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Mathematics Games Creation by Using Block-Based Programming (Scratch) to Enhance Students Learning Experiences

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Abstract: *The use of information technology in making teaching materials by teachers can improve students' learning experiences. One of learning methods that can be adopted with technology integration is game-based learning design. The problem is that teachers generally lack the ability to utilize technology in learning process. Through service-learning approach, the team provides assistance to teachers at MTsN 5 and MTsN 6 Padang in designing interesting learning process using game-based learning design. This approach produces active involvement of students in the learning process while increasing students' creativity and understanding.*

Introduction

The indicators of a country's development can be seen from how rapidly the country's science and technology is developing. The Indonesian government has stated that science and technology is an important element in achieving Indonesia's vision in 2045[1]. Robotics, artificial intelligence, big data, or genetic engineering, are some examples of science and technology products and they all require mathematics as a basic foundation in the creation or development of these products.

However, based on the results of a survey conducted by the Program of International Student Assessment (PISA) in 2018, of the 79 countries that took part in the survey, Indonesia was in 76th position in the fields of literacy, mathematics and science which similar to the results obtained by Indonesia in 2015[2]. Apart from that,

[1] Bappenas, "Kebijakan Pembangunan IPTEK Untuk Kemajuan Bangsa: Pentingnya Sistem Nasional IPTEK Dan Inovasi," 2018, https://www.bappenas.go.id/index.php/berita/kebijakan-pembangunan-iptek-untuk-kemajuan-bangsa-pentingnya-sistem-nasional-iptek-dan-inovasi.

[2] OECD, "PISA 2018 Results Combined Executive Summaries Volume I, II & III," 2019,

not much different from the PISA results, based on the Intelligence Capital Index (ICI), Indonesia also got an unsatisfactory score. Based on ICI, Indonesia received a D+ score (ranks 89th out of 128 countries)[3]. From the results of these two measurements and from other measurement methods not mentioned, the level of understanding of mathematics is determined indicator used in determining whether a country is advanced in the field of science and technology.

Madrasas as part of the education system in Indonesia have the task of advancing the intelligence of the nation, especially students. In the current era, students are required to not only be proficient in the field of religion, but also in the fields of science and technology. Madrasah must act dynamically towards the changes that occur. Therefore, activities such as the Madrasah Science Competition (KSM) continue to be carried out by the Ministry of Religion every year in order to improve the abilities of madrasah students in the fields of mathematics and science.

However, based on the average score of the National Examination (UN), Madrasas are still behind the Ministry of Education, Culture, Research and Technology. From 2016 - 2019 data published by the Educational Assessment Center of the Ministry of Education and Culture[4], the average National Examination of madrasah students at the Ibtidaiyah (MI), Tsanawiyah (MTs)and Aliyah (MA) levels at the national level for the subjects Indonesian Language, Mathematics, and science tested in the National Examination is still behind the scores of students who study at schools under the Ministry of Education and Culture and Research and Technology (SD, SMP, and SMA).

Table 1. Comparison of the average National Examination scores for Indonesian language subjects at MTs and SMP 2016 - 2019

Indonesian Language Average National Examination Score	2016	2017	2018	2019
MTs	69.94	62.31	61.61	61.06
SMP	71.12	65.04	64.83	65.69

Table 2. Comparison of the average National Examination scores for Mathematics at MTs and SMP 2016-2019

National Mathematics Average	2016	2017	2018	2019
MTs	51.8	50.36	41.16	42.24
SMP	49.84	50.34	44.05	46.56

https://www.oecd.org/pisa/Combined_Executive_Summaries_PISA_2018.pdf.

[3] K.L. Chan, "Intelligence Capital Index," 2017, http://www.kailchan.ca/wp-content/uploads/2017/04/KC_Intelligence-Capital-Index-full-results-and-methodology_Apr-2017_v2.pdf.

[4] Kemdikbud Pusat Penilaian Pendidikan, "Laporan Hasil Ujian Nasional," 2019, https://hasilun.pusmenjar.kemdikbud.go.id/.

