



Analysis of the Use of Polypad-Based Educational Media on Mathematics Teacher Competencies in Indonesia: A Structural Equation Modelling (SEM) Approach

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ABSTRACT

This research focuses on use of Polypad-based educational media to improve the competence of mathematics teachers using the Structural Equation Modelling (SEM) approach. The background to this research includes the challenges in mathematics education in Indonesia, especially in terms of the lack of interactive and relevant educational media, resulting in students' low literacy and numeracy abilities. The problem statement identified is the limitations of media that can affect the effectiveness of mathematics teaching. The main aim of this research is to evaluate the effectiveness of Polypad-based educational media in the context of mathematics learning on the competence of mathematics teachers. The research method used is a quasi-experimental method. Data collection was carried out through questionnaires to measure the effectiveness of Polypad-based educational media in the context of mathematics learning on the competence of mathematics teachers. The quantitative data was analysed using structural equation modelling (SEM) to identify relationships between the variables studied. The research results show that Polypad-based educational media has a significant influence in improving teachers' mathematical competence. SEM analysis revealed a positive relationship between the use of this media and increased competence of mathematics teachers. In conclusion, Polypad-based educational media can increase the effectiveness of mathematics learning and is recommended for application in mathematics education to improve the quality of learning in the future.

Keywords:

Competence; Media education; Polypad;
Structural equation modelling (SEM)

1. Introduction

In the current digital era, the use of educational media has become an important aspect in improving the quality of learning [1-3]. Educational media, which includes various types of tools and technology, such as software, applications, and interactive tools, are designed to support the

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learning process in a more interesting and effective way [4,5]. This media not only helps in delivering material but also increases engagement and understanding of the concepts being taught. Educational media plays a crucial role in learning, especially for complex subjects like mathematics, by bridging the gap between theory and practice, and making abstract mathematical concepts more concrete and easier to understand.

In Indonesia, the use of educational media has grown rapidly in recent years in line with technological advances and government efforts to improve the quality of education. Schools across the country have started adopting various forms of digital media to make lessons more engaging and effective [6]. Despite these advancements, many teachers still rely heavily on conventional media in their teaching methods. Conventional media, such as textbooks, blackboards, and printed worksheets, remain a major part of teaching methods in many schools. This reliance on traditional methods can contribute to the low literacy and numeracy skills observed among Indonesian students.

Several previous studies have highlighted that conventional media currently used in many Indonesian schools are not effective enough in helping students understand complex mathematical concepts. Traditional teaching tools often fail to provide the interactive and engaging experience necessary for students to fully grasp difficult subjects like mathematics [7,8]. This limitation can lead to a gap between the theoretical knowledge taught in classrooms and the practical understanding required to apply these concepts. Consequently, there is a pressing need for innovation in the use of learning media to improve students' comprehension of mathematical concepts.

To address this issue, one innovation that can be implemented is the use of web-based application technology, such as Polypad. Polypad is a digital platform that offers a variety of interactive tools for visualizing mathematical concepts [9,10]. By using Polypad, teachers can present learning material in a more engaging and interactive way, allowing students to manipulate mathematical objects directly and understand concepts more concretely [11-13]. Polypad's interactive visual form helps make abstract concepts more tangible, aiding in better comprehension. Additionally, the engaging nature of Polypad can increase students' interest and motivation in learning, making the educational experience more enjoyable. The use of Polypad-based educational media is particularly important for mathematics teachers. Mathematics, often perceived as a challenging subject, benefits greatly from tools that can demystify its concepts. Polypad provides an innovative approach that can transform how mathematics is taught and learned. It allows teachers to demonstrate complex ideas through dynamic and interactive visuals, making it easier for students to follow and understand. This not only enhances students' learning experiences but also empowers teachers to be more effective in their instructional methods.

To determine the extent to which Polypad influences the competence of mathematics teachers, the Structural Equation Modelling (SEM) approach can be used [14]. SEM is a statistical method used to analyse the relationships between various variables in a model [15,16]. In the context of this research, SEM is employed to evaluate the impact of using Polypad on improving mathematics teacher competence. By using SEM, researchers can identify how different factors associated with Polypad usage contribute to enhancing teachers' abilities to present mathematical learning material effectively. SEM analysis involves creating a model that represents the hypothesized relationships between variables [17-19], such as the use of Polypad, teacher competence, and student outcomes. Data collected through questionnaires and observations are then analysed to test these relationships. In this study, the model might include variables like the frequency of Polypad use, the teachers' confidence in using the tool, the students' engagement levels, and their performance in

mathematics. By analysing these variables, SEM can reveal the direct and indirect effects of Polypad on teacher competence.

