



THE IMPROVEMENT OF PHYSICS TEACHERS' COMPETENCE IN DEVELOPING AN INTERACTIVE RECITATION PROGRAMS TO REMEDIATE STUDENTS' MISCONCEPTION

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ABSTRACT

During learning from home, the teacher is very limited in giving feedback on assignments. Consequently, students' understanding of physics concepts is still low and experiencing misconceptions. Therefore, teachers should be able to develop an interactive recitation program completed by corrective feedback that could remediate students' misconceptions. The research objective is to improve the competence of physics teachers at Sijunjung Regency through mentoring in developing an interactive recitation program. This sort of research is quasi-experimental with one-group pretest-posttest design. The research data was obtained from the pretest and posttest about understanding of the interactive recitation programs. The results showed that there was an increase in the knowledge of high school physics teachers in understanding the interactive recitation program with a percentage of 32.4%, and the provision of mentoring activities have a significant effect on increasing the competence of physics teachers in developing interactive recitation programs.

PENINGKATAN KOMPETENSI GURU FISIKA DALAM MENGEMBANGKAN PROGRAM RESITASI INTERAKTIF UNTUK MEREMEDIASI KESALAHAN KONSEP SISWA

ABSTRAK

Kata Kunci:

Resitasi interaktif
Miskonsepsi dalam fisika
Kemampuan guru fisika

Selama *learning from home*, ada keterbatasan memberikan *feedback* terhadap tugas. Ini menyebabkan pemahaman konsep fisika siswa dangkal dan kesalahan konsep masih banyak dialami oleh siswa. Sehingga guru harus mampu mengembangkan program resitasi interaktif yang disertai dengan pemberian *corrective feedback* untuk meremediasi kesalahan konsep siswa selama *learning from home*. Tujuan penelitian untuk meningkatkan kompetensi guru fisika Kabupaten Sijunjung melalui pendampingan dalam mengembangkan program resitasi interaktif dengan *software iSpring Suite*. Jenis penelitian adalah *quasi experimental* menggunakan *One-group pretest-posttest design*. Data penelitian didapatkan dari pretes dan postes untuk melihat pemahaman guru terhadap program resitasi interaktif. Hasil penelitian yaitu terjadi peningkatan pengetahuan guru fisika SMA dalam memahami program resitasi interaktif dengan persentase 32,4%, dan pemberian kegiatan pendampingan berpengaruh

signifikan terhadap peningkatan kompetensi guru fisika dalam mengembangkan program resitasi interaktif.

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1. INTRODUCTION

High school physics learning aims to make students could master the concepts of physics related to nature and its phenomena. Besides, they can use scientific methods based on a scientific attitude to solve the problems they face. Therefore, they are more aware of the greatness of God Almighty [1-2]. Learning physics is needed to understand and study natural phenomena by mastering the concepts and principles of physics. In addition, the purpose of learning physics stated in the 2013 Curricula are mastering concepts and principles as well developing knowledge and students' self-confidence [3]. In addition, understanding the concepts and principles of physics is also needed by students to solve various real-world problems, such as problems that arise due to technological developments. For example, a student might difficult to understand the advanced technology in aircraft, if he does not understand the concepts of force and fluid correctly. So, mastering the correct physics concept is one of the keys to solving physics problems to achieve learning objectives [4-5].

Understanding of concepts could be trained through various student learning activities, such as conducting investigations, discussing learning, solving problems, conducting experiments, and giving structured assignments. These learning activities can arise from multi-directional interactions between students, teachers, and learning resources in educational situations [6-7]. Due to multi-directional interactions, teachers as learning agents need to master and apply interactive multimedia in physics learning, both conventional learning and learning from home. This interactive multimedia is essentially needed when students cannot interact directly with teachers in class.

Nowadays, learning from home is becoming popular in education as an alternative solution because the learning process cannot be done directly (face-to-face learning). Due to the amid of Covid-19 that require students to study from home, which could protect them from the virus. However, in contrast to face-to-face learning, learning from home will reduce learning interactions between teachers and students, so it will be difficult for teachers to provide deeper explanations about materials that are difficult to understand [8-9-10].

Based on the interviews of physics teachers in Sijunjung Regency regarding how physics learning conducted during the Covid-19 pandemic, it explained that teachers were becoming more frequent in using the assignment method (recitation) in the form of giving physics questions to students. Based on the theory, this recitation method is effectively applied to train students in solving problems as long as providing feedback on assignments [11]. However, during learning from home, teachers are very limited in giving explanations and guidance on students' tasks. As a result, students are incapable do it properly because their understanding of physics concepts is low. From the evaluation of the assignment, there are still many students who experience misconceptions in solving physics problems. It might cause students' physics learning outcomes to decrease, particularly in the aspect of knowledge [12]. To prevent this problem, the competence of teachers in developing application of the assignment through the method (recitation) by mentoring activities in developing interactive recitation programs accompanied by the provision of corrective feedback that can remediate students' misconceptions during learning from home. By giving the corrective feedback in each assignments, students would capable to evaluate their weaknesses in learning, as well as strengthening concepts during independent study. This

interactive recitation program is also a solution for deepening concepts outside of face-to-face learning hours [13].

Recitation is a learning method by giving special assignments to students to deepen the material outside of class hours [14-15]. The purpose of deepening the material is to help students gain in-depth knowledge and skills in the form of conceptual deepening or problem-solving exercises that are in accordance with the material that has been taught in classroom learning, but students still have difficulty understanding it [5]. During learning from home as it is now, a recitation program that contains conceptual questions with feedback is needed for students to learn independently [16]. This means that this recitation program could be used independently by students without any guidance from the teacher. In order for feedback on the recitation program to be more effective, it must be given as soon as possible and developed properly, so that it is interesting for students to learn. This recitation program is designed with a relatively large number of conceptual questions and each option on the questions is accompanied by feedback.

