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KHOFIFAH IRMA FELA SISYANTI, MOH ZAYYADI, UKHTI RAUDHATUL JANNAH, SRI IRAWATI

144 - 155

ANALYSIS OF STUDENT MATHEMATICS REPRESENTATION IN SOLVING MINIMUM
COMPETENCY ASSESSMENT PROBLEMS BASED ON MATHEMATICS ABILITY

PDF

JUNARTI JUNARTI, PUPUT SURIYAH

156 - 165

THE READINESS OF SECONDARY SCHOOL TEACHERS IN DEVELOPING LEARNING
TOOLS FOR BLENDED LEARNING MODEL

PDF

RATIH CHRISTIANA, IBNU MAHMUDI, SUHARNI SUHARNI, LELA FITRI MURNI CAYANTI

166 - 179

PSYCHOLOGICAL CONDITION OF LECTURERS AND EDUCATION STAFF BEFORE THE
IMPLEMENTATION OF THE COVID-19 VACCINATION

THE READINESS OF SECONDARY SCHOOL TEACHERS IN DEVELOPING LEARNING TOOLS FOR BLENDED LEARNING MODEL

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Abstract: *This research aims to prepare teachers for the process of developing mathematical learning tools based on the blended learning model. In order to suit the needs of students in offline and online learning, mathematics learning tools evolved into blended learning model tools. Mixed-method concurrent embedded is the employed method in this study. Simultaneous collection of quantitative and qualitative data was also conducted in this study. The method known as ADDIE (Analysis, Design, Development, Implementation, and Evaluation) was utilized in developing the learning tools. 72% of the responses to the study on teacher readiness to design blended learning model learning materials were positive. According to the results of the learning tools' validity aspect, the material's content is appropriate, and its components are consistent. Furthermore, it demonstrates that the learning tools are user-friendly, curriculum-aligned, and implementable based on their actual use. Finally, based on efficacy, student learning test scores are above the minimum standard (75 on a scale of 100) with a success rate of 91.4%, indicating that classical mastery is reached. The result is that teachers are prepared to develop blended learning model learning tools, which can be applied in secondary schools to study mathematics.*

Keywords: Blended learning model; Learning tools; Teacher readiness.

Introduction

There is an unquestionable requirement for instructional resources to be available to secondary school teachers. The readiness of instructors to adapt to the changes brought about by the progression of the times requires them to modify their teaching methods to meet the requirements of their students. The level of preparation that a teacher has put into designing a concept of learning that will take place at school will impact how well students will be able to meet the requirements of that concept. This teacher preparation is provided in the form of learning tools.

Developing high-quality learning resources, and following a methodical plan (Deviana & Kusumaningtyas, 2019; Hamka & Vilmala 2019) is the first step in achieving excellent and successful learning (Nursiddieq *et al*, 2022). According to Deviana and Kusumaningtyas (2019), more work needs to be done to ensure that educational technology can keep up with today's classroom curricula. There is also a need for instructional resources to aid teachers in the classroom (Masitah, 2018). Using the 2013 curriculum is another motivation for creating educational resources (Salim *et al.*, 2021; Deviana & Kusumaningtyas, 2019).

Blended learning implementation must be able to support learning in schools, and some of the results of studies on blended learning implementation relate to the readiness of teachers or instructors to carry out the major issues (Adams *et al.*, 2020a, 2020b; Mufarrochah, 2021). Additionally, implementing blended learning is an urgent and crucial

requirement (Charbonneau-Gowdy & Chavez, 2018). Blended learning approaches may help students become more self-reliant in their studies (Abdullah, 2018; Nande & Irman, 2021; Sari, 2021). Teachers need to create models of blended learning devices if their students will benefit from using this kind of instruction.

Through clinical supervision, educators have been prepared to implement blended learning methods (Yurnalis, 2018). Teachers' preparation for integrated learning occurs not only in universities and high schools but also in primary institutions (Anandari, 2022). Teachers need to be prepared to adopt blended learning models in the education sector. This demonstrates that there is no wiggle room for compensating teachers for the time they spend modifying instructional materials for use in blended learning environments (Wijayanti *et al*, 2017). Teachers worldwide have had to quickly adapt to the urgent requirements of producing blended learning model learning tools due to the Covid-19 phenomenon. Learning is increasingly conducted online, especially in the educational sector, because it facilitates efficiency and effectiveness in the classroom.

Although there are still a significant number of high school students who are not accustomed to online learning, face-to-face learning is still the preferred method of instruction for most students, as well as for various reasons. However, teachers and students must adapt due to the covid-19 pandemic and the rapid progress of technology. Such constraints necessitate the availability of blended learning. To meet these objectives, teachers must be able to create learning resources using a blended learning model. How prepared are high school instructors to compile blended learning model learning tools in light of this gap? Especially for mathematics subjects, the data indicate that students who are taught simply face-to-face are less able to follow, let alone be taught in various ways over the Internet. However, as the world evolves, blended learning is inevitably required. The ability of secondary school teachers to compile learning aids for blended learning models should therefore be thoroughly investigated and trained (Rosmiati *et al*, 2013). This conforms to future studies' suggestions on the implications of blended learning techniques (Adams *et al*, 2020).

As a result of this reason, the objective of this research is to prepare teachers for the process of developing blended learning model learning tools, particularly in the subject of mathematics. Learning tools for mathematics are currently being developed into blended learning model learning tools to suit students' demands in both offline and online learning environments.

Method

This is a mixed-method concurrent embedded study, which means that both quantitative and qualitative data were collected simultaneously (Sugiyono, 2017; Creswell, 2015; Creswell, 2017). One hundred ten teachers from SMKN 2 Bojonegoro and 35 TEI X students participated in the quantitative study. To conduct this qualitative study, researchers interviewed three teachers who had not yet implemented the blended learning model.

The quantitative data used in this research include student test scores and teacher questionnaires about their preparedness to create blended learning model learning tools. Quantitative data can only reveal how well blended learning technologies work; therefore, qualitative data gleaned from interviews and classroom observations using observation sheets provides a deeper understanding of how well prepared teachers are for these tools. Two expert validators examine the content of all learning instruments and tools.

The lesson plan and the syllabus were created with teachers as part of this project. The development model relates to the ADDIE model with the analysis, design, development, implementation, and evaluation stages. Teachers were given a questionnaire at the beginning and end of a five-meeting training program in which they were asked to collaborate on developing learning tools. The teacher must then implement learning tools in the classroom. Class XII TEI was selected as the target of tools implementation-related observation and was subsequently observed using an observation sheet. Then, after applying the blended learning model to the students, a test was administered to quantify their performance of individual completion based on minimum criteria of mastery learning scores in specific Mathematics subjects on a scale of 75 to 100.

Results and Discussion

A. Results

1. Teacher Readiness to Develop Blended Learning Model Learning Tools

Teachers' readiness in compiling blended learning model learning tools before training showed the results of 30% of 110 teachers. This shows that 70% of teachers are not ready to compile blended learning model learning tools. Based on the results of the deepening through interviews, it shows that some teachers use Google Classroom and WhatsApp. Almost all teacher uses the same pattern, and the teacher states, "the important thing is that there is a learning process for students at home." Learning models like this, when traced to the tools compiled by the teacher, do not reflect the blended learning model. After five training meetings, through questionnaires, the results of teacher readiness were obtained, and there was an increase in teacher readiness to compile blended learning model learning tools to 72%. The combination of learning models used is quite varied, including those that teachers have used to develop with several platforms such as google meet, google form, Schoology, flipped classroom, and WhatsApp web; some are through WhatsApp only through the photos of the teacher's writings that are delivered; some go through WhatsApp in the form of short sentences related to tasks (for example, please study a particular book and then mention the task question page).

At the stage of developing blended learning tools, through the stages of validation of the content, language, and suitability of the learning tool with the applicable curriculum, the results presented from the three research subjects in Table 1 on assessment of the syllabus, followed by Table 3 on assessment of the lesson plan, are as follows:

Table 1. Results of Syllabus Content Assessment of Three Teachers by Expert Validators

No	Assessment Components	Assessment			\bar{V}	Conclusion
		Teacher 1	Teacher 2	Teacher 3		
1.	Competencies instilled in students through a learning activity	4	4	4	4	V
2.	Activities carried out to instill the competence of learning activities	4	4	3	3,6	V
3.	Efforts were made to find out that students already own learning competencies	4	5	4	4,3	V

Description:

V = Valid

\bar{V} = Average value of validity

The evaluation results presented in Table 1 above demonstrate that, on the whole, the average value of the validity of the contents of the syllabus falls into the "valid" category and meets the criteria for the contents of the syllabus. This can be seen by looking at the overall score. Therefore, the syllabus's content criteria are already met by the information in the syllabus itself.

In addition, Table 2 below displays the outcomes of a detailed evaluation of the syllabus' completeness.

Table 2. Assessment results of the Syllabus Components of Three Teachers By Expert Validators

No	Assessment Components	Assessment			\bar{V}	Conclusion
		Teacher 1	Teacher 2	Teacher 3		
5	1. Subject Identity	4	4	4	4	V
2.	2. School Identity	4	3	4	3,6	V
3.	3. Core Competencies	4	4	5	4,3	V
4.	4. Basic Competencies	4	4	4	4	V
5.	5. Indicators of competence achievement	4	3	4	3,6	V
6.	6. Subject Matter	4	4	5	4,3	V
7.	7. Learning	4	4	5	4,3	V
8.	8. Assessment	4	4	4	4	V
9.	9. Time allocation	4	4	5	4,3	V
10.	10. Learning Resources	4	4	4	4	V

Description:

V = Valid

\bar{V} = Average value of validity

According to the data presented in Table 2 above, the comprehensive evaluation of each syllabus component already demonstrates that it is valid and meets the requirements outlined in the syllabus. This demonstrates that the required standards have been met regarding the level of readiness of the teachers to prepare the parts of the syllabus.

In addition, the findings of the lesson plan assessment by validators are reported to the three research participants (teachers) as follows in Table 3.

Table 3. Lesson Plan Assessment Results from Three Teachers by Expert Validators

No	Assessment Components	Assessment			\bar{V}	Conclusion
		Teacher 1	Teacher 2	Teacher 3		
1	Completeness of lesson plan components	4	4	3	3,6	V
2	Completeness of lesson plan identity	4	4	4	4	V
3	Conformity of goal formulation with Core Competencies and Basic Competencies	4	4	3	3,6	V
4	The accuracy of measurable operational verb preparation stated in the learning objectives	4	4	4	4	V
5	Breadth of material that fits the learning objectives	4	4	4	4	V
6	The conformity of the material to the cognitive development of students	5	5	4	4,6	V
7	Systematics of the arrangement of matter	4	4	4	4	V
8	Conformity of the learning methods used with learning indicators and objectives	4	4	4	4	V
9	Learning activities accommodate students to learn independently	4	4	4	4	V
10	The suitability of learning resources to learning objectives	4	4	3	3,6	V
11	Compatibility of learning resources with learning materials	5	5	4	4,6	V
12	The use of communicative discussions	4	4	4	4	V

Description:

V = Valid

\bar{V} = Average value of validity

The results of the analysis shown in Table 3 above show that

- The average value of the total validity of lesson plan identities is $V = 4$, can be categorized as "Valid" (3.5 – /4.5), and meets the criteria for validity.
- The average validity value for the basic competency aspect is $V = 3.6$, can be categorized as "Valid" (3.5 – 4.5), and meets the criteria for validity.
- The average score for learning purposes is $V = 4$, can be in the category of "Valid" (3.5 – 4.5), and meets the criteria for validity.
- The average value for the completeness aspect of the lesson plan components is $V = 3.6$, can be categorized as "Valid" (3.5 – 4.5), and meets the criteria for validity.
- The average score for aspects of the learning material is $V = 4$, can be categorized as "Valid" (3.5 – 4.5), and meets the validity criteria.
- This average score for the suitability of learning resources with learning materials is $V = 3.6$, can be categorized as "Valid" (3.5 – 4.5), and meets the validity criteria.

Based on the 12 criteria evaluated for the lesson plan, it demonstrates a high average level of validity. This finding indicates that teachers are highly prepared after receiving training on the development of blended learning tools.

2. Student Responses and Learning Outcomes Tests

During the six meetings dedicated to the learning process, observations were made on the activities in which students in the classroom who were being instructed to utilize a blended learning approach participated. In addition to that, a survey was distributed regarding the students' responses, and then a final exam on the learning outcomes was distributed to evaluate the students' level of minimum criteria of mastery learning achievement. The findings of the questionnaire were designed to determine whether or not the learning aids that were produced include criteria that are both effective and practical. The findings of the response questionnaire and the results of the tests taken by the students are reported in the following.

a. Student Response to Questionnaire

The student questionnaire in this study was used to provide data on the usefulness of learning tools based on student assessments. Table 4 shows the findings of the student response questionnaire that was distributed.

Table 4. Student Response Questionnaire Results

Measurement Variables	Statistical Value
Subject of study	35
Ideal score	80
Average Score	64,4
Standard Deviation	6,0
Variance	36,4
Maximum Score	78,8
Minimum Score	52,5
Number of Completed Students	29
Incomplete Number of Students	6

The findings of the questionnaire of the response of Class XII TEI students to mathematics learning in the Blended Learning model acquired an average score of 64.4 from the ideal score of 100 with a standard variation of 6.0, as shown in Table 2. In addition, students received a minimum score of 52.5 and a maximum score of 78.8. This demonstrates that the number of students who respond to and comprehend blended learning is extremely high. Learning is also carried out in the meaning phase to make it easier for students to understand the subject by asking students to actively undertake experiments so that students are immediately involved in the material being studied.

b. Learning Outcomes Test

The learning outcomes test was given to students to measure minimum criteria of mastery learning achievement, which includes students' mastery of the material taught through the Blended Learning model learning tool. Table 5 shows the results of the descriptive analysis in a quantitative way of mastering mathematics after being given action on the learning outcomes test.

Table 5. Results of Learning Outcome Test

Measurement Variables	Statistical Value
Subject of study	35
Ideal score	100
Average Score	75
Standard Deviation	6,4
Variance	40,9
Maximum Score	90
Minimum Score	59
Number of Completed Students	32
Incomplete Number of Students	3

The learning outcomes of Class XII TEI students of SMK Negeri 2 Bojonegoro on mathematics learning in the Blended Learning model obtained an average score of 75 from an ideal score of 100 with a standard deviation of 6.4, as shown in Table 5. In addition, students received a minimum score of 59 and a maximum score of 90.

The results of the questionnaire of Class XII TEI students of SMK Negeri 2 Bojonegoro's response to mathematics learning in the Blended Learning model obtained an average score of 64% of the ideal score of 100 with a standard deviation of 6.0, as shown in Table 4. In addition, students received a minimum score of 52.5 and a maximum score of 78.8. According to the table above, the number of students who completed learning or achieved individual completion was approximately 32 or 91.4%. This data demonstrates that the expected practicality and effectiveness are fulfilled.

B. Discussion

The readiness of teachers to compile blended learning model learning tools there is increased in the number of teacher readiness to compile blended learning model learning tools to 72%. The combination of learning models is quite varied and increases the number of platforms used. These results show that secondary school teachers have properly prepared blended learning model learning tools (Deviana & Kusumaningtyas, 2019; Masitah, 2018). The readiness of these teachers can support the implementation of the 2013 curriculum to the fullest (Salim et al., 2021; Deviana & Kusumaningtyas, 2019).

According to the questionnaire results, the response of Class XII TEI students from SMK Negeri 2 Bojonegoro to mathematics learning in the Blended Learning model received an average score of 64% out of 100, with a standard deviation of 6.0. Students received a minimum score of 52.5 and a maximum score of 78.8. This result demonstrates that students at SMK N 2 Bojonegoro can independently and responsively follow the process of learning a blended learning model. Learning independence is developed through a blended learning model (Sari, 2021).

Based on learning outcomes, it appears that the level of student mastery of the material taught using the Blended Learning model learning tool has met the minimum criteria of mastery learning value. The average score is 75 out of 100, with a standard deviation of 6.4.

Students received a minimum of 59 points and a maximum of 90 points. This result indicates that approximately 32 students, or 91.4%, completed their learning or achieved individual completion. This data demonstrates that the expected practicality and effectiveness are met. According to Anggraini (2021), the effectiveness of a learning tool is used correctly and according to the target to support students' learning processes in the classroom.

Conclusion

The level of ability of teachers in compiling blended learning model learning tools makes blended learning model devices have reached 72% of the number of teachers, as many as 110 and showed a positive response. Moreover, based on the assessment results from the aspect of the validity of learning tools which include the syllabus and lesson plan categorized as valid and meet the criteria, thus showing the suitability of the material content and consistency between the components of the learning device.

Based on the practicality aspect, it shows that learning tools are easy to use, consistent with the curriculum, and can be implemented. Finally, the effectiveness aspect shows that student learning test results are above the minimum standard (75 with a value scale of 100) with an achievement percentage of 91.4%; this shows that classical completion is achieved. In conclusion, teachers are ready to create a blended learning tool model that can be implemented for mathematics learning in high school.

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11