2. Methodology

2.1 Participant and Data Collection

The population in the research was 135 teacher participants consisting of 42 teacher trainers, 21 school principals, 72 fellow teachers, and 2 students. Respondent data obtained during the research is presented in Table 1.

Table 1
 Respondent Profile of Participant

Description	Frequency	(%)
School Principal	21	17.80
Teacher (Trainee)	42	35.60
Teacher (Peer)	72	44.92
Students	2	1.68

2.2 Research Design and Instruments

This research uses quantitative methods through questionnaires [20]. Testing the effectiveness of using polypads in learning was carried out after respondents were given training in making and using polypads as an educational medium for learning mathematics. Furthermore, the effectiveness of using polypads in learning was observed for 10 months. Participants responded to the use of polypads in mathematics learning in the form of a questionnaire with a Likert scale of 1-5 which was given in the form of the Google Form provided.

The instrument used in this research questionnaire analyses the role of using polypad as a mathematics education medium on mathematics teacher competence, both pedagogical competence, social competence and professional competence). The distribution of instruments is shown in Table 2.

Table 2
 Instruments used in research according to specified variables

Variable	Total
Pedagogical Competence	
Using Polypad educational media is safe and comfortable for students	2
Learning with effective student-centred Polypad educational media	4
Assessment of use of Polypad media, feedback, and learner-centred reporting	3
Professional competence	
Knowledge of learning content using Polypad media, teaching and skills	3
Characteristics and learning styles of students equipped with polypad media	3
Curriculum and how to use polypad media	4
Social-Emotional Learning Competencies	
Collaboration to improve learning by compiling polypad-based media	3
Involvement in professional organizations and wider networks to improve learning with polypad-based media	2
Demonstrate spiritual, moral, emotional maturity, and be able to use polypad media in learning	4

2.3 Analysis Technique

Data analysis uses an integrative approach by integrating formative data analysis into the research process, integrating various data sources through observation or literature to find possible relationships, participating in related theories and in a collaborative and reflective process, realizing that the general framework of data analysis is systematic and deliberate, and using the emerging conceptual framework as a guide. Path analysis uses the SEM (Structural Equation Modelling) approach using the SPSS version 25 application and the Lisrel version 8.8 application. SEM involves three activities simultaneously [9,21]. This is done to enrich and clarify the results which are explicitly interpreted to be close to the actual results. This research data was analysed using structural Equation Modelling (SEM) with the Lisrel application which can be downloaded on the page <https://www.ssilive.com/license/lisrel>. SEM [22] used to combine confirmatory factor analysis (CFA) with regression analysis, between CFA and path analysis, as well as a combination of structural models and measurement models. SEM is able to analyse relationship patterns between latent variables and their indicators, latent variables with each other, and other measurement errors. SEM can thoroughly explain the relationship between variables in research with the condition of building a hypothesis model consisting of a structural model and a measurement model in the form of a diagram based on theoretical justification. The following are the stages of data analysis:

- i. Validity and Reliability Test Analysis. The validity test of each indicator item in the questionnaire used was analysed using the Lisrel application version 8.8. An indicator is said to be valid if the standardization value between the indicator and the variable is above 0.50. Reliability tests were carried out on questionnaires that met the validity test using the results of the Lisrel application. It is said to be reliable if the Construct Reliability (CR) value is > 0.50 or Variance Extracted (VE) > 0.50, the following equation:

$$CR = \frac{(\sum \text{Standardized Loading})^2}{(\sum \text{Standardized Loading})^2 + (\sum \text{Measurement Error})} \text{ And } VE = \frac{(\sum \text{Std. Loading } g)^2}{(\sum \text{Std. Loading } g)^2 + (\sum e)} \quad (1)$$

- ii. Classical Assumption Test Analysis includes normality test, multicollinearity test, and heteroscedasticity test. In SEM, the model is said to be fit if the RMSEA value is <0.05.
- iii. Direct and indirect impacts. Simultaneous and indirect influence tests were obtained from the confirmatory factor analysis (CFA) output of the Lisrel application. The regression equation must satisfy the following equation:

Structure 1:

$$Z = a X1 + b X2 + c X3 + \delta \quad (2)$$

Structure 2:

$$Y = a X1 + b X2 + c X3 + \delta \quad (3)$$

Structure 3:

$$Y' = a' X1 + b' X2 + c' X3 + d Z + \delta \quad (4)$$

3. Results

The polypad educational media used for mathematics learning activities is structured in the following stages:

- i. Preparation polypad: Teachers need to understand how Polypad works and its main features. This can be achieved through tutorials or initial training that provide in-depth knowledge about using the platform. Once teachers have mastered Polypad, the next step is to prepare the mathematics learning materials that will be used. Ensure that these materials are aligned with the curriculum and meet the needs of the students so that the learning process can be effective and efficient. By understanding Polypad and preparing relevant materials, teachers can maximize the benefits of this educational media to enhance students' competence and understanding in mathematics. See Figure 1.

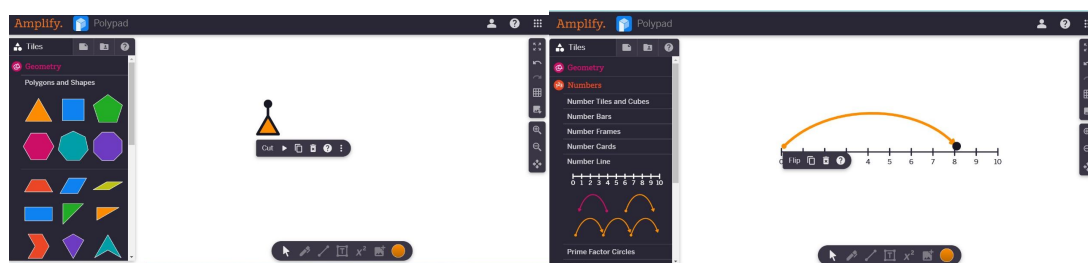


Fig. 1. Preparing Educational Media Using Polypad

- ii. Use polypad in the classroom: Begin by introducing Polypad to students, demonstrating how to use the basic tools and features. Follow this with interactive activities, such as drawing graphs, creating geometric shapes, or manipulating numbers, encouraging students to actively participate. Finally, allow students to explore Polypad independently to complete assignments or projects, which will help them gain a deeper understanding of the concepts. See Figure 2.

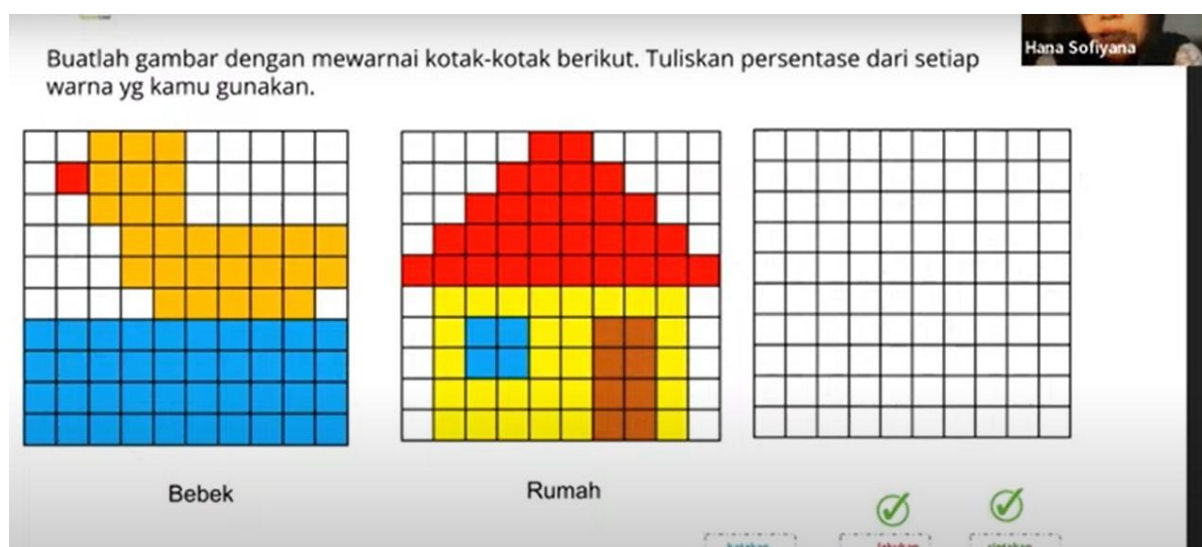


Fig. 2. Use Polypad in the Classroom

- iii. **Use for Evaluation:** To effectively integrate Polypad into the learning process, it is essential to create exercises and tests that students can complete using the platform. By doing so, teachers can assess student understanding in real-time, allowing them to identify areas where students may need additional support. These exercises and tests should be designed to cover various mathematical concepts, providing a comprehensive evaluation of student proficiency. In addition to real-time assessments, providing immediate feedback on the assignments completed on Polypad is crucial. This immediate feedback allows students to quickly identify and correct their mistakes, reinforcing their understanding and aiding in the retention of concepts. The interactive nature of Polypad also makes it easier for teachers to highlight specific errors and explain the correct methods, fostering a more effective learning environment. By incorporating practice exercises, exams, and immediate feedback into the use of Polypad, teachers can create a dynamic and responsive educational experience. This approach not only enhances student engagement but also ensures a deeper understanding of mathematical concepts, ultimately leading to improved academic performance. See Figure 3.

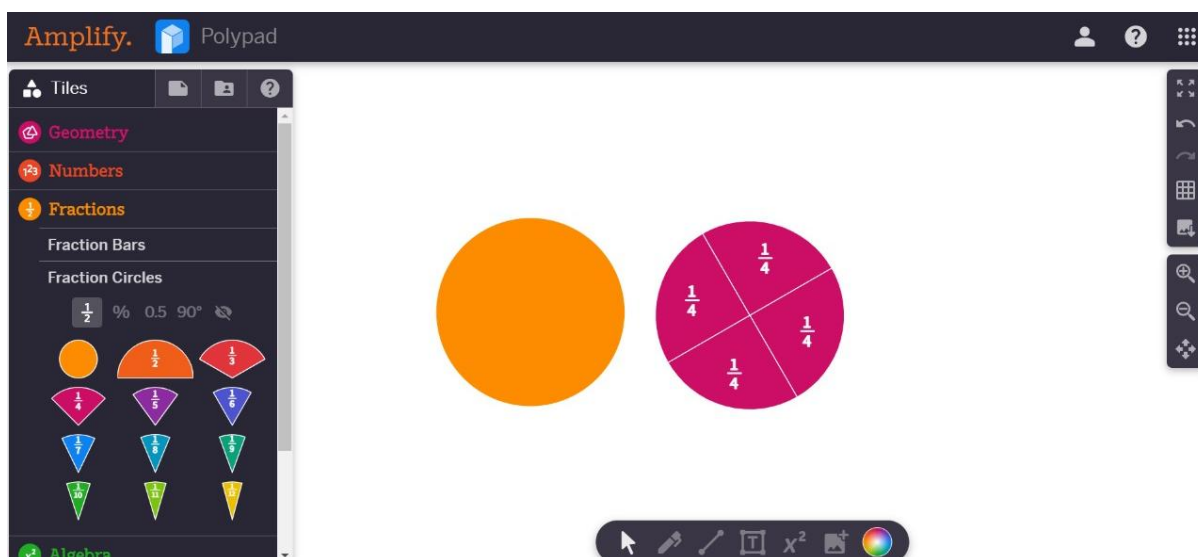


Fig. 3. Polypad Based Evaluation Questions

- iv. **Teacher Professional Development:** Creating a forum for discussion group where teachers can share their experiences and best strategies for using Polypad is a crucial step in professional development. This collaborative space allows educators to exchange insights, discuss challenges, and offer practical solutions, fostering a supportive community where continuous learning and improvement are prioritized. By sharing success stories and effective techniques, teachers can enhance their instructional methods and better integrate Polypad into their classrooms, ultimately benefiting student engagement and understanding.
- v. **Evaluation and Improvement:** Periodically evaluating the effectiveness of using Polypad in learning is essential for ensuring its continued success. Collecting feedback from both students and teachers provides valuable insights into what works well and what needs adjustment. This feedback loop allows for continuous improvement, as teachers can make informed adjustments to their use of Polypad based on the evaluations. By regularly refining and enhancing the implementation of Polypad, educators can ensure

that it remains a dynamic and effective tool for improving the quality of learning and addressing the evolving needs of students.

