students' conceptual mastery and technical skills.

A more detailed analysis shows that this improvement occurred consistently across all ability indicators. In the Educational Game Concept indicator, the post-test score nearly doubled, resulting in an N-Gain score of 0.95, which is classified as high. This shows that students were able to comprehensively understand the functions, structure, and objectives of educational games as a learning medium. In the Basic Design indicator, the N-Gain score reached 1, indicating a maximum improvement in visual design skills after participating in the mentoring program. This was supported by the use of Canva as an initial design medium that was easy for beginners to understand. Meanwhile, the Beginner Coding indicator obtained an

N-Gain value of 0.61, which is in the moderate category. This improvement shows that even though coding is the most challenging aspect, students are still able to understand the basics of ActionScript through direct practice during mentoring.

In addition to improving cognitive and technical skills, this activity also contributes to the development of students' creativity, as shown by the creativity skills assessment in Figure 8. The indicators of Fluency (83%), Originality (77%), and Flexibility (74%) show that students are able to generate design ideas, adapt visual concepts, and create creative game elements. Meanwhile, the Elaboration indicator (55%) is the lowest aspect, indicating that students still need more guidance in developing detailed designs, especially in layer settings, advanced animation, and interactive game refinement.

Participants' satisfaction with the training activities also showed excellent results. Six participant satisfaction indicators showed a high level of positive response, especially in the indicators of Clarity, Appearance, and Usefulness, which reached 100%. This high level of satisfaction indicates that the method of delivering the material, the training media used, and the facilitator's guidance have met the students' expectations and are relevant to their needs in technology-based learning.

Several students successfully presented preliminary designs for digital educational games accompanied by illustrations of their own creations. The day's activities concluded with a summary, reflection session, and group discussion with participants. The students shared their experiences during the training, while the lecturers provided feedback and suggestions for the development of future activities. This was followed by a satisfaction survey and the collection of criticism and suggestions. The survey results showed a high level of satisfaction among participants with the implementation of this community service activity, and the findings illustrated the students' great enthusiasm for the material provided (Sari et al., 2025) and (Komarudin et al., 2025). In addition to face-to-face activities, the team also provided an online support forum through WhatsApp Group and Zoom Meeting to share additional material, provide tutorials, and provide a space for further discussion. The use of these online platforms as a follow-up to the training supports the concept of blended learning, which is flexible and collaborative (Nazhifah et al., 2023) and (Chairatunnisa et al., 2023). This effort ensures that participants can continue to interact and develop their products outside of the training schedule. These training sessions and workshops have had a tangible impact on improving the creative thinking skills of the students. Previously unfamiliar with design applications and digital

software, the participants are now able to produce digital educational game design prototypes that meet learning needs.

Overall, this community service activity has succeeded in improving students' competence in creating educational games through a project-based learning approach. Active student involvement, facilitator support, and the integration of design and game development software provide an effective and meaningful learning experience. These results also indicate that digital media-based learning has great potential for application in creative learning in schools, particularly in supporting the mastery of digital literacy and 21st-century skills.

Conclusion

The mentoring activity for the creation of Adobe Flash CS6-based educational games at SMAN 10 Palembang proved to be effective in improving students' cognitive abilities and technological literacy. The average score increased significantly from 69.16 to 90.41, with high N-Gain in the game concept and design indicators, and moderate N-Gain in coding skills. Students' creativity also developed, especially in terms of fluency, flexibility, and originality.

Survey results showed a very high level of satisfaction, with most indicators scoring 80–100%, indicating that participants found the activities relevant, easy to follow, and useful. This program successfully strengthened students' digital competence, creativity, and problem-solving skills, and has the potential to become a model for technology literacy development that supports SDG 4 (Quality Education) and improves the quality of innovation-based digital learning.

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