Table 3. Comparison of the average National Examination scores for MTs and SMP science subjects in 2016-2019

UN Science National Average	2016	2017	2018	2019
MTs	56.74	51.79	45.65	44.61
SMP	56.22	52.36	48.05	48.79

Table 4. Comparison of the average National Examination scores between Aliyah (MA) and High School (SMA) level for the 2018/2019 academic year

National Average	2018/2019
SMA (Science Major)	53
SMA (Social Science Major)	47.42
SMA (Language Major)	51.63
MA (Science Major)	48.72
MA (Social Sciences Major)	44.84
MA (Languages Major)	53.12

The city of Padang, as the capital of West Sumatra province, where the Community Service Activity is carried out, is not free from the same problems. Based on a comparison of the National Examination results in Padang City in the 2018/2019 academic year, the MTs National Examination results were below the SMP National Examination results for Indonesian, English, Mathematics and Science subjects (Figure 1 and Figure 2).

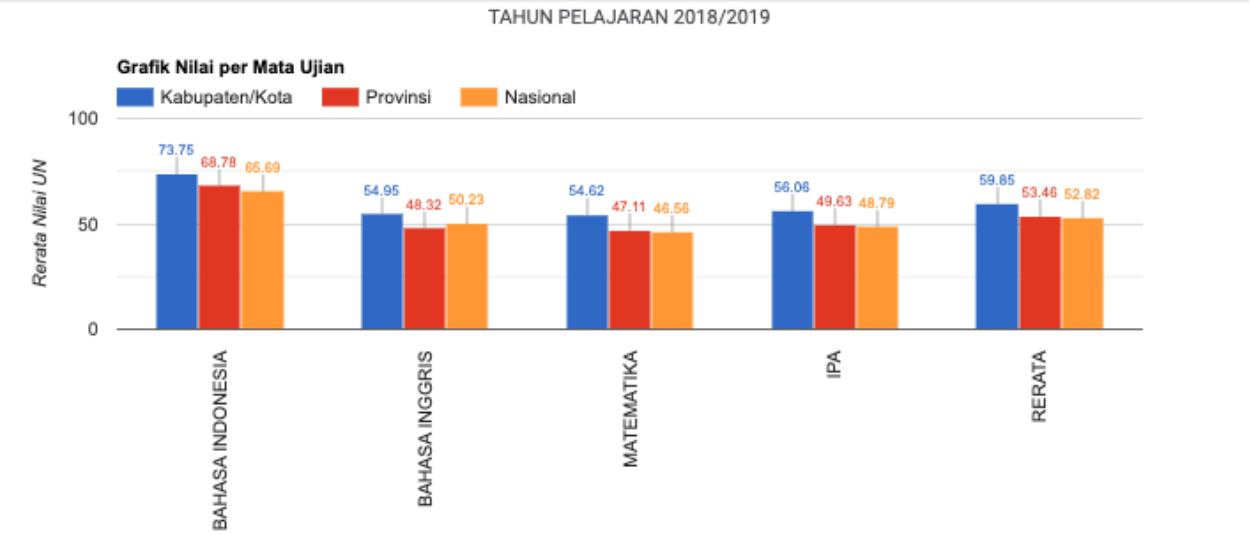


Figure 1. Average National Examination scores at junior high school (SMP) level for the 2018/2019 academic year (Center for Educational Assessment, 2019)

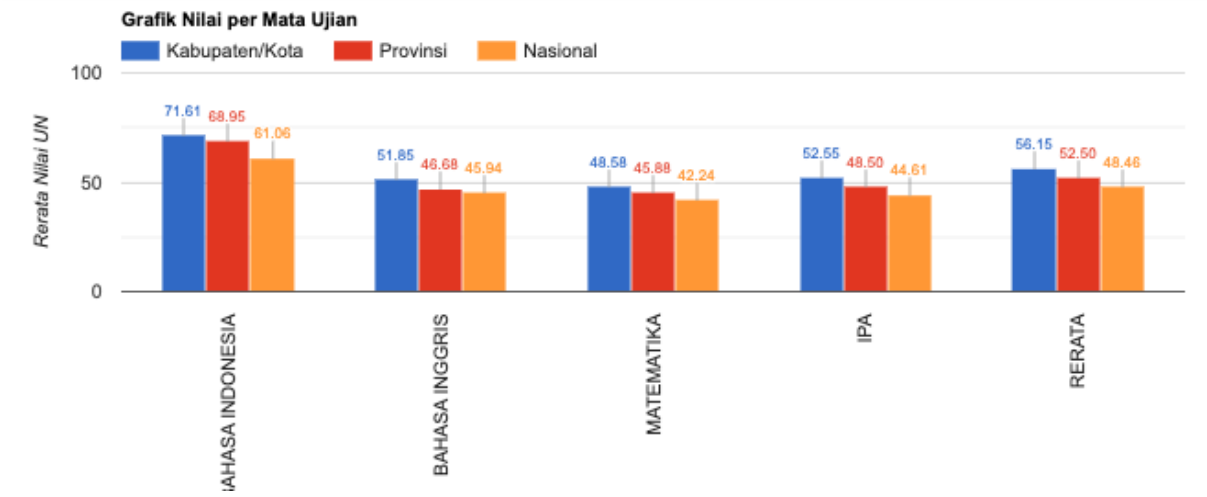


Figure 2. Average National Examination scores at MTs level 2018/2019 academic year (Center for Educational Assessment, 2019)

This condition shows that there are things that must be improved within students and also teachers in educational units under the Ministry of Religion. Among the most important things to improve is the ability to think logically and draw conclusions which are closely related to science, especially mathematics.

According to Klau et al.[5] children aged 11-15 years, who are generally receiving junior high school (SMP) / Tsanawiyah (MTs), are the ideal age for learning to think logically and draw conclusions. Learning to think critically from an early age is expected to be one of the factors that can be the key to students' success in the future.

So far, the approach used to improve students' thinking abilities is conventional. Usually, the teachers explain related concepts in one direction or tries the discussion method without sufficient interest from the students so that it ends in boredom and the learning objectives are not achieved. However, it cannot be denied that in this current era, even students are familiar with digital technology, but it is not intended for learning purposes. This means that students' interests have shifted to technological matters. Meanwhile, on the other hand, teachers who have substantial abilities but are not accompanied by mastery of technology still use conventional methods in the learning process so that they fail to attract students' interest. Therefore, these two things, the teacher's substantial abilities and students' interests, must be brought together. The way to bring this together is to make teachers familiar with technology so they can use it for teaching and learning processes that attract students' interest.

The background conditions described above move the community service team

[5] Yashinta Esterina Klau, Siprianus Suban Garak, and Damianus D. Samo, "Kajian Kemampuan Berpikir Kreatif Dalam Pembelajaran Matematika Di Sekolah Menengah Pertama Pada Materi Geometri," *FRAKTAL: JURNAL MATEMATIKA DAN PENDIDIKAN MATEMATIKA* 3, no. 1 (2022): 1–11.

to contribute to increasing the capacity of students and teachers at partner madrasas by maximizing the use of technology in an interesting learning process.

Method

This Community Service is carried out at two MTs in Padang City, namely MTsN 5 and MTsN 6 Padang. In carrying out service, the team use the Service Learning (SL) approach. SL aims to provide practical experience, academic learning to students by involving them together with the community to solve the problems faced by that community[6].

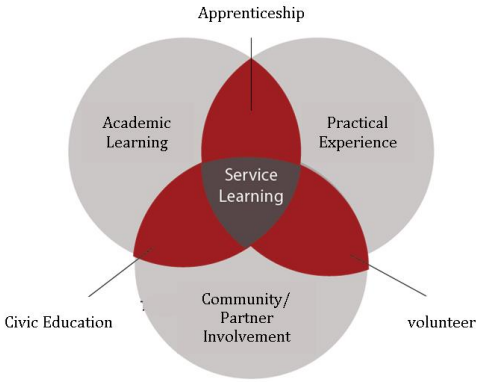


Figure 3. Scope of Service Learning. Image adapted from (Heffernan, 2001)

According to the Service Learning 2000 Center, Stanford University, to create high quality SL at least 7 (seven) elements should be fulfilled, namely integrated learning, high quality services, collaboration, student voice/ideas, responsibility, reflection, and evaluation[7].

In this service, the team uses the Kaye approach which divides service learning into 4 (four) stages: investigation, preparation, action, and reflection[8].

Investigation

In carrying out the investigation, the service team consisting of lecturers and university students, coordinated first with Rahmat M.Pd as chairman of the Mathematics Teachers Conference (Mathematics MGMP) of Padang City for 2021-2024 period and Safinah Azmir, M.Pd as Acting chairman of the Padang City Mathematics

[6] K Heffernan, "Fundamentals of Service-Learning Course Construction," 2018, https://compact.org/resources/fundamentals-of-service-learning-course-construction.