Based on the questionnaire given during the observation of the influence of polypad educational media on teacher competition, data was obtained from 42 teacher respondents. Following are the data in Table 3.

Table 3

Recapitulation of the average value of each variable for 42 respondents

Variable	Total	Average	%
Pedagogical Competence	9	33.14	82.9
Professional competence	10	42.12	84.2
Social-Emotional Learning Competencies	8	38.60	85.8

The recapitulation from Table 3 was tested for validity and reliability using the Lisrel 8.8 application as part of SEM (Structural Equation Modelling), and the recapitulation was obtained in Table 4.

Table 4

Validity and Reliability Test of 135 respondents with the Lisrel 8.8 application

Variable	Total	Legitimate	Cr	Results	VE	Results	Decision
Pedagogical Competence	9	9	4.1360	reliable	0.5531	reliable	reliable
Professional Competency	10	10	4.8435	reliable	0.5749	reliable	reliable
Social-Emotional Learning	9	9	3.4144	reliable	0.4803	Can not be relied on	reliable
Motivation in Training	9	7	3.2648	reliable	0.4767	Can not be relied on	reliable
Learning Leadership	18	17	8.2767	reliable	0.5540	reliable	reliable

The results of Table 4 are in accordance with the goodness of fit statistical output in the Lisrel 8.8 application below:

DATE: 7/ 1/2024

TIME: 0:37

LISREL 8.80

BY

Karl G. Jöreskog & Dag Sörbom

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the following lines are read from the file H:\datalisrel_Obs\validasibaruNUM.spj:

EM Algorithm for Missing Data:

Number of different missing value patterns = 2

Convergence of EM algorithm in 8 iterations

$-2 \ln(L) = 8464.90954$

Percentage of missing values = 0.01

Notes:

Covariance and/or means to be analysed are estimated by the EM procedure and is only used to obtain a start value for the FIML procedure

Sample Size = 135

Latent Variable PD PF SE MOT LOL

Connection

X1-X9=PD

X10-X19=PF

X20-X28=SE

X29-X37=MOT

X38-X55=HAHAHA

Path Diagram

End of Problem

Sample Size = 135

Global Goodness of Fit Statistics, Missing Data Cases

$-2\ln(L)$ for saturated model = 8464.910

$-2\ln(L)$ for installed model = 4441.280

Degrees of Freedom = 1420

Complete Information ML Chi-Square = -4023.63 (P = 1.00)

Root Mean Square Error of Approximation (RMSEA) = 0.0

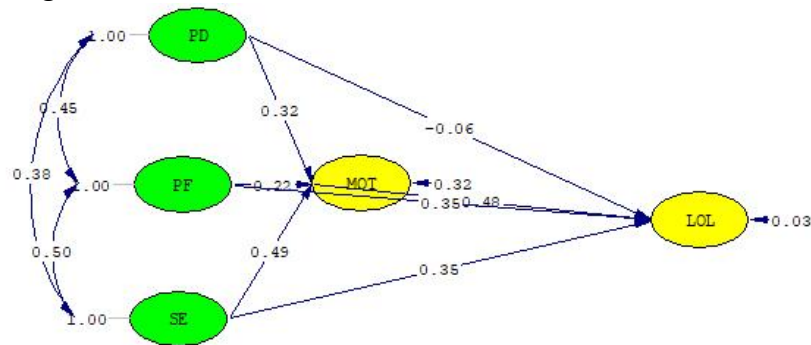
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0)

P-value for Close Fit Test (RMSEA < 0.05) = 1.00

Time used: 61.953 Seconds

The results of Table 4 show that the RMSEA value = 0.000 < 0.050 so that the model is declared fit. The results were tested again by hiding the statements X28, 0.000 < 0.500 (model fit). The model according to Figure 1 with existing variables is tested for validity and reliability. Table 4 shows that the variables whose instruments are invalid are Social Emotional Learning (X28), training motivation variables (X39 and X30) and learning leadership variables (X55). All variables based on the CR (construct reliability) value calculated using Eq. (1) are pedagogical competence (4.1360), professional competence (4.8435), social emotional competence (3.4144), motivation to participate in training (3.2648), and learning leadership (3.2648). 8.2767). The VE (variance extract) value from the calculation of Eq. (1) is pedagogical competence (0.5531), professional competence (0.5749), and learning leadership (0.5540) > 0.500. Meanwhile, social emotional competence (0.4803) and motivation to participate in training (0.767) are not reliable. CR and VE values are reliable; The CR value is reliable, and the VE value is not reliable because one of them is reliable. Thus, all variables can be relied on and can be continued for further calculations to prove the hypothesized model.

The results of the Fit model were tested further without including statements of less than 0.500 to obtain the relationship between polypad educational media and increasing teacher competency, which can be seen in Figure 5.



Chi-Square=-1774.49, df=895, P-value=1.00000, RMSEA=0.000

Fig. 5. Final Structural Equation Modelling (SEM) model from Lisrel 8.8

The confirmatory factor analysis (CFA) model approach using the Lisrel application shows that variables have a causal relationship based on Figure 5 and Figure 6, supported by the syntactic output results in the Lisrel application. The final SEM model in Figure 5 obtained the following results: the relationship between the pedagogical competency variable and the professional competency variable (0.45), the relationship between the pedagogical competency variable and the social emotional competency variable (0.50), and the relationship between the pedagogical competency variable and the social emotional competency variable. (0.38). The hypothesis presented at the beginning of this article is that the use of polypad educational media can increase teacher competence [23-27]. Based on the analysis and model calculations obtained from the Lisrel application in Figure 5 and Figure 6, the model fits with RMSEA (0.000) and p-value (1.000) which means the hypothesized relationship between variables is supported by empirical data. Figure 5 is a model of the relationship between increasing teacher competence in mathematics learning using polypad educational media. For more details, see Figure 6.

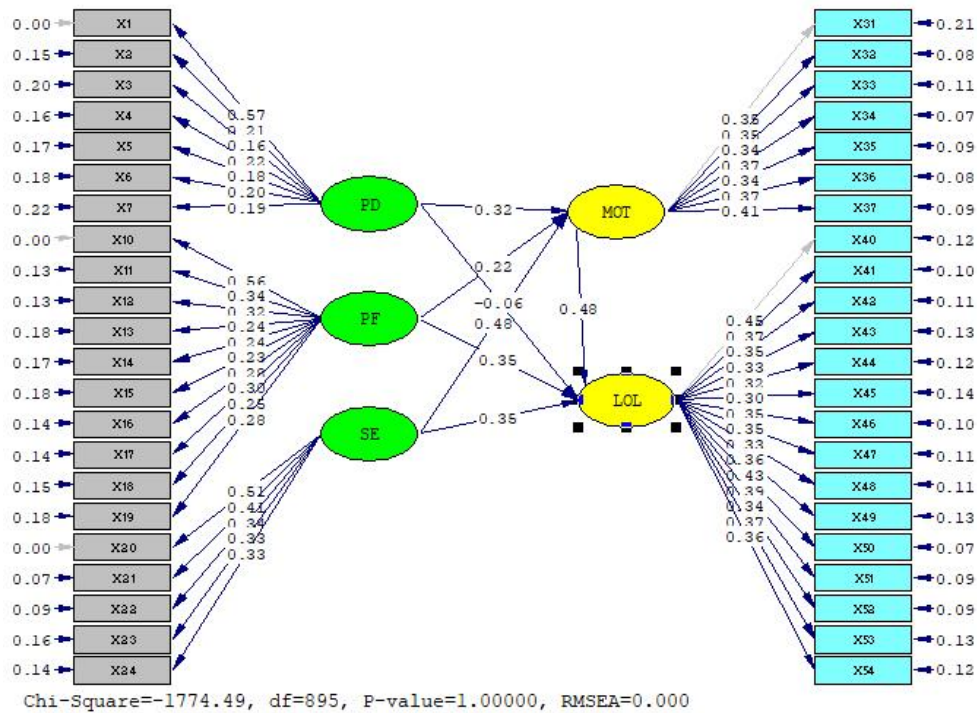


Fig. 6. Final Structural Equation Modelling (SEM) standard solution from Lisrel 8.8

The results were the role of polypad educational media on the pedagogical competency variable (0.32), the professional competency variable (0.22), and the social emotional competency variable (0.49). Each had a t-value > 1.650, namely the pedagogical competence variable (4.22), the professional competence variable (3.03), and the social emotional competence variable (5.53) for 135 respondents. These results indicate that polypad educational media is more influenced by pedagogical competence (-0.006), professional competence variables (0.35), and social emotional competence (0.35) in accordance with calculations in the goodness of fit statistical output in the Lisrel 8.8 application . Indirect influence on the pedagogical competence variable (0.038), professional competence variable (0.048), and social emotional competence variable (0.054) with t-count of pedagogical competence variable (-1.66), professional competence variable (7.23), and social emotional competency variable (6.48).

The results of Figure 5 and Figure 6, correspond to the goodness of fit statistical output in the Lisrel 8.8 application below:

DATE: 7/ 1/2024

TIME: 1:12

LISREL 8.80

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The following lines are read from the file H:\datalisrel_Obs\validasibaruNUM.spj:
Raw Data from file 'H:\datalisrel_Obs\newvalidationNUM.psf'

EM Algorithm for Missing Data:

Number of different missing value patterns = 2
Convergence of EM algorithm in 4 iterations
-2 Ln(L) = 6814.11981
Percentage of missing values = 0.02

Notes:

Covariance and/or means to be analysed are estimated
by the EM procedure and is only used to obtain a start
value for the FIML procedure

Sample Size = 135

Latent Variable MOT LOL PD PF SE

Connection

X1-X7=PD

X10-X19=PF

X20-X24=SE

X31-X37=MOT

X40-X54=HAHAHA

MOT=PD PF SE

LOL=PD PF SE

LOL=MOT

set the X1 variance error to 0.00001

set the X10 variance error to 0.00001

set the X20 variance error to 0.00001

Path Diagram

End of Problem

Sample Size = 135

LISREL Estimate (Maximum Likelihood)

Structural Equations

MOT = 0.32*PD + 0.22*PF + 0.48*SE, Errorvar.= 0.31 , R² = 0.68

(0.076) (0.074) (0.091) (0.088)

4.22 3.03 5.35 3.59

LOL = 0.48*MOT - 0.063*PD + 0.35*PF + 0.35*SE, Errorvar.= 0.027 , R² = 0.97

(0.086) (0.038) (0.048) (0.054) (0.013)

5.57 -1.66 7.23 6.48 2.01

Reduced Form Equations

MOT = 0.32*PD + 0.22*PF + 0.48*SE, Errorvar.= 0.31, R² = 0.68

(0.076) (0.074) (0.091)

4.22 3.03 5.35

LOL = 0.092*PD + 0.45*PF + 0.58*SE, Errorvar.= 0.100, R² = 0.90

(0.040) (0.058) (0.065)

2.31 7.84 8.87

Independent Variable Correlation Matrix

PD PF SE

PD 1.00

PF 0.45 1.00

(0.07)

6.58

SE 0.38 0.50 1.00

(0.07) (0.06)

5.16 7.77

Latent Variable Covariance Matrix

MOT LOL PD PF SE

MOT 0.99

LOL 0.90 0.99

PD 0.61 0.52 1.00

PF 0.61 0.79 0.45 1.00

SE 0.72 0.84 0.38 0.50 1.00

Global Goodness of Fit Statistics, Missing Data Cases

-2ln(L) for saturated model = 6811.062

-2ln(L) for installed model = 5036.569

Degrees of Freedom = 895

Complete Information ML Chi-Square = -1774.49 (P = 1.00)

Root Mean Square Error of Approximation (RMSEA) = 0.0

90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0)

P-value for Close Fit Test (RMSEA < 0.05) = 1.00

Time used: 0.922 Seconds

Eq. (2), Eq. (3) and Eq. (4) by entering the values in Figure 4, and outputting goodness of fit statistics in Lisrel 8.8. its application, for pedagogical competency variables (X1), professional competency variables (X2), and social emotional [28] competency (X3), the motivation of participants to take part in numeracy literacy training (Z) and learning leadership (Y) becomes:

Structure 1:

$$Z = 0.32 X1 + 0.22 X2 + 0.48 X3 + \delta \tag{5}$$

Structure 2:

$$Y = 0.092 X1 + 0.45 X2 + 0.58 X3 + \delta \tag{6}$$

Structure 3:

$$Y' = -0.063 X1 + 0.35 X2 + 0.035 X3 + 0.48Z + \delta \tag{7}$$

LISREL Estimation Structural Equation Calculation (Maximum Likelihood): motivation is directly influenced by pedagogical competence variables, professional competence variables, and social emotional competence variables [24-26]. The results of structural Eq. (1) mean that the role of polypad educational media influences pedagogical competence (32%), professional competence (22%), and socio-emotional competence (48%). Confirmatory factor analysis (CFA) using SEM with its application makes it very easy to find causal relationships or relationships between two variables that influence each other [32,33], as seen in Figure 5 and Figure 6, supported by the LISREL Estimates (Maximum Likelihood) output. The results of the independent variable correlation matrix show that professional competence is influenced by personality competence by 0.45 with a t-value of 6.58. Socio-emotional competence is influenced by personality competence by 0.38 with a calculated t value of 5.16 > 0.50 and professional competence by 0.50 with a t value of 7.77 > 0.50, which means the influence is significant.

The findings in this research are that the use of polypad educational media has the effect of increasing teacher competence. This research reveals important findings that the use of Polypad educational media has a significant influence on increasing teacher competency [34-36]. This study was conducted with the aim of evaluating the effectiveness of Polypad in the context of mathematics education and how this media can support improving teachers' teaching skills. These findings are based on empirical data collected through various methods, including observation, interviews, and analysis of teacher performance before and after using Polypad.

At the start of the study, teachers were given intensive training on how to use Polypad and how to integrate it into their mathematics learning [37]. This training includes a basic understanding of Polypad features, such as the use of tools for drawing graphics, manipulation of geometric shapes, and interaction with numbers and formulas. The goal is to ensure that teachers feel comfortable and confident in using the tool before implementing it in the classroom [38-40].

After the training, the teachers started using Polypad in their daily teaching. They are given the freedom to adapt the tool to suit their classroom needs and teaching preferences. Using Polypad in the classroom involves a variety of interactive activities designed to make mathematics learning more interesting and interactive for students. Teachers use Polypad to create assignments that engage students in manipulating shapes, solving math problems, and understanding complex concepts through visualization and simulation.

One of the main findings of this research is that Polypad helps improve teachers' pedagogical skills. Teachers report that they feel better able to explain difficult math concepts with the visual and interactive aids provided by Polypad. Additionally, Polypad allows teachers to provide direct feedback to students during the lesson, which helps correct mistakes in real-time and improves student understanding. This research also shows that using Polypad increases student engagement in learning [41]. Students become more enthusiastic and motivated to learn mathematics when they can interact with interesting and fun digital tools. Teachers noted increased student participation in class discussions and group activities, as well as improvements in their academic performance. Polypad helps students to see mathematics as a subject that is more interesting and relevant to their everyday lives. Furthermore, quantitative data from this research shows a significant increase in teacher competency scores after using Polypad. Teacher competency assessment covers various aspects, including understanding of mathematical concepts, teaching abilities, and skills in using technology in teaching [42,43]. Teachers who used Polypad showed greater improvement compared to those who did not use the tool, demonstrating Polypad's effectiveness in improving the quality of teaching. This research also explores the challenges and obstacles teachers face in using Polypad. Some teachers initially found it difficult to integrate this tool into their teaching routine. However, with the right support and ongoing training, most

teachers are successful in overcoming these obstacles and developing effective strategies for using Polypad. In addition, this research notes the importance of support from the school and administration in providing the resources and facilities necessary for the use of Polypad.

4. Conclusions

This research succeeded in showing that the use of Polypad educational media had a significant influence on increasing the competence of mathematics teachers. Through intensive training and application of Polypad in daily teaching, teachers are able to improve their pedagogical skills, especially in explaining complex mathematical concepts with the help of interactive visualizations. The use of Polypad has also been proven to increase student engagement and motivation in learning mathematics, which is reflected in increased participation in class and their academic results. Quantitative data from this study confirmed that teachers who used Polypad demonstrated significant improvements in competency scores, including understanding of mathematical concepts, teaching abilities, and technology skills. Although there were initial challenges in integrating Polypad into teaching routines, ongoing support and training enabled teachers to overcome these barriers and develop effective strategies.

Acknowledgement

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