International Journal of Social Science and Human Research

ISSN (print): 2644-0679, ISSN (online): 2644-0695

Volume 07 Issue 12 December 2024

DOI: 10.47191/ijsshr/v7-i12-41, Impact factor- 7.876

Page No: 9107-9112

Enhancing Middle School Teachers' Competence through Training and Mentoring in Artificial Intelligent Technology

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ABSTRACT: SMP Negeri 3 Selat is located in Duda Utara, Selat District, Karangasem Regency, Bali Province, Indonesia. Situational analysis shows that most teachers have not utilized artificial intelligence (AI) technology optimally in education. In fact, artificial intelligence technology has the potential to help teachers' work in improving the quality of learning. The purpose of this study was to see the effectiveness of training and mentoring activities in improving teacher knowledge about AI technology and its utilization, as well as improving teacher skills in utilizing AI technology for compiling learning administration; designing learning processes and compiling teaching materials. The data used were primary data from training and mentoring participants consisting of 20 teachers of SMP Negeri 3 Selat. The data were in the form of quantitative data, namely pretest and posttest scores. The data analysis stage began with a plot of pretest and posttest scores and a bar chart plot of grouped data, both of which showed a significant increase in scores after being given intervention in the form of training and mentoring. Paired t-test. To see how big the effect of the training and mentoring intervention was, Cohen's effect size was calculated, the percentage change in pretest and posttest scores. The paired t-test results show that there is a significant difference between the pretest and posttest scores. Based on Cohen's size, it was found that the training and mentoring intervention had a very strong effect on changes in pretest and posttest scores. In addition, it was also found that the percentage of changes in pretest and posttest was 106.85% and it can be 95% certain that the average posttest score in the population is estimated to be 32.76 to 45.24 points higher than the average pretest score, due to the intervention in the form of training and mentoring. This is reinforced by the pretest and posttest difference plot showing that there was a significant increase in scores after the intervention.

KEYWORDS: Artificial intelligence, skills, intervention, utilization, training and mentoring

I. INTRODUCTION

The use of AI in education has great potential to improve the quality of learning (Luckin, 2017; Gonzalez-Calatayud ´ et al., 2021) by offering more personalized learning and adaptive learning, fostering teachers' understanding of students' learning processes, and providing a system that can be accessed anywhere and anytime to ask questions and provide immediate feedback. However, the lack of understanding of AI technology is a challenge to introducing or integrating it into schools and universities (Hussin, 2018; Shirin (2022), Lee, et al. (2023)). Shirin (2022) stated that AI technology has the potential to contribute to helping teachers complete their tasks. Kim and Kim's (2022) research shows that most STEM teachers state that AI is a superior source of scaffolding. In addition, Lin's (2022) research results show that the four aspects, namely the learning process, assignments, exams, and assessments assisted by AI, have a significant positive influence on learning effectiveness. Lin (2022) provides important references for teachers to utilize AI scientifically and choose more accurate teaching strategies according to students' learning conditions.

One of the schools in Duda Utara, Selat District, Karangasem Regency, Bali Province, Indonesia is SMP Negeri 3 Selat. Based on the application of basic education data (DAPODIK) of the Ministry of Education, Culture, Research and Technology and Information from the Principal of SMPN 3 Selat, in the 2023/2024 academic year, this school uses the Merdeka Curriculum. The number of teachers consists of 35 people with 13 male teachers and 22 female teachers. Based on the results of interviews with the Principal of SMPN 3 Selat and initial surveys, it shows that only a few teachers at SMP Negeri 3 Selat Karangasem utilize AI technology in the field of education other than Google Classroom and Ruang Guru. However, they have not utilized this technology optimally to help them with their duties as teachers. In fact, in the current digital era, AI has become one of the fastest growing technologies and has many applications in various fields, including education. In accordance with the roadmap of Indonesia's

artificial intelligence program for priority areas 2020-2024 in the field of education, one of which is the adaptive learning system (Agency for the Assessment and Application of Technology, 2020), which can be realized by utilizing AI.

Given the enormous potential of AI to be applied in the field of education, while only a few teachers at SMP Negeri 3 Selat Karangasem have utilized artificial intelligence technology, efforts are needed to improve teachers' knowledge of artificial intelligence and its optimal use. One effort that can be made is through training and mentoring activities to optimize the use of artificial intelligence in education, especially to improve the quality of learning. To find out whether interventions in the form of training and mentoring are effective in increasing teachers' knowledge of artificial intelligence and its use, a study is needed. Thus, the purpose of this study is to determine the effectiveness of training and mentoring activities to improve teachers' knowledge and skills in utilizing artificial intelligence technology in education optimally.

II. METHODS

The data used in this research is primary data. The data is in the form of quantitative data, namely pretest and posttest scores, each consisting of 20 data and in the form of paired data.

The research steps carried out are as follows:

1. Visualization: Creating a before-after plot or a difference plot can help visualize the change in scores from pretest to posttest.
2. Calculating the difference between each pair of pretest and posttest data (d_i)
3. Perform a normality test on the data from the (di) values obtained in step 1 with the Shapiro Wilk Test using test statistics (1) (Hanusz et.al., 2016)

$$W = (\sum_{i=1}^{20} b_i)^2 / s_{d_i}^2 \quad (1)$$

With $b_i = (d_{n-i+1} - d_i) * a_i$ (2);

The coefficient a_i is obtained from a special Shapiro-Wilk table based on the number of samples (in this case, n = 20)

4. If it turns out that the data is normally distributed, then the paired t test can be used. However, if the data is not normally distributed, the Wilcoxon test is carried out
5. Paired t test (Sundayana, 2014)
   a. Calculate the average value and standard deviation of d_i
   b. Determine value of t using the equation

$$t_{hit} = \frac{\overline{d_i}}{s_{d_i}/\sqrt{n}} = \frac{\overline{d_i}\sqrt{n}}{s_{d_i}} \quad (3)$$

   where n = the number of paired data; $\overline{d_i}$ =average d_i; s_{d_i}= standard deviation of d_i

   c. Determine t_{table} (t_{α} with n – 1 degrees of freedom)
   d. Hypothesis testing criteria: If - $t_{table} \leq t \leq t_{table}$ then H_0 is accepted
6. Calculating the effect size of the intervention with
   a. Cohen's *d effect* using equation (4)

$$Cohen'sd = \frac{\overline{d_i}}{s_{d_i}} \quad (4)$$

   Cohen's d value criteria :

   0.2: Effect small
   0.5: Effect currently
   0.8: Effect big

   (Cohen, 1988)

   b. Calculate the average percentage change from pretest to posttest. Percentage Change = (Posttest Average - Pretest Average) / Pretest Average * 100% (5)
   c. Additional analysis: **Confidence interval:** Calculating a confidence interval for the difference in means will give an idea of how large the difference may be in the population. Form a confidence interval using (Smithson, 2003)
      - $\overline{d_i} \pm t(\alpha/2, df) * (s_{d_i}/\sqrt{n})$ (6)

III. RESULT AND DISCUSSION

Training and mentoring for teachers at SMP Negeri 3 Selat Karangasem was conducted for 3 days, namely July 22-24, 2024, with 20 teachers as partisipants. The event began with the pretest and ended with the posttest. The pretest and posttest scores are presented in Table I.

Table I: Pretest and PostPosttest Score

Respondent	Pretest Score	Posttest Score	Respondent	Pretest Score	Posttest Score
1	20	70	11	40	90
2	60	90	12	50	90
3	40	80	13	50	90
4	20	80	14	20	50
5	40	80	15	50	70
6	40	80	16	20	60
7	50	80	17	40	70
8	10	80	18	10	60
9	40	80	19	30	70
10	60	70	20	40	70

Based on the pretest and posttest values in Table 1, visualization was carried out as presented in Figure 1.

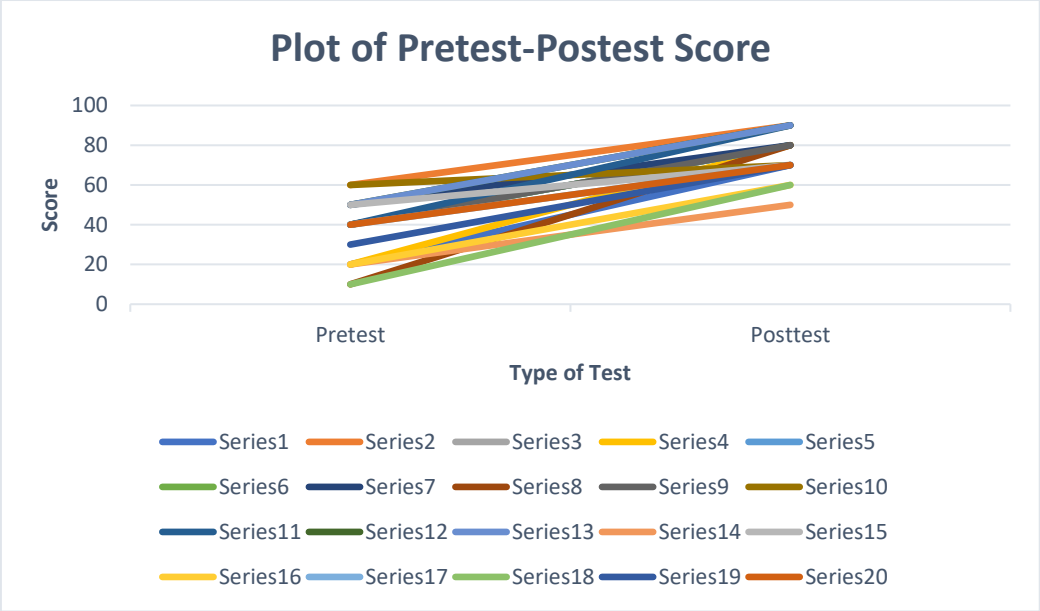

Figure 1: Plot of Pretest dan Posttest Score (Series i = Respondent i, i = 1, 2, 3, ..., 20)

Table 1 and Figure 1 show that there was an increase in score of each respondent from the pretest score.

Next, the change in pretest and posttest scores is calculated by $d_i = x_i - y_i$, i = 1, 2, 3, ..., 20. The d_i values are presented in Table II. If d_i presented in grouped data are obtained as in Table III.

Table II: The value of d_i

Respondent (i)	Pretest Score (y_i)	Posttest Score (x_i)	$d_i = x_i$-y_i	Respondent (i)	Pretest Score (y_i)	Posttest Score (x_i)	$d_i = x_i$-y_i
1	20	70	50	11	40	90	50
2	60	90	30	12	50	90	40
3	40	80	40	13	50	90	40
4	20	80	60	14	20	50	30
5	40	80	40	15	50	70	20
6	40	80	40	16	20	60	40
7	50	80	30	17	40	70	30
8	10	80	70	18	10	60	50
9	40	80	40	19	30	70	40
10	60	70	10	20	40	70	30

Table III: The value of d_i in group data

Class of d_i	Frequency
10 - 19	1
20 - 29	1
30 - 39	7
40 - 49	8
50 - 59	3
60 - 69	0
70 - 79	1

The bar chart of Table II is presented in Figure 2

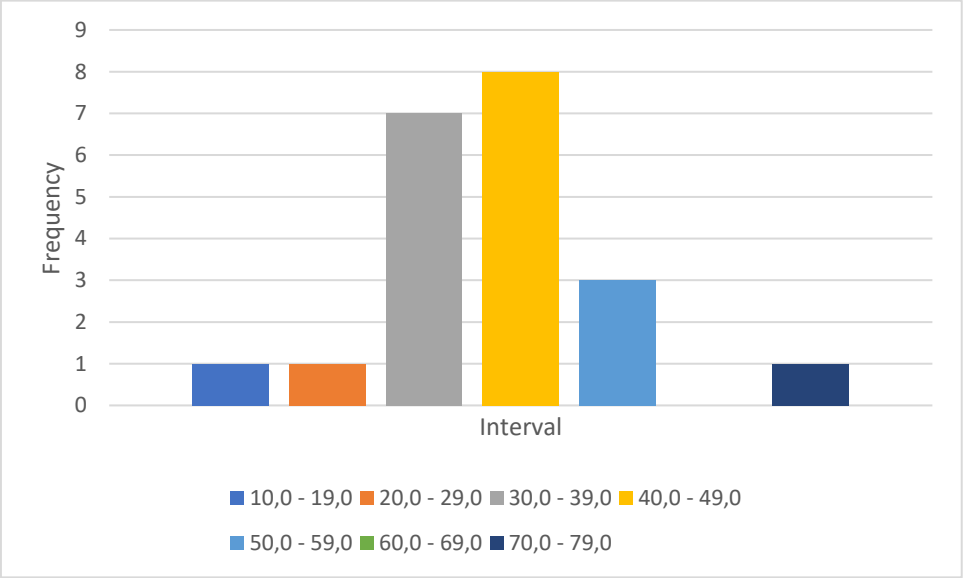

Figure 2: The value of d_i in Group Data Base on Table III

Figure 2 shows the distribution of differences in scores between the posttest and pretest. Most of the differences are in the range of 30-59, indicating a significant increase in scores after the intervention. There are no outliers visible in this plot, indicating that there were no extreme or unusual changes in scores.

To further ensure that the increase in value is significant, a statistical test is carried out. First, a normality test is carried out for the data in. Because the data is small (20 < 50), the normality test is carried out using the Shapiro Wilk Test, with the hypothesis:

H_0: Data is normally distributed

H_1: Data is not normally distributed

Here the Shapiro Wilk test is carried out with SPSS and the output obtained is W value = 0.956; p-value = 0.629. While the critical value of Shapiro-Wilk for n = 20 and α = 0.05 is 0.868. Because the W value (0.956) > critical value (0.868) and p-value (0.629) > α (0.05), it fails to reject H_0. Therefore, with a significance level of 5%, there is insufficient evidence to state that the difference between the pretest and posttest values is not normally distributed. In other words, the assumption of normality for the paired t-test is met. Furthermore, the paired t-test is carried out.

The paired t-test is used to compare the means of two related (paired) data sets. In this case, we want to know whether there is a significant difference between the pretest and posttest mean scores of the same respondents with the hypothesis:

H_0: There is no significant difference between the mean pretest and posttest scores

H_1: here is a significant difference between the mean pretest and posttest scores

Output SPSS showed that t = 13.08 and p-value = 0. Since the p-value is much smaller than the significance level α (0.05), H_0 is rejected. Thus, there is very strong evidence to state that there is a significant difference between the average pretest and posttest scores. The average posttest score is significantly higher than the average pretest score. These results indicate a significant change after the intervention in the form of training and mentoring activities (represented by the difference between the pretest and posttest).

Next, we measure how much the intervention influences the change from the pretest value to the posttest value in the data by looking at the effect size and the percentage change. Effect size is a statistic that describes the magnitude of the difference between two groups or conditions. In this case, we can calculate the effect size to see how much influence the intervention has on the change in scores from pretest to posttest. One of the commonly used effect sizes for paired t-tests is Cohen's d. Cohen's d is calculated using

equation (4), so that Cohen's d = 39.0 / 13.34 = 2.92 is obtained. Based on the Cohen's d value criteria, because Cohen's d > 0.8, it can be said that the intervention in the form of training and mentoring activities has a very large effect on the change in scores from pretest to posttest. Furthermore, the effect of the intervention was also measured by calculating the percentage change in the average from pretest to posttest using equation (5). Since the average pretest and posttest scores were 36.5 and 75.5 respectively, this means that there was an increase in the posttest score of = ((75.5 – 36.5)/36.5) × 100% = 106.85% compared to the pretest score.

Finally, additional analysis was performed using confidence intervals. Calculating the confidence interval for the mean difference will give an idea of how big the difference might be in the population. The confidence interval with $\alpha = 0.05$ is formed based on (6), the 95% confidence interval for the mean value at is $39.0 \pm 2.093 * (13.34 / \sqrt{20})$. Therefore, the 95% confidence interval is (32.76, 45.24). In other words, we can be 95% confident that the difference between the average posttest and pretest scores in the population is between 32.76 and 45.24. This means that the average posttest score in the population is estimated to be 32.76 to 45.24 points higher than the average pretest score.

Thus, it is examined using any analysis for pretest and posttest value data, the training and mentoring intervention provided an increase in the knowledge of respondents participating in mentoring and training at SMP Negeri 3 Selat regarding artificial intelligence.

In this activity, evaluation is also carried out by looking at the results of teacher performance in creating learning modules, designing learning processes, creating learning media, all of which are carried out with the help of artificial intelligence technology. Participants can work on projects well by utilizing artificial intelligence technology. Thus, interventions in the form of training and mentoring improve teacher skills in utilizing artificial intelligence technology in learning.

In addition, participants gave a positive impression of the implementation of the training and mentoring provided. Participants were very grateful for the holding of this event and they felt that their work was made easier by understanding the use of AI technology to complete their tasks. Therefore, it can be concluded that the intervention in the form of training and mentoring to optimize the use of artificial intelligence technology improves teacher competence related to artificial intelligence technology and its use.

IV. CONCLUSIONS

Intervention for SMPN3 Selat Karangasem teachers in the form of training and mentoring activities to optimize the use of artificial intelligence technology, which was carried out offline at SMPN 3 Selat Karangasem, Bali from 22 to 24 July 2024, provided an increase in teacher competence in terms of knowledge and skills in utilizing artificial intelligence technology optimally. Increased knowledge can be seen from the increase in scores, where the post-test score for each participant was greater than the pre-test score. Increased skills can be seen from the results of teacher performance in the form of projects, where teachers have been able to optimally utilize artificial intelligence technology in carrying out their duties as teachers..

ACKNOWLEDGMENT

This community service activity is funded by DIPA PNBP of Udayana University for Fiscal Year 2024, in accordance with the Assignment Agreement Letter for the Implementation of Research, Number: B/256.107/UN14.4.A/PM.01.01/2024, dated April 17, 2024. Therefore, we, the implementation team of the community service activity, would like to extend our deepest gratitude to Udayana University.

REFERENCES

1) Badan Pengkajian dan Penerapan Teknologi. (2020). *Strategi Nasional Kecerdasan Artificial Indonesia* (2020 – 2024)
2) Cohen, Jacob. (1988). *Statistical Power Analysis for The Behavioral Sciences*. Second Edition. United States of America: Lawrence Erlbaum Associates
3) Gonz´alez-Calatayud, V., Prendes-Espinosa, P., & Roig-Vila, R. (2021). Artificial Intelligence for Student Assessment: A Systematic Review. *Applied Sciences*, 11(12), 5467. https://doi.org/10.3390/app11125467
4) Hanusz, Z., Zielinski, W., and Tarasinska, J. (2016). Saphiro Wilk Test With Known Mean. *Revstat-Statistical Journal*. 14(1), 89-100
5) Hussin, A. A. (2018). Education 4.0 Made Simple: Ideas for Teaching. *International Journal of Education and Literacy Studies*, 6(3), 92–98. https://doi.org/10.7575/aiac.ijels
6) Kim, N.J. dan Kim, M. K. (2022). Teachers'Perception of Using an AI-Base Educational tool for Scientific Writing. *Frontier in Education*, 7 doi:10.3389/feduc.2022.755914. https://www.frontiersin.org/articles/10.3389/feduc.2022.755914/full
7) Lee, S. , Lee, S., Kim, S. (2023). Secondary Social Studies Teachers'Perception and Training Demand for AI-Base Education. *Korean Association For Learner-Centered Curricullum and Instruction*, 23(7), 743-759
8) Lin, Hualiang. (2022). Influences of Artificial Intelligence in Education on Teaching Effectiveness. *International Journal of Emerging Technologies in Learning(IJET)*, 17(24), 144-156

9) Luckin, R. (2017). Towards Artificial IntelligenceBbased Assessment Systems. *Nature Human Behaviour*, 1(3). https://doi.org/10.1038/s41562-016-0028, 0028
10) Shirin, Alpona. (2022). Artificial Intelligence Technology on Teaching-Learning: Exploring Bangladeshi Teachers Perception. *Embedded Self Organising System*, 9(4), 3 – 9
11) Smithson, Michael. (2003). Confidence *Intervals*. United States of America: Sage Publications Ltd.
12) Sundayana, Rostina. (2014). *Statistika Penelitian Pendidikan.*Bandung: Penerbit Alfabeta.