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MOODLE-BASED LEARNING MEDIA DEVELOPMENT OF FLEX MODEL IN IMPROVING MATHEMATICAL HARD SKILLS

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Abstract

The development of the flex media model looks like the beginning of the problems in the classroom, especially in the new normal. Students experience difficulties when given math problems. Students are less able to solve these problems, especially in understanding justifying mathematical ideas and arithmetic skills, and are less interested and enthusiastic when learning. This study aimed to develop a Moodle-based flex model learning media to improve students' mathematical hard skills with three-dimensional material. The study was used to research and develop the four-D model. The instruments used included validation, questionnaires, pre, and post-test questions, small-scale trials of 10 students, and large-scale trials with a purposive sampling technique of 30 class XII students. Data collection techniques include (1) validation questionnaires of media and material experts, (2) practicality questionnaires (student responses), and (3) pre-posttest questions. Material and media expert validator test with very decent results. The results of the student response questionnaire were reasonably practical regarding statements related to the practicality of the Moodle-based flex model media. The N-gain average score indicated a "moderate" improvement category. Based on the study results, the developed media meets valid, practical, and effective criteria for improving students' hard skills.

Keywords: 4D Model; Flex Model; Mathematical Hard Skill; Moodle

Abstrak

Pengembangan media flex model terlihat seperti awal dari permasalahan yang terdapat di dalam kelas, terutama pada kondisi new normal, siswa mengalami kesulitan ketika diberikan soal matematika. Siswa kurang mampu menyelesaikan permasalahan tersebut terutama dalam hal pemahaman materi dalam menjustifikasi ide matematika, keterampilan membaca, dan berhitung yang esensial, serta kurang tertarik dan antusias saat belajar. Tujuan dari penelitian ini adalah mengembangkan media pembelajaran flex model berbasis Moodle untuk meningkatkan kemampuan matematika sulit siswa dengan materi dimensi tiga. Metode penelitian menggunakan jenis Research and Development dengan 4-D. Instrumen yang digunakan meliputi validasi, angket, dan soal pre-test dan post-test, serta uji coba skala kecil sebanyak 10 siswa dan uji coba skala besar dengan teknik purpose sampling kepada 30 siswa kelas XII. Teknik pengumpulan data meliputi (1) angket validasi ahli media dan materi, (2) angket kepraktisan (respons siswa), (3) Soal pretest-posttest. Uji validator ahli materi dan media dengan hasil sangat layak. Hasil angket respon peserta didik diperoleh cukup praktis mengenai pernyataan terkait kepraktisan media flex model berbasis moodle. Skor rerata n-gain 0,60 menunjukkan kategori peningkatan "sedang". Berdasarkan hasil penelitian, media yang dikembangkan terbukti memenuhi kriteria valid, praktis dan efektif untuk meningkatkan hard skills siswa.

***Kata Kunci**: 4-D; Flex Model; Hard Skill Matematika; Moodle*

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INTRODUCTION

The purpose of learning mathematics is explicitly the importance of mathematical hard skills for students (Darwanto, 2019). Hard skill is the ability to master cognitive science (Fan et al., 2017; Kunanusorn, 2021; Sumarmo, 2014) and academic skills (Permendikbud, 2016; Sugianto et al., 2022) that students acquire through direct activities (Sopa et al., 2020; Wisshak & Hochholdinger, 2020). Therefore, it can be concluded that mathematical hard skills are students' ability to solve mathematical problems, manifested in direct activities in the learning process.

Student activity in the learning process can be seen when students can conclude mathematical problems. Furthermore, students will be able to conclude when using their mathematical hard skills, especially in the ability to think creatively (Masfingatin et al., 2020; Siburian et al., 2019), think logically (Triatmi & Setiawan, 2018; Wahyuddin et al., 2021), critical thinking (Changwong et al., 2018; Darmayanti et al., 2022), communication (Kamid et al., 2020; Sugianto et al., 2022), connection (Baiduri et al., 2020; Knuth, 2020; Rizki et al., 2022), the problem solving (Björn et al., 2019; Güner & Erbay, 2021; Rahmah et al., 2022), reasoning, (Kabael & Akin, 2018; Palinussa et al., 2021; Sterner et al., 2020) and understanding (Basir et al., 2020; Bossé et al., 2021; Minarni et al., 2016; Nurani et al., 2021). However, students can nott master all of these aspects.

Something was found in the results of unstructured observations and interviews. Namely, when observations were seen: 1) students still experienced difficulties when given mathematical problems, 2) were less able to solve these problems, 3) students were challenged to understand mathematics subjects, 4) students rarely expressed because most of them do not know and understand what is being asked 5) some students can complete mathematics but do not understand what has contained problem (not meaningful), 6) some students are unable to make conclusions from the concepts that have been learned, 7) when students' learning seems less interested and enthusiastic, 8) the inability of students to bring mathematics into the realm of the concrete. It shows a low ability to reason, understand, and solve mathematical problems in students' mathematical hard skills.

A successful teacher manages students' mathematical hard skills in the learning process. In addition, teachers need to design a conducive learning process and form cognitive knowledge to influence students' intellectual quotient (IQ). Furthermore, teachers must articulate knowledge through project management mechanisms as tools, processes, procedures, and techniques by explicitly describing students' behaviors and skills (Borrego et al., 2019; Goestjahjanti et al., 2020). Such efforts will make learning mathematics easier if assisted by learning media. One of the learning media in facilitating the student's needs is by designing more effective and creative using moodle-based technology learning media.

Moodle is an application program and the right solution. Because it can overcome face-to-face frequencies that limit interaction between students and teachers. Moodle can be maximally and meaningfully determined by selecting the best models to create practical, systematic learning. And in sync with learners' interests (Teo et al., 2019).

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Models that support the existence of moodle media is the flex models.

The Flex model is a learning model with an instructional design where students can participate in two online and offline learning activities simultaneously with the whole group and small group instructions, personal or face-to-face guidance, and group projects so that learning becomes flexible (Mahmud, 2021; Schindelwig et al., 2017). Therefore, the flex model is suitable for learning and can meet needs based on learning needs, interests, teaching methodology, objectives, situations, and other uses.

Previous research related to the flex model was carried out (Moss & Fink, 2014; Siyamta, 2015; Tarashchin et al., 2016) and (Yudt & Columba, 2017) the flex model could provide flexible learning and learning centered on students with personalities that arise through the teacher's role as a facilitator. Furthermore, research (Schindelwig et al., 2017) states that the flex model effectively builds new knowledge based on previous experience. (Sari, 2019; Sinta et al., 2019) with results showing that the flex model enables teachers to reach more students as part of their instructional time is replaced by technology-based instruction. Furthermore, flex model research (Hawamdeh & Adamu, 2020; Mabuan & Ebron, 2018; Mahmud, 2021; Siyamta, 2015) could improve student learning outcomes.

Furthermore, moodle research is associated with the flex model conducted by (Deryhlazov et al., 2017; Tirza, 2021), making it possible for students to enter the classroom digitally when learning online. Moodle is flex based to provide easy access, effectively helping increase student knowledge. Research related to hard skills has been done by (Delita et al., 2016) found an increase in the ability to understand geography questions. The same is true of research, which found optimal interactions between vocational students and teachers by utilizing learning resources. (Ubaydillah, 2019) also found differences in students' capacity to solve problems of *Aqidah Akhlak* when dealing with them through the teacher's efforts to help develop students' hard skills, especially those related to academic achievement.

However, from previous studies, no one has developed moodle-based learning media associated with mathematical hard skill ability, incredible understanding, reasoning, and problem-solving abilities. The difference from this research that will be developed is to include the flex model in moodle, where the media can improve the three mathematical hard skill abilities (comprehension, reasoning, problem-solving). Another difference from this research is that the media to be developed is a two-way interactive learning media or can also be carried out synchronously, and the availability of discussion features by creating interaction, feedback, debate, and online collaborative work, both open and private only. Furthermore, this media can also convey material in document files, pictures, videos, and practice questions that can be accessed anytime and anywhere.

Therefore, based on the background description above, this study aims to develop a flex model learning media Moodle-based to improve valid, practical, and influential high school students' mathematical hard skills. This media is expected to be a contribution and can be used as an alternative solution, especially in the current new normal conditions.

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RESEARCH METHODS

This research is research and development type. This research was conduct in SMA Negeri 4 Pasuruan. The subject of this research are students of SMA Negeri 4 Pasuruan in the last semester of the 2021/2022 academic year.

This research was used four-D model (Thiagarajan, 1974), which consists of 4 stages: definition, design, development, and dissemination. A description of the development of this media is explained in Figure 1. Beside that, more specifical steps that have been carried out can be seen in Figure 2.

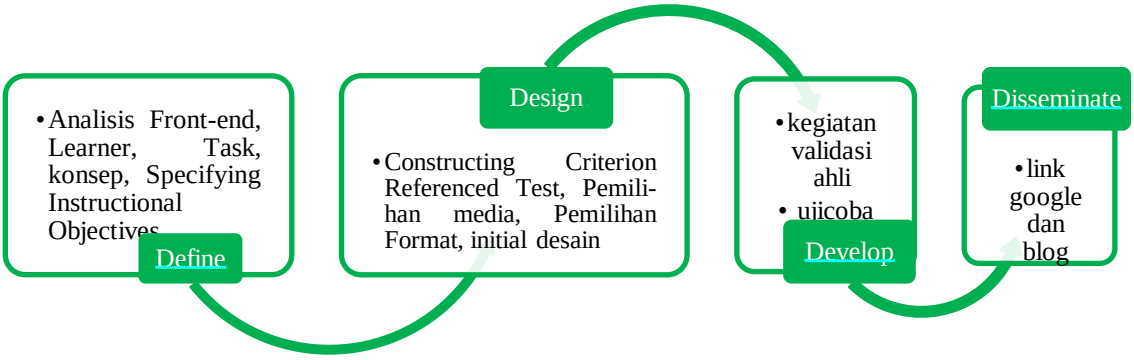

Figure 1. Stage of Model *Four*-D (Darmayanti et al., 2022)

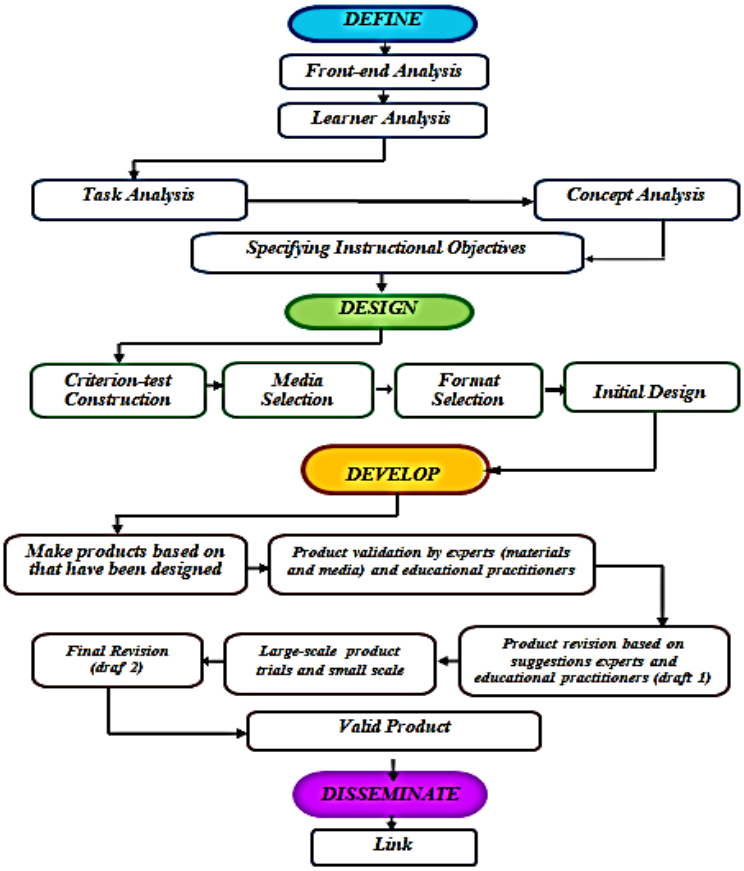

Figure 2. Modification to develop a Moodle-based media flex model from the four-D model

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Based on Figure 1, first stage is **define** (in this phase, we first perform front-end analysis, then learner, task analysis, concept analysis, and the last phase is developing learning objectives). Second stage is **design**, the process of designing Moodle-based flex model media is synchronized with the three-dimensional material in the 2013 curriculum (this phase first prepares a benchmark reference test, selects the media, selects the format, and finally makes the initial design of the media). The third stage is **develop**, where draft one is produced (the process of verification by experts/practitioners of the media to be developed, revisions, then trials or development tests, revisions, until draft two is produced). In the development phase, where the two drafts of the Moodle-based media flex model that has been made meet the valid criteria, the final step is to disseminate. More specifically, the steps that have been carried out can be seen in Figure 2.

This research used three kinds of instruments on data collection. The instruments used are:

1. Media and Material Validation Sheet adapted by Indahsari & Kintoko (2021). Expert validation was made using a Likert scale with a rating scale of 1-4. Two lecturers and two teachers carried out expert validation.
2. The questionnaire consists of 20 statement questions adapted from Cahyadi (2019) (used to collect response information after using the product).
3. Pre and post-test questions (to obtain efficacy data, the aim is to find differences between products produced and learning outcomes). The questions are descriptive in a form consisting of three contextual questions, each including the ability to understand, reason, and solve problems arising from students' test questions at school.

Measure the excellent learning media. It must meet the criteria of validity, practicality, and effectiveness. The study tested the adequacy of the material (learning design, content, language) and media (in terms of functionality, convenience, and attractiveness). Utilities must meet the criteria of practicality, convenience, appearance, and attractiveness. Meanwhile, for the effectiveness of media, trials will be conducted to find the effectiveness of the products produced on learning outcomes.

The field trial was carried out in two small and large stages, allowing it to receive direct input in the form of students' responses, reactions, and comments on the media that had been prepared. Even though it was small, it was done by ten people to find flaws in the first product. Four meetings were held in the large-scale experimental stage with trials in one class (30 students). The experimental design uses before and after use to determine the effect of the product on learning outcomes before and after using the product. The experimental model can be seen in Figure 3.

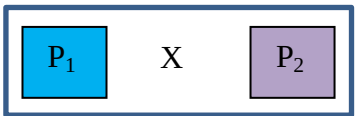

Figure 3. Experimental design (before-after)

P1 is before treatment, P2 is after treatment, and X is teaching materials.

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RESULT AND DISCUSSION

In other words, the results obtained in this development study are similar to the development study model developed by Thiagarajan, Semmel, and Semmel (1974), which is an adaptation of the definition, design, development, and dissemination model. The results obtained are described in the following presentation.

1. Define

The goal of this activity phase is to identify and define instructional requirements. Through the analysis, the objectives and limitations of instructional materials are identified. The definition phase consists of five main steps: (a) Front-end analysis, learner analysis, concept analysis, task analysis, and setting lesson objectives.

a. Front Analysis (Front-end Analysis)

Teaching materials used by students in this new normal era are teaching materials in the form of worksheets and 2013 curriculum package books from the government. The activity was carried out to refine and strengthen the fundamental problems encountered in the classroom by focusing on the "point-to-point distance" material. Based on observations and unstructured interviews with teachers and students, the researchers found that the teaching materials used by students in the form of three dimensions still have many weaknesses, especially in terms of language, content, and structure and use.

b. Learner Analysis

Activities at this stage include describing the concepts that students must find and learn in teaching materials. The idea in question is understanding, reasoning, and problem-solving related to the Three Dimensional material. Moodle-based model flex media that handles three-dimensional "point-to-point" materials. The first step in making a product is to identify potential problems by conducting field studies and gathering information about the potential of SMAN 4. Learning at SMAN 4 has not provided learning tools that utilize technological developments in which learning can be found in interaction (feedback) in group discussions, two-way interactive or can also be carried out synchronously and the availability of discussion features by creating interaction, feedback, debate, and online collaborative work, both open and private only, which includes problem-solving skills

c. Concept Analysis

Concept analysis is the conceptual identification stage of the material that will be used as a means by which students acquire basic skills. This step is intended to package the material so that it is not forgotten and is more systematic so students can easily understand it. The material that has been determined is "point-to-point distance" in three dimensions. The material will be displayed in a media design with a Moodle-based flex learning model. The material is presented through learning videos and summaries containing questions from the application of daily activities through the Moodle-based flex model media.

d. Task Analysis

The material used in printed books and videos shared by teachers on three-dimensional material, namely "point-to-point distance" in essential competencies 3.1 and 4.1, only discusses general topics not related to the focus of the application of questions containing hard skills (the ability to

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understand, reason, and solve problems). Therefore, researchers developed a Moodle-based flex media model so that students can learn flexibly to increase student participation in mastering concepts that are difficult to understand, universal, and can be accessed quickly. Furthermore, students do not understand the material because the video content belongs to someone else, so it is not a problem for students. In addition, the sample questions contained in the video content do not apply examples in everyday life, mainly due to time constraints. Teachers often send materials via WhatsApp groups to encourage students to learn independently

e. Specifying Instructional Objectives

After the document's conceptual examination, the next step is determining the learning objectives students need to achieve and ensuring the material is tailored to their needs. The learning objectives that need to be completed by students are by studying three-dimensional material "point to point distance" through the Moodle-based flex model learning media which is attractively designed both in terms of appearance, audio, animation, and content (materials and questions containing hard skills).

2. Define

The definition stage runs when the researcher finds a problem. We prepare materials and product prototypes for the first draft during the design phase. This phase involves four steps: (a) construction of criteria test, (2) Selection of media according to the nature of teaching materials and learning objectives, (c) format selection, namely deciding the format and the format of the material to be developed, (d) Create an initial design according to the selected format. The following is the result of the steps taken:

a. Construction of Criteria Test

The criteria reference test is the step that connects the definition and design phases. The analytical results of the preparation of the criterion reference test obtained a grid of questions containing hard skill indicators (understanding, discussion, problem-solving) using the Moodle-based flex model learning media, Guidelines for assessing each hard skill item. The solution key for each hard skill item.

b. Media Selection

The Moodle-based media flex model was chosen because it is very relevant now. In addition, the Moodle-based flex model media was chosen because it aims to increase students' mathematical hard skills. Media selection is made with the appropriate media based on media selection, namely components such as text, audio, video, images, and animation. The Flex model from its Moodle base Application programs used to support media creation are the Zepeto application, Background Eraser, Kinemaster,

c. Format Selection

The choice of format when developing learning tools will help design or learn content in this case. The developed format is intended to design or design the contents of the media flex model with Moodle, which contains titles, instructions, essential competencies, core competencies, indicators, tools and materials, work methods, experiments, and supporting materials for experimental activities developed.

d. Initial Design

The activity is carried out by the initial design in media design according to the defined stage before being

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assessed by expert lecturers. This design begins with identifying the material, precisely the material that will be used in research. The purpose of this essential skill is for students to be able to explain the distance between points in space, explain the procedures for determining the distance of a point to a point, and determine the distance between points to points between flat plane spaces with an initial design that can be accessed on mobile devices. The display of the Moodle-based flex media model can be seen in Figure 3.

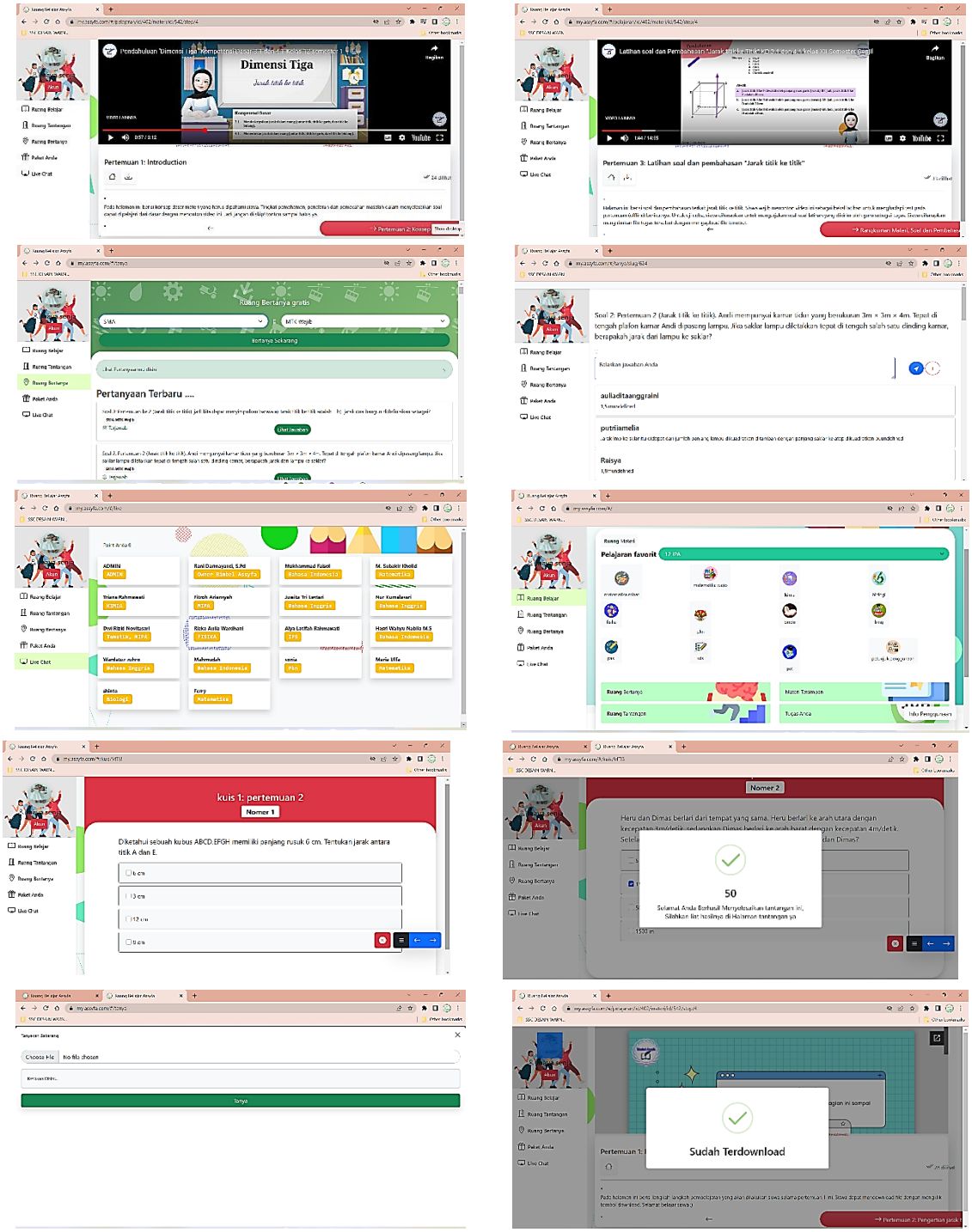

Figure 3. Example of material display, practice, quizzes, discussions in the media

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3. Product Development

(a) Expert validation

Validation aims to determine the feasibility of the media and materials developed. Furthermore, before the researchers conducted research, this validation was carried out by involving several expert validators, namely: (1) Lecturers and media specialist teachers: Mr. Agus Setiawan, M.Pd., Lecturer of IAIM NU Metro Lampung, and Mr. Aditya Kusuma Wardahana, M.Pd., Teachers at SMKN 1 Blitar; (2) Lecturer of Material Expert: Mr. Muniri, M.Pd., IAIN Tulungagung Lecturer and Mr. Fitroh Ariansyah, S.Pd., Teacher at SMAN 4 Pasuruan. From 22 May to 28 May 2022.

Table 1. Validation Results

Aspect of Validation	Indicators	Score	Criteria	Average Score	Criteria
Material	Learning design	3.50	worth trying out	**3. 58**	**Worth and pray**
	Content aspect	3.63	worth trying out		
	Language and writing	3.58	worth trying out		
Media	Usability	3. 69	worth trying out	**3. 68**	**Very valuable and doable**
	Functionality	3. 81	worth trying out		
	Characteristics	3.54	worth trying out		

(b) Product trials

The trial of the Moodle-based flex media model in the field explores the results of the application of learning media using Moodle-based flex media in the classroom. Tests are used to determine the practicality and effectiveness of teaching materials using Moodle-based flex media models, including student response questionnaires and question results, before and after student testing before and after using Moodle-based flex media models from learning materials. This activity was carried out in a limited trial for Class XII at SMAN 4 Pasuruan involving ten students. These teaching materials were tested several times, including on May 31, 2022, and June 2, 2022, at SMAN 4 Pasuruan.

(c) Practicality Analysis

Media practicality data was collected from the results of student questionnaires. Questions and answers emerged after students used the learning material template in the Moodle-based flex model media. The practicality test aims to determine how students react to the Moodle-based flex media model. The results can be seen in Table 2.

Table 2. Results of student response questionnaires

Num	Aspect	Score
1	Benefits of using media	3.78
2	Ease of use of media	3.70
3	Display media	3.73
4	Media pulls	3.84
total score		**15.05**
Total average score		**3.76**
Percentages		**94%**
Categories		**Very practical**

Regarding the aspect of media appearance and media attractiveness characteristics, the score was 3.73 and 3.84. The total score obtained from the results of the student response questionnaire to determine the practicality of the Moodle-based flex media model got a score of 15.05 with an average score of 3.76, and the percentage obtained was 94 percent in the "efficient" category.

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(d) Effectiveness

Data on the effectiveness of teaching materials were collected from test results (pre and post-tests). The pre-test questions were distributed to ten students before continuing with learning using teaching aids. Post-test questions are given after learning to use teaching materials. The purpose of providing pre-test and post-test is to determine students' mathematical hard skills before and after learning using Moodle-based flex media models. The study results can be seen in Table 3.

Table 3. The Mean Scores of Pre, Post-Test and N-Gain

Score		N-Gains	Criteria
Pre	**Post**		
33.75	65.99	0.60	moderat

Table 3 shows that the average pre-test score was 33.75, the average score was 65.99, and the average n-gain score was in the "moderate" category of improvement. Moodle-based flex model learning media can also be "effective" in learning to improve students' mathematical hard skills. It can be seen from the difference in the average post-test score, which is higher at 65.99, while the average pre-test value is 33.75, with an n-gain of 0.60 in the moderate increase category.

4. Product Distribution

The product results in a flex media model based on the model to improve the hard math skills of high school students after being tested by knowing the feasibility, practicality, and effectiveness of learning. The product produced has been said to be "very valid," so no re-test was carried out. Furthermore, the product in the form of a Moodle-based flex media model can be disseminated online to SMAN 4 students and teachers on a limited beforehand basis via a web link that is shared with the WhatsApp group.

The development of the Moodle-based flex media that has been carried out has three main objectives, validating the product to be developed, testing the practical product, and using it in the learning process. So the media can increase the mathematical hard skills ability of high school students as a learning medium with research and development to evaluate new products and assess their effectiveness by utilizing the 4-D technique of Thiagarajan, Melvyn Semmel, and Dorothy Semmel. Define, Design, Development, and Disseminate are steps in 4-D development.

Media Moodle-based flex model learning improves mathematical hard skills. Mathematical hard skills are essential for students specifically. Mathematical hard skills in students can be developed and realized in solving problems to solve math problems (Patacsil & Tablatin, 2017; Rohaeti, 2019)which is oriented from the 2013 curriculum (Darwanto, 2019; Hendarman & Cantner, 2018) as the goal of education in general (Budiarti & Harlis, 2020; Radeswandri et al., 2021). Regarding that, students' mathematical hard skills when solving math problems in learning cannot be separated. Hard Skill is the ability to master cognitive, technology (Evalina et al., 2021; Hämäläinen et al., 2021), and academic skills (Asbari et al., 2020) which students get through direct activities (Claessen et al., 2014; Ruswanto et al., 2018). Therefore, it can be concluded that students' hard skills in mathematics are students' ability to solve mathematical problems, which are manifested directly through activities in the learning process in class.

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Moodle-based flex media model with an instructional design where students can participate in two online and offline learning activities simultaneously with the whole group and small group instruction, personal or face-to-face guidance, and group projects so that learning becomes more flexible. The experience that students get when the learning process is a bridge in providing access to learning because it utilizes technology to contribute to creating an intelligent society with the proper pedagogy and management. For that, the flex model is a model that can activate an intelligent digital society so that students can participate in two online and offline learning activities at the same time.

Results analysis of practicality data obtained from student responses above resulted in a percentage of 94 percent in the convenient category. In line with research conducted by (Deryhlazov et al., 2017), web-based learning media using moodle met applicable criteria as seen from the results of student questionnaires with excellent categories. The development of web-based learning media with Moodle can function as two-way interactive learning media or can also be carried out synchronously and provide discussion features by creating interaction, feedback, debate, and online collaborative work, both open and private.

Results of student tests before and after using the Moodle-based flex model media showed increased students' mathematical hard skills in the material "point to point distance." The research conducted by (Mayasari & Pagiling, 2020; Pratiwi & Silalahi, 2021) namely that using moodle-based learning media can improve hard skill abilities, especially in understanding, reasoning, and mathematical problem-solving abilities, of students by showing an increase after using moodle media. Therefore, based on the description that has been presented, the Moodle-based flex model learning media is to improve students' mathematical hard skills (ability to understand, reasoning, and problem-solving).

Flex model learning media to convey information by designing flex model media to become digital media integrated with internet-assisted technology so that it can be accessed through portals, namely by developing moodle-based flex model media. The development of this media allows students to enter the classroom digitally when learning mathematics online (Kurniawan, 2019). Moodle-based flex media is a platform in the form of a community website intended for moodle projects that are run by downloading source code and website-based plugins (Gamage et al., 2019). Various forums can provide solutions to problems related to the use of moodle (Aikina & Bolsunovskaya, 2020). Moodle-based flex model media is a tangible medium appropriate for the mathematics learning process because it can be adapted to the concrete operational developmental stage of students who can create the ability to think logically. So moodle impacts acquiring knowledge from learning outcomes because it can provide interest and attention when information is delivered digitally with internet technology (Mpungose, 2020; Vidyastuti et al., 2022; Widyaningsih et al., 2021). Teachers and students can choose which class to follow according to what has been provided (Setyawan & Masduki, 2021; Wahyuaji & Taram, 2018).

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CONCLUSION

The teaching materials development using the Moodle-based flex model has met the valid, practical, and effective criteria for improving students' mathematical hard skills. Based on the results of media expert validation, the excellent category has a score of 3.68, then the results of material expert validation give a score of 3.58, which means that the media is feasible to be tested on students. The practical aspects of the media were obtained from student questionnaires. The results obtained show a convenient item with a level of 94%. The influence of the media obtained as a result of increasing math skills shows an increase in the N-Gain value of 0.60, which is included in the moderate growth, meaning that students' math skills increase, and the media can be said to be effective.

Researchers suggest other researchers are expected to develop learning materials using other aspects of hard skills with other materials by the conditions of their respective regions, then be able to upload and download them on the Playstore the App Store so that they are easily accessible to many people, both students and other members of the public.

REFERENCES

Aikina, T. Y., & Bolsunovskaya, L. M. (2020). Moodle-based learning: Motivating and demotivating factors. *International Journal of Emerging Technologies in Learning*, *15*(2). https://doi.org/10.3991/ijet.v15i02.11297

Asbari, M., Chi Hyun, C., Wijayanti, L. M., Imelda, D., & Purwanto, A. (2020). Hard Skills Atau Soft Skills: Manakah Yang Lebih Penting Bagi Inovasi Guru. *Edumaspul - Jurnal Pendidikan*, *4*(1), 1–20. https://www.researchgate.net/publication/339274657_HARD_SKILLS_ATAU_SOFT_SKILLS_MANAKAH_YANG_LEBIH_PENTING_BAGI_INOVASI_GURU

Baiduri, Putri, O. R. U., & Alfani, I. (2020). Mathematical connection process of students with high mathematics ability in solving PISA problems. *European Journal of Educational Research*, *9*(4), 1527–1537. https://doi.org/10.12973/EU-JER.9.4.1527

Basir, M. A., Alif Hazira, K. V., & Kusmaryono, I. (2020). PENGEMBANGAN MEDIA ISLAMIC MATH COMICS DALAM MENINGKATKAN PEMAHAMAN MATEMATIS DAN KARAKTER SISWA. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *9*(3). https://doi.org/10.24127/ajpm.v9i3.2539

Björn, P. M., Äikäs, A., Hakkarainen, A., Kyttälä, M., & Fuchs, L. S. (2019). Accelerating mathematics word problem-solving performance and efficacy with think-aloud strategies. *South African Journal of Childhood Education*, *9*(1). https://doi.org/10.4102/sajce.v9i1.716

Borrego, G., Morán, A. L., Palacio, R. R., Vizcaíno, A., & García, F. O. (2019). *Towards a reduction in architectural knowledge vaporization during agile global software development*. *112*(March), 68–82.

Bossé, M. J., Bayaga, A., Lynch-Davis, K., & ... (2021). Assessing Analytic Geometry Understanding: Van Hiele, SOLO, and Beyond. *International Journal for …*, *22*(1).

Budiarti, R. S., & Harlis, D. N. (2020). High order thinking skills for biology education: Applied

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i4.6031

microbiology learning videos based on Jambi local wisdom. *Universal Journal of Educational Research*, *8*(2). https://doi.org/10.13189/ujer.2020.080242

Changwong, K., Sukkamart, A., & Sisan, B. (2018). Critical thinking skill development: Analysis of a new learning management model for Thai high schools. *Journal of International Studies*, *11*(2), 37–48. https://doi.org/10.14254/2071-8330.2018/11-2/3

Claessen, F. N., Claessens, B., Hommelberg, M. P. F., Molderink, A., Bakker, V., Toersche, H. A., & van den Broek, M. A. (2014). Comparative analysis of tertiary control systems for smart grids using the Flex Street model. In *Renewable Energy* (Vol. 69). https://doi.org/10.1016/j.renene.2014.03.037

Darmayanti, R., Sugianto, R., Baiduri, Choirudin, & Wawan. (2022). Digital comic learning media based on character values on students' critical thinking in solving mathematical problems in terms of learning styles. *Al-Jabar: Jurnal Pendidikan Matematika*, *13*(1), 49–66. http://ejournal.radenintan.ac.id/index.php/al-jabar/index

Darwanto, D. (2019). Hard Skills Matematik Siswa. *Jurnal Eksponen*, *9*(1), 21–27. https://doi.org/10.47637/eksponen.v9i1.129

Delita, F., Elfayeti, & Sidauruk, T. (2016). Peningkatan Soft Skills Dan Hard Skills Mahasiswa Melalui Project-Based Learning Pada Mata Kuliah Perencanaan Pembelajaran Geografi. *Journal Geografi Universitas Negeri Medan*, *8*(2).

Deryhlazov, L. v., Kukharenko, V. M., Perkhun, L. P., & Tovmachenko, N. M. (2017). The Models of Distance Forms of Learning in National Academy of Statistics, Accounting and Audit. *Scientific Bulletin of the National Academy of Statistics, Accounting and Audit*, *3*. https://doi.org/10.31767/nasoa.3.2017.10

Evalina, Utami, R. T., Darmawan, Sunarsi, D., Paramarta, Iswadi, U., Bakri, R., & Farida, dewi mutia. (2021). Effect of Organizational Learning on the Hard Skills, Soft Skills and Innovation of Employees: Evidence from Information Technology Industries. *Information Technology in Industry*, *9*(1), 1085–1098. https://doi.org/10.17762/itii.v9i1.242

Fan, C. S., Wei, X., & Zhang, J. (2017). SOFT SKILLS, HARD SKILLS, AND THE BLACK/WHITE WAGE GAP. *Economic Inquiry*, *55*(2). https://doi.org/10.1111/ecin.12406

Gamage, S. H. P. W., Ayres, J. R., Behrend, M. B., & Smith, E. J. (2019). Optimising Moodle quizzes for online assessments. *International Journal of STEM Education*, *6*(1). https://doi.org/10.1186/s40594-019-0181-4

Goestjahjanti, F. S., Asbari, M., Purwanto, A., & Agistiawati, E. (2020). PENGARUH ORGANIZATIONAL LEARNING TERHADAP PENINGKATAN HARD SKILLS , SOFT SKILLS DAN INOVASI GURU. *Journal of Education, Psychology and Counseling*, *2*(1), 202–226.

Güner, P., & Erbay, H. N. (2021). Prospective mathematics teachers' thinking styles and problem-solving skills. *Thinking Skills and Creativity*, *40*. https://doi.org/10.1016/j.tsc.2021.100827

Hämäläinen, R., Nissinen, K., Mannonen, J., Lämsä, J., Leino, K., & Taajamo, M. (2021). Understanding teaching professionals' digital competence:

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i4.6031

What do PIAAC and TALIS reveal about technology-related skills, attitudes, and knowledge? *Computers in Human Behavior*, *117*. https://doi.org/10.1016/j.chb.2020.106672

Hawamdeh, M., & Adamu, I. (2020). The Flex Model Of Blended Learning Enabled Digital Citizenship. In *Online Pedagogy and Management for Smart Societies* (pp. 25–36). Ankara Pegem Akademi Yayıncılık. https://doi.org/10.14527/9786257052498.03

Hendarman, A. F., & Cantner, U. (2018). Soft skills, hard skills, and individual innovativeness. *Eurasian Business Review*, *8*(2). https://doi.org/10.1007/s40821-017-0076-6

Kabael, T., & Akin, A. (2018). Prospective middle-school mathematics teachers' quantitative reasoning and their support for students' quantitative reasoning. *International Journal of Research in Education and Science*, *4*(1), 178–197. https://doi.org/10.21890/ijres.383126

Kamid, Rusdi, M., Fitaloka, O., Basuki, F. R., & Anwar, K. (2020). Mathematical communication skills based on cognitive styles and gender. *International Journal of Evaluation and Research in Education*, *9*(4). https://doi.org/10.11591/ijere.v9i4.20497

Knuth, E. J. (2020). Understanding Connections between Equations and Graphs. *The Mathematics Teacher*, *93*(1). https://doi.org/10.5951/mt.93.1.0048

Kunanusorn, A. (2021). What Are Required Basically by Users of a Hotel Internship Programme: Hard-skills or Soft-skills? *Advances in Social Sciences Research Journal*, *8*(3). https://doi.org/10.14738/assrj.83.9864

Mabuan, R. A., & Ebron, G. P. (2018). MOOCs and more: Integrating F2F & virtual classes via blended learning approach. *Asian EFL Journal*, *20*(2).

Mahmud, R. (2021). Blended Learning Model Implementation in the Normal, Pandemic, and New Normal Era. *Proceedings of the 5th Progressive and Fun Education International Conference (PFEIC 2020)*, *479*(Pfeic), 130–139. https://doi.org/10.2991/assehr.k.201015.021

Masfingatin, T., Murtafiah, W., & Maharani, S. (2020). Exploration of Creative Mathematical Reasoning in Solving Geometric Problems. *Jurnal Pendidikan Matematika*, *14*(2), 155–168. https://doi.org/10.22342/jpm.14.2.7654.155-168

Mayasari, D., & Pagiling, S. L. (2020). Keefektifan Media Pembelajaran Berbasis Moodle terhadap Kemampuan Pemecahan Masalah Matematis Mahasiswa. *GAUSS: Jurnal Pendidikan Matematika*, *3*(2). https://doi.org/10.30656/gauss.v3i2.2392

Minarni, A., Napitupulu, E. E., & Husein, R. (2016). Mathematical understanding and representation ability of public junior high school in North Sumatra. *Journal on Mathematics Education*, *7*(1), 43–56. https://doi.org/10.22342/jme.7.1.2816.43-56

Moss, B., & Fink, L. (2014). Blended learning resources for middle grade teachers. *Voices From the Middle*, *22*(2).

Mpungose, C. B. (2020). Is Moodle or WhatsApp the preferred e-learning platform at a South African

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i4.6031

university? First-year students' experiences. *Education and Information Technologies*, *25*(2). https://doi.org/10.1007/s10639-019-10005-5

Nurani, M., Riyadi, R., & Subanti, S. (2021). Profil Pemahaman Konsep Matematika Ditinjau Dari Self Efficacy. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(1), 284. https://doi.org/10.24127/ajpm.v10i1.3388

Palinussa, A. L., Molle, J. S., & Gaspersz, M. (2021). Realistic mathematics education: Mathematical reasoning and communication skills in rural contexts. *International Journal of Evaluation and Research in Education*, *10*(2). https://doi.org/10.11591/ijere.v10i2.20640

Patacsil, F. F., & Tablatin, C. L. S. (2017). Exploring the importance of soft and hard skills as perceived by it internship students and industry: A gap analysis. *Journal of Technology and Science Education*, *7*(3). https://doi.org/10.3926/jotse.271

Permendikbud. (2016). Permendikbud Nomor 21 Tahun 2016 Tentang Standar Isi Pendidikan dasar dan Menengah. *Salinan Lampiran Permendikbud RI*. http://www.bssaonline.org/content/95/6/2373%5Cnhttp://www.bssaonline.org/content/95/6/2373.short%0Ahttp://www.bssaonline.org/cgi/doi/10.1785/0120110286%0Ahttp://gji.oxfordjournals.org/cgi/doi/10.1093/gji/ggv142%0Ahttp://link.springer.com/10.1007/s00024-01

Pratiwi, I. R., & Silalahi, P. (2021). Pengembangan Media Pembelajaran Matematika Model Blended Learning Berbasis Moodle. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(1), 206. https://doi.org/10.24127/ajpm.v10i1.3240

Radeswandri, R., Budiawan, A., Vebrianto, R., & Thahir, M. (2021). Developing instrument to measure the use of online comic as educational media. *Journal of Education and Learning (EduLearn)*, *15*(1), 119–126. https://doi.org/10.11591/edulearn.v15i1.18961

Rahmah, K., Inganah, S., Darmayanti, R., Sugianto, R., & Ningsih, E. F. (2022). Analysis of Mathematics Problem Solving Ability of Junior High School Students Based on APOS Theory Viewed from the Type of Kolb Learning Style. *INdoMATH: Indonesia Mathematics Education*, *5*(2), 109–122. https://indomath.org/index.php/

Rizki, N., Laila, A. R. N., Inganah, S., & Darmayanti, R. (2022). Analysis of Mathematic Connection Ability in Mathematics Problem Solving Reviewed from Student's Self-Confidence. *Seminar Nasional Teknologi Pembelajaran*, *2*(1), 111–126. http://snastep.um.ac.id/pub/index.php/proceeding/indexKeahliandanPerformaPakardalamTeknologiPendidikanuntuk

Rohaeti, E. E. (2019). Building Students' Hard and Soft Skills through Innovative Teaching Approaches to Mathematics. *Journal of Southwest Jiaotong University*, *54*(5). https://doi.org/10.35741/issn.0258-2724.54.5.48

Ruswanto, Dwijanto, & Widowati. (2018). Realistic Mathematics Education Model Includes Characteristic to Improve the Skill of Communication Mathematic. *Unnes Journal of Mathematics Education Research*, *7*(1), 94–101.

Sari, M. (2019). Analisis Model-model Blended Learning di Lembaga Pendidikan. *NATURAL SCIENCE: Jurnal Pendidikan IPA Dan Pendidikan IPA*, *5*(2), 836.

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i4.6031

Schindelwig, K., Ellensohn, S., Kaps, P., & Nachbauer, W. (2017). Validation of a three-dimensional finite element model of flex-pole impacts. *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology*, *231*(4). https://doi.org/10.1177/1754337117700260

Setyawan, F., & Masduki, L. (2021). Desain math e-learning berbasis moodle pada sekolah penggerak. *Seminar Nasional Matematika Dan Pendidikan Matematika*, *3*(2), 346–353. http://conference.upgris.ac.id/index.php/senatik/article/view/1972

Siburian, J., Corebima, A. D., Ibrohim, & Saptasari, M. (2019). The correlation between critical and creative thinking skills on cognitive learning results. *Eurasian Journal of Educational Research*, *2019*(81). https://doi.org/10.14689/ejer.2019.81.6

Sinta, R., Made Putrawan, I., & Neolaka, A. (2019). The effect of blended learning strategy and students' personality on the students' knowledge about the basic concepts of ecology. *Journal of Advanced Research in Dynamical and Control Systems*, *11*(9 Special Issue). https://doi.org/10.5373/JARDCS/V11/20192582

Siyamta. (2015). Pengaruh Strategi Blended Learning Flex Model Terhadap Peningkatan Pengetahuan dan Keterampilan pada Diklat Kompetensi Kejuruan Program Keahlian Teknik Komputer dan Informatika Guru SMK Kabupaten Kutai Timur. *Seminar Nasional Teknologi Pendidikan UM*, 680–689.

Sopa, A., Asbari, M., Purwanto, A., Budi Santoso, P., Mustofa, Hutagalung, D., Maesaroh, S., Ramdan, M., & Primahendra, R. (2020). Hard skills versus soft skills: Which are more important for indonesian employees innovation capability. *International Journal of Control and Automation*, *13*(2), 156–175.

Sterner, G., Wolff, U., & Helenius, O. (2020). Reasoning about Representations: Effects of an Early Math Intervention. *Scandinavian Journal of Educational Research*, *64*(5). https://doi.org/10.1080/00313831.2019.1600579

Sugianto, R., Cholily, Y. M., Darmayanti, R., Rahmah, K., & Hasanah, N. (2022). Development of Rainbow Mathematics Card in TGT Learning Model for Increasing Mathematics Communication Ability. *Kreano: Jurnal Matematika Kreatif-Inovatif*, *13*(2), 221–234. http://journal.unnes.ac.id/nju/index.php/kreano

Sumarmo, U. (2014). ASESMEN SOFT SKILL DAN HARD SKILL MATEMATIK SISWA DALAMKURIKULUM 2013. *Seminar Pendidikan Matematika Di Sekolah Tinggi Agama Islam Negeri Batusangkar*, *564*, 1–73.

Tarashchin, M., Rezaee, R., & Zarif Sanaiey, N. (2016). Design, Implementation and Evaluation of Proposal Writing Module Through Blended and Face to Face Learning Methods. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*, *In Press*(In Press). https://doi.org/10.5812/ijvlms.10835

Teo, T., Zhou, M., Fan, A. C. W., & Huang, F. (2019). Factors that influence university students' intention to use Moodle: a study in Macau. *Educational Technology Research and Development*, *67*(3). https://doi.org/10.1007/s11423-019-09650-x

Tirza, J. (2021). *IMPLEMENTATION OF M-FLEX BASED MOODLE IN*

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v11i4.6031

PANCASILA COURSE : AN INITIAL EVALUATION ON STUDENT ' S VIEW. *19*, 201–215.

Triatmi, E., & Setiawan, R. (2018). Analisis Strategi Bernalar Logis dan Membagi Kasus Pada Permasalahan Non Rutin Kombinatorika. *Jurnal Pendidikan Matematika Dan Matematika (JPMM)*, *II*(3).

Vidyastuti, A. N., Mahfud Effendi, M., & Darmayanti, R. (2022). Aplikasi Tik-Tok: Pengembangan Media Pembelajaran Matematika Materi Barisan dan Deret Untuk Meningkatkan Minat Belajar Siswa SMA. *JMEN: Jurnal Math Educator Nusantara*, *8*(2). http://ojs.unpkediri.ac.id/index.php/matematika

Wahyuaji, N. R., & Taram, A. (2018). Pengembangan Media Pembelajaran Matematika Berbasis E-Learning Menggunakan Learning Management System (LMS) MOODLE pada Materi Program Linear untuk Siswa SMA Kelas XI. *Seminar Nasional Pendidikan Matematika Ahmad Dahlan*, *November 2018*, 189–194. http://seminar.uad.ac.id/index.php/sendikmad/article/view/407

Wahyuddin, Satriani, S., & Asfar, F. (2021). *Analisis Kemampuan Menyelesaikan Soal High Order Thingking Skills Ditinjau dari Kemampuan Berpikir Logis*. *10*(2), 521–535.

Widyaningsih, S. W., Yusuf, I., Prasetyo, Z. K., & Istiyono, E. (2021). The development of the hots test of physics based on modern test theory: Question modeling through e-learning of moodle lms. *International Journal of Instruction*, *14*(4). https://doi.org/10.29333/iji.2021.1444a

Wisshak, S., & Hochholdinger, S. (2020). Perceived instructional requirements of soft-skills trainers and hard-skills trainers. *Journal of Workplace Learning*, *32*(6). https://doi.org/10.1108/JWL-02-2020-0029

Yudt, K., & Columba, L. (2017). The effects of blended learning in pre-service elementary mathematics teachers' performance and attitude. *National Teacher Education Journal*, *10*(1).