[7] Stanford University Service Learning 2000 Center, "Seven Elements of High Quality Service Learning," 1998.

[8] C.B. Kaye, *The Complete Guide to Service Learning: Proven, Practical Ways to Engage Students in Civic Responsibility, Academic Curriculum, and Social Action* (Free Spirit Publishing., 2010).

MGMP for the 2021-2024 period. The coordination done regarding possible topics that will be covered in the service activity. After coordinating, the team then carried out an investigation by conducting an FGD with the service partners consisting of the Principal, Deputy Principal, Chair of the Padang City MGMP, and also the mathematics teachers of the service partners. This field investigation aims to map the problems experienced by teachers and also to find out the current conditions regarding the resources owned by partners (human resources and facilities).

Preparation

After the investigation process is complete, the service team coordinates both with team members and with the mathematics teacher coordinator at the partner madrasas. This stage is carried out to prepare what is needed when the implementation process is carried out and also to mitigate the possibility of unnecessary things that will happen when the implementation is carried out.

Action

The action or implementation stage is carried out based on the results of the field investigation and also the preparations that have been made by the service team. However, before the service team carried out implementation, the service team coordinated with service partners about what methods will be used in the service. It was done with purpose that partners would be able to adapt to the implementation carried out by the service team.

Reflection and Evaluation

Reflection and evaluation basically cannot be separated in the quality assurance process of an activity. At the reflection and evaluation stage, the service team conducted discussions with partners and also between members of the service team about what had been done during the action stage. The results of the reflection and evaluation stages became material for self-introspection and improving performance in subsequent activities.

According to the Center for Innovative teaching and learning, reflection and evaluation activities can be carried out during or after service activities (Center for Innovative Teaching and Learning, 2023). Therefore, during activities, the service team carries out reflection and evaluation both after one activity ends with the aim of anticipating undesirable things at the next meeting, as well as during the process of closing the activity.

Result

Community service activities that have been carried out by following the steps in the method section have obtained the following results:

Investigation at MTsN 5 Padang and MTsN 6 Padang

The investigation that has been carried out aimed to obtain general information about the partner's condition. The process was done using a focus group discussion method (FGD) involved the Chairman of Mathematics MGMP of Padang.

The FGD conducted at MTsN 5 Padang was carried out to map SWOT - Strength, Weakness, Opportunity and Threat. In the process of determining the SWOT, the service team involved stakeholders. The stakeholder elements who took part in this discussion were the principal, deputy principal for academic affairs, chairman of Mathematics MGMP, and also MTsN 5 Padang City mathematics teachers.

While the FGD at at MTsN 6 Padang was carried out to map the SWOT owned by partners. The element of stakeholders who took part in this discussion were the Principal, Deputy Principal for Academic Affairs, Acting Chair of the Padang Mathematics MGMP, and MTsN 6 Padang mathematics teachers.

The results of the FGD at MTsN 5 Padang and MTsN 6 Padang were obtain as follows:

***Table 5*. SWOT MTsN 5 Padang and MTsN 6 Padang**

SWOT	MTsN 5 Padang	MTsN 6 Padang
Strengths	(1) Learning support facilities such as a computer laboratory, adequate internet access (2) Human Resources (HR) (teachers) who have S1 – S3 education levels. (3) Serious commitment from human resources in improving the quality of education (4) School accreditation A (5) There is support from parents in the educational process	(1) Learning support facilities such as computer laboratory and adequate internet access (2) Human Resources (teachers) who have undergraduate up to doctoral education levels. (3) Serious commitment from human resources in improving the quality of education (4) School accreditation A (5) It is a model madrasa in Padang (6) There is support from parents in the education process (7) Students who are proficient

		in using information technology (8) School achievements at national level
Weaknesses	(1) There are limited reliable human resources in the field of information technology so that digital-based teaching innovation is underdevelope (2) Students who are less skilled in using information technology	(1) Human resources are limited in the field of information technology so that digital-based teaching innovation is underdeveloped
Opportunities	(1) The location is close to the famous State University in Padang City (2) Support from the government regarding educational development	(1) Support from the government in improving the quality of education (2) The location of the madrasa is in the education area (3) The location is in the city center (4) The location of the madrasa is close to well-known universities in Padang
Threats	(1) Junior high schools are more favorite than partner school (2) Information technology products bother students' intellectual/emotional development power	(1) Junior high school is more favorite than partner (2) The onslaught of information technology entertainment products are more interesting than learning at school

Figure 4.a. Investigation at MTsN 5 Padang

Figure 4.b. Investigation at MTsN 6 Padang

Preparation

After the investigation stage is carried out, the service leader coordinated with other members of the service team as well as with the mathematics teacher coordinator at the partner madrasas regarding what concerns the service would be covered. From the results of coordination, agreement was obtained:

a. Creating digital games for mathematics teachers and students is the focus of service.
b. For MTsN 5, the training participants consisted of 7 (seven) mathematics teachers and also students from grades 7 and 9. Meanwhile for MTsN 6, the training participants consisted of 10 (ten) mathematics teachers and also students from grade 8 and 9.
c. The training planned to have 5 (five) meetings with 3 (three) meetings carried out by the service team for mathematics teachers and 2 (two) meetings carried out by the teachers to the students.
d. The training is carried out on a project basis where students are required to create digital games that utilize mathematical knowledge such as logic, arithmetic or other branches of mathematics.

After reaching an agreement between the service team and partners, the team then conducted a literature study regarding what game engine would be used for the community service. From the results of the study, the service team agreed to use Scratch as a game creation medium. Different from other game engines such as Unity, Construct, Gdevelop, and others, Scratch places more emphasis on a person's way of thinking to solve a problem by creating a game. Apart from that, Scratch is suitable for someone who is unfamiliar with the game creation process because Scratch uses block-based programming in building a game.

After the literature study is complete, the service leader distributed tasks to each member of the service team. The team leader and one member create training materials intended for teachers and students, while the other team members are responsible for the technical preparation and training facilities that will be carried out by the service team.

Action

The action stage consisted 5 (five) meeting of training for each MTs. The training is divided into two parts based on the training participants. Training for teachers who are resourced by the lecturers and the university students, and training for students who are resourced by teachers who have been trained by the service team.

a. First Meeting (For Teachers)

   At the first meeting, the material presented included *variables*, *operators*, *looks*, *sound*, and *motion*. A *variable* is an entity whose value can change and an *operator* is an operation that is performed on a variable. *Looks* relates to the appearance of the game interface desired by the game creator. Meanwhile, *sound*, as the name suggests, is related to the sound effects desired by the game creator. *Motion* is

related to what kind of movement will occur if a motion block is implemented into a game object. At this meeting, the teachers basically already had knowledge about variables and operators, but applying them in a digital game was their first experience.

Figure 5.a. First meeting training for teachers at MTsN 5 Padang

Figure 5.b. First meeting training for teachers at MTsN 6 Padang

b. Second Meeting (For Teachers)

At the second meeting, the service team provided training regarding *events*, *controls* and *sensors*. *Events* are block scripts that aim to trigger a block so that it works according to the trigger given by the event block. *Control* is a block to regulate the work of a block based on a condition. *Sensors* are related to running a block based on a given sensor block.

Figure 6.a. Second meeting training for teachers at MTsN 5 Padang

Figure 6.b. Second meeting training for teachers at MTsN 6 Padang

c. Third Meeting (For Teachers)

At the third meeting, the teachers no longer learned about the components of the Scratch block, but instead, the teachers created a math game based on the guidelines provided by the service team. It is hoped that by creating games based on the

guidelines provided, teachers will have a better understanding of what they have been taught. The case study material provided are: (1)

(1) *Mouse catching game*. This game aims to catch as many mice as possible. If the mouse is successfully caught, the mouse variable value increases by 1 (one). This is an implementation of simple counting and agility.

(2) *Linear and quadratic functions*. This material teaches teachers how to simulate linear functions or quadratic functions and then the teachers develop it into a game.

(3) *Arithmetic series*. This material provides an explanation of the implementation of arithmetic series in the form of jumping games and arithmetic quiz games.

Figure 7. The Mouse catching game

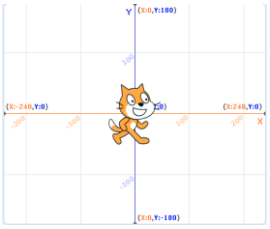


Figure 7.b. The linear and quadratic functions game

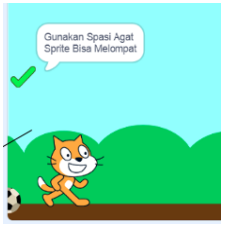


Figure 7.c. The arithmetic series game

Figure 8.a. Third meeting training for teachers at MTsN 5 Padang

Figure 8.b. Third meeting training for teachers at MTsN 6 Padang

d. First Meeting (For Students)

In contrast to the training material provided by the service team to teachers, the material delivered by teachers to students places more emphasis on examples of how students created games based on guidelines and teachers explanation of code blocks in the game. The game making material delivered by the teachers was the learning material that is being studied by the students so that in delivering the game material, the teacher does not ignore the learning material that the students are studying.

Figure 9.a. First meeting training for students at MTsN 5 Padang

Figure 9.b. First meeting training for students at MTsN 5 Padang

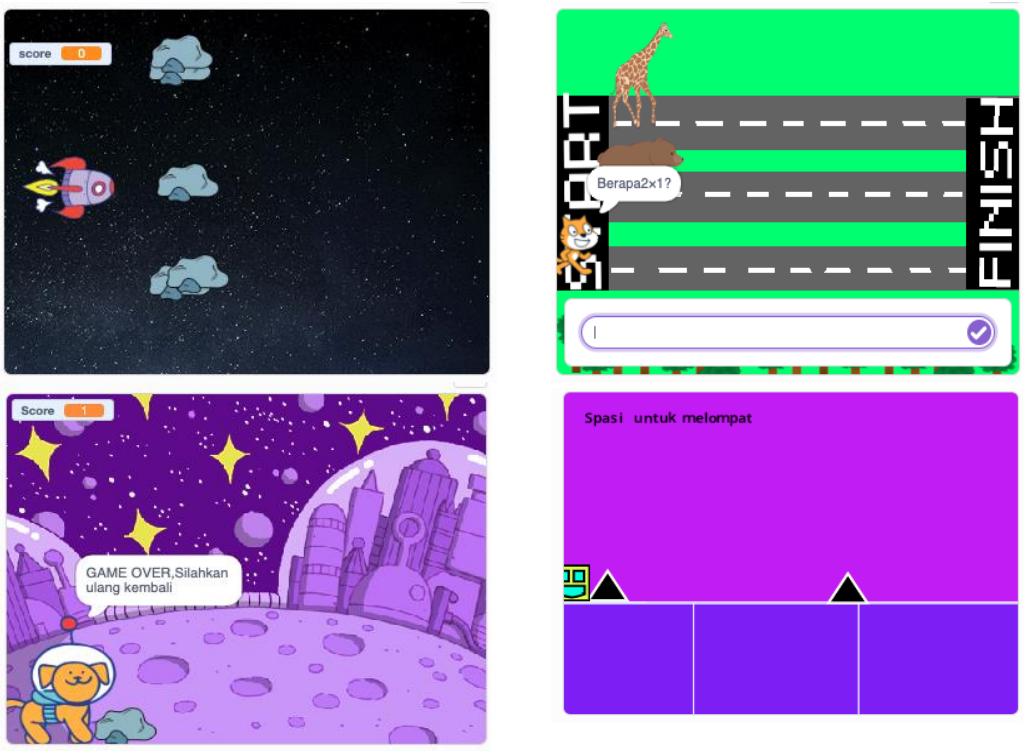
e. Second Meeting (For Students)

At the second meeting, the students were divided into several groups consisting of 4 (four) students. With teacher assistance, students are required to create a game concept which will later be used as a basis for creating games in Scratch. In the process of designing to producing work, students indirectly learn to work together and learn to think to solve problems based on the concepts they have created.

Figure 10.a. Second meeting training for students at MTsN 5 Padang

Figure 10.b. Second meeting training for students at MTsN 5 Padang

From the training carried out, the students were able to translate what they had conceptualized into a game. Below are some of the students' game works that they have successfully created.



Figures 11. Games created by students

2. Reflection and Evaluation

Reflection and evaluation stage involved the service team members and madrasah partners. The involvement of partners in the reflection and evaluation process becomes a benchmark for the service team to provide better services in the future.

Figure 12.a. Reflection, evaluation, and closing of the service at MTsN 5 Padang

Figure 12.b. Reflection, evaluation, and closing of the service at MTsN 6 Padang

Overall, the community service activities went well. There were several adjustments made at the implementation (action) stage regarding the speed and flow of delivery of training material given to teachers. These adjustments are made to ensure that

the material is delivered effectively to teachers so that they can pass on the material to students as well.

Discussion

The gap between student interests and learning material, especially in mathematics, needs to be filled with something that will bring the two together. The idea to fill this gap is to make an effort to tap into students' interests. To be able to do this, the teachers must adapt the learning material to something that attracts students' attention, such as involving games in the learning process.

Based on the investigation results obtained from MTsN 5 and MTsN 6 Padang, it was found that there were similar weaknesses and threats faced by both of the MTs. Therefore, the service team, which is part of the opportunity for both schools, used the strengths possessed by partners to be able to cover the problems they faced. Among the strengths of the two MTs are students who have high interest and sufficient ability to use information technology. However, that students' interests and abilities are not always guaranteed to be used in positive ways. Most of their activities are used for purely entertainment purposes. This is in line with the findings of Apriyanti et al.[9] study about the impact of gadgets on student learning outcomes. They found that gadgets among junior high school students, the subjects of their research, is not only used as a means of communication but also as a playing tools for a very long duration every day. This condition makes the gap between students' interests and learning material even wider which ultimately results in the learning objectives not being achieved.

Kengwee, et al. (2008)[10] and Makodamayanti, et al. (2020) [11] in their study explain the benefits of learning with technology tools when integrated into teaching. Utilizing technology as a learning medium can be done with a game-based learning design. Play games described as being integral to, and evolving with, children's stages of cognitive development. There is a number of reasons being advanced for why games are effective learning environments. Some of the most important reasons are regarding motivation, player engagement, adaptivity, and graceful failure[12].

However, the game-based learning approach is not something that does not have

[9] F Aprianti et al., "The Impact of Gadgets on Student Learning Outcomes: A Case Study in Indonesia Junior High School Students," *International Journal of Education, Information Technology, and Others* 5, no. 5 (2022): 121–30.

[10] Jared Keengwe, Grace Onchwari, and Patrick Wachira, "The Use of Computer Tools to Support Meaningful Learning," *AACE Journal* 16 (2008): 77–92.

[11] Septiarini Makodamayanti, Deli Nirmala, and Catur Kepirianto, "The Use of Digital Media as a Strategy for Lowering Anxiety in Learning English as a Foreign Language," *Culturalistics: Journal of Cultural, Literary, and Linguistic Studies* 4, no. 1 (December 3, 2020): 22–26, https://doi.org/10.14710/culturalistics.v4i1.8187.

[12] Jan L. Plass, Bruce D. Homer, and Charles K. Kinzer, "Foundations of Game-Based Learning," *Educational Psychologist* 50, no. 4 (October 2, 2015): 258–83, https://doi.org/10.1080/00461520.2015.1122533.

any negative effects at all. Learning with a game-based learning approach can give rise to students' tendency to play games, not for studying. Apart from that, learning using games can cause learning distractions and the objectives of the game are sometimes not aligned with the learning objectives.

Different from general game-based learning which emphasizes the learning process carried out by playing games [13] [14],[15],[16], this service is carried out to teach students and teachers to be able to create digital games by integrating them into learning topics, especially topics related to mathematics. Hughes-Robert et al. (2020)[17] stated that creating games, apart from being able to improve students' cognitive and behavioral aspects, is also an effective way to encourage students to be more enthusiastic in learning and also train their collaboration skills[18]. For teachers, creating games that are integrated with learning materials can improve the quality of learning carried out by teachers [19]. Therefore, Gabriel (2018) encourages schools to implement the creation of digital games as part of the learning curriculum [20].

As is the case with research conducted by [21],[22], games creation in this service activity is using Scratch. Scratch focuses on developing computational thinking, problem solving skills, creative learning, self-expression and collaboration[23]. According to Dewi (2021), learning using Scratch has a significant influence in improving students' critical

[13] Eric Zhi Feng Liu and Po-Kuang Chen, "The Effect of Game-Based Learning on Students' Learning Performance in Science Learning – A Case of 'Conveyance Go,'" *Procedia - Social and Behavioral Sciences* 103 (November 2013): 1044–51, https://doi.org/10.1016/j.sbspro.2013.10.430.

[14] Cândida Barros, Ana Amélia Carvalho, and António Salgueiro, "The Effect of the Serious Game Tempoly on Learning Arithmetic Polynomial Operations," *Education and Information Technologies* 25, no. 3 (2020): 1497–1509, https://doi.org/10.1007/s10639-019-09990-4.

[15] Khanh-Phuong Thai, Hee Jin Bang, and Linlin Li, "Accelerating Early Math Learning with Research-Based Personalized Learning Games: A Cluster Randomized Controlled Trial," *Journal of Research on Educational Effectiveness* 15, no. 1 (January 2, 2022): 28–51, https://doi.org/10.1080/19345747.2021.1969710.

[16] Cristina Jiménez et al., "Digital Escape Room, Using Genial.Ly and A Breakout to Learn Algebra at Secondary Education Level in Spain," *Education Sciences* 10, no. 10 (October 1, 2020): 271, https://doi.org/10.3390/educsci10100271.

[17] Thomas Hughes-Roberts et al., "Examining the Potential Impact of Digital Game Making in Curricula Based Teaching: Initial Observations," *Computers & Education* 158 (December 2020): 103988, https://doi.org/10.1016/j.compedu.2020.103988.

[18] Thomas Hughes-Roberts et al., "Examining the Potential Impact of Digital Game Making in Curricula Based Teaching: Initial Observations," *Computers & Education* 158 (December 2020): 103988, https://doi.org/10.1016/j.compedu.2020.103988.

[19] Rohmi Juharoh et al., "Designing a Scratch Media to Increase Tenth-Graders' Collaborative and Communicative English Learning and," 2022.

[20] Sonja Gabriel, "We Make Games: An Evaluation of Introducing Game Design Concepts in Schools" (Academic Conferences and Publishing Limited, 2018), 117.

[21] Rohmi Juharoh et al., "Designing a Scratch Media to Increase Tenth-Graders' Collaborative and Communicative English Learning and," 2022.

[22] Iva Sarifah et al., "Scratch-Based Interactive Games to Increase Interest in Learning Mathematics for the Second Grade Elementary School Students," *Jurnal Pendidikan Dan Pengajaran* 56, no. 2 (August 1, 2023): 359–69, https://doi.org/10.23887/jpp.v56i2.66556.

[23] Scratch, "Https://Scratch.Mit.Edu/About," *About Scratch* (blog), 2023, https://scratch.mit.edu/about.

thinking skills[24] which is an important competency that students must have to be able to adapt well in their environment[25].

In this service, the subjects of assistance are not only students, but also teachers. According to James et al (2020)[26], When implementing a game-based learning approach, the challenge faced by teachers is the difficulty in creating games, especially digital games. Therefore, to overcome this issue in carrying out this service activity, the teachers were trained by the team to have the ability to create mathematics games for learning purposes. The game creation training process for teachers emphasizes the logic of creating digital games and how to build games using Scratch. The focus of service for teachers is not on finding ideas or visual game design, but reconstructing the games given by the service team and then developing them.

After that, the teachers were asked to train students to create their own mathematics games based on the material taught to them in class. This process is also accompanied by the service team so that all stages can be seen directly by the service team. In the game's creation training process at both madrasas, students were divided into groups where each group consisted of a minimum of 2 students and a maximum of 4 students, and teachers were involved to direct and control them. According to Hughes-Roberts et al (2020), the process of controlling the assisted subjects when creating games needs to be carried out so that the learning process is as expected.

From the game's creation training for teachers and students, it was found that the students' process in creating games is faster than the teachers. It was demonstrated by the students' ability to modify the games taught by the teachers. This is very natural and in accordance with what has been found at the investigation stage where students, which is generation Z, adapt more easily to the developments of information technology compared to previous generations because digital technology has become part of their lives[27].

However, the students were still lacked in applying their logic to the games so that assistance from teachers is important to direct or correct if there are logical errors in the process of creating games by students. Therefore, game-based learning is designed to facilitate student's creativity supported by teacher's substantial knowledge.

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Conclusion

From the community service activities that have been carried out, it can be concluded that teachers basically need to be trained to be able to integrate technology into their teaching methods. With good technology mastery, teachers will be able to present interesting and high-quality teaching materials. More than that, they can also engage students in an interactive and interesting learning process. A learning process that involves student more actively will stimulate their creativity and innovation. With students being active, they will be able to translate conceptual things into practical applications. Thus, it is hoped that students' understanding of the concepts will become stronger.

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