The recitation program developed by the physics teacher at the High School in Sijunjung Regency was interactive because of the display of questions and feedback made from the iSpring Suite software accessed via computers or smartphones. Students can work on physics problems well and get a direct explanation of the concept in their answers. The utilization of iSpring Suite software could make teachers and students access it anytime and anywhere, as long as the device used is connected to the internet network [16-17-18]. The students could use this program to relearn the material outside the school hours [19]. Therefore, the development of this recitation program is beneficial for teachers in providing explanations, emphasis, and deepening of material to students through the tasks given.

There were several studies related to the development of recitation programs in Physics learning. The first result showed that a web-based recitation program with multiple representations of kinematics was valid and practice to be used for teaching materials. There were various advantages of the web-based multi-representation recitation program as follows (1) it could be accessed anytime and anywhere, (2) it can be accessed online through any type of electronic device that can be connected to the internet, (3) can be accessed without the need to install a program, (4) does not require memory space, and (5) equipped with audio-visual feedback [20-21].

Next, other findings showed that the implementation of the recitation method could increase student learning outcomes. For instance, there are improvements in students' understanding of physics and grades of their tasks. With the implementation of this recitation method, data obtained that the average value of students has increased in each meeting. The average score of students increases supported by increasing mastery of the material [22-23]. Subsequent research recommended that it was essential to create an interactive recitation method, which encourages the student in deepening physics material during the Covid-19 widespread. Thus, students can master physics concepts and increase their confidence in solving problem from the feedback provided [17]. In addition, another study explained that the use of interactive recitation methods could improve students' understanding and mastery of concepts [24].

From several previous studies, it has not found a recitation program developed with the iSpring Suite software. The utilization of this software is the novelty of this study, and it could make an assignment more interactive. It expects to help physics teachers in making assignments more effective, so as to improve students' mastery of physics concepts. This study aims to increase the competence of physics teachers in the Sijunjung Regency

through mentoring activities in developing an interactive recitation program which use to remediate students' misconceptions during learning from home.

2. METHOD

This type of research was a quasi-experimental design with a quantitative approach. The research design was in the form of a one-group pre-treatment and post-treatment design (One-group pretest-posttest design). It meant that one sample group had given treatment, and the effect had shown under controlled conditions [25-26]. Before being given treatment, the sample group was given a pretest to determine the initial knowledge of the participants. After applying the treatment, a posttest was given to determine the final conditions of the participants. The effectiveness of the treatment could be determined from the comparison between the posttest and pretest.

The population was all high school physics teachers who are members of the physics teachers forum in the Sijunjung Regency. Meanwhile, the sample was a high school physics teacher who participated in the mentoring to develop an interactive recitation program full-time [27]. Thus, a total of 14 physics teachers in the Sijunjung Regency was involved in this study. The test was used to obtain research data that consisted of 15 multiple-choice questions each (pretest and posttest). This test would determine the teacher's knowledge of the mentoring material in remediation of misconception in physics learning, evaluation, and interactive recitation developed.

The data obtained were analyzed by appropriate statistical tests. This test consists of the normality test, the homogeneity test, and paired t-test. Then, the data were analyzed using descriptive analysis, which describes group data in the form of minimum values, maximum values, average values, standard deviations, and variances. The normality and homogeneity tests were used to examine the distribution of group data and the similarity of variance of the two groups, respectively [28]. Based on data analysis, both groups of data were normally distributed and had the same variation. An independent sample t-test was used to test the hypothesis. It could determine the effect of developing an interactive recitation program on the remediation of misconceptions.

The research procedure consists of six stages, namely: pretest, material provision, program development assistance, independent activities, evaluation monitoring, and posttest. In more detail, the procedure is shown in Figure 1.

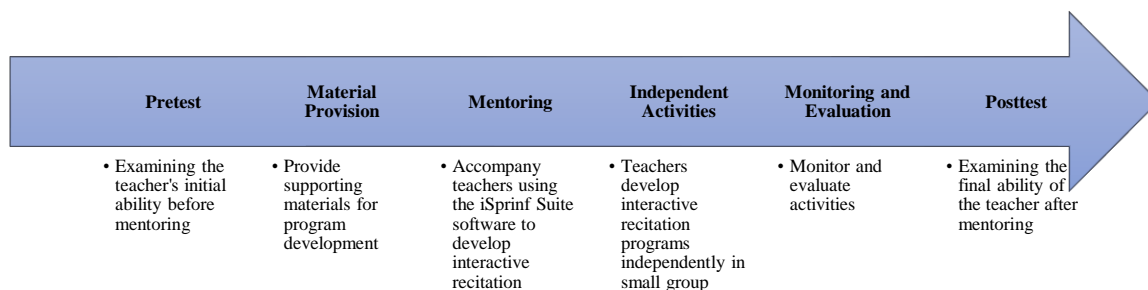



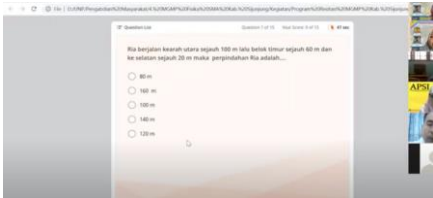


Figure 1. Research Procedure

Based on Figure 1, the initial step was the pretest. It would examine teachers' competence in understanding the mentoring materials. Then, the materials were delivered to the participant through direct explanations. After providing participants with some knowledge, they continued to do mentoring activities in developing a recitation program. They learned to make this product by themselves. Finally, the products were assessed by the expert in monitoring and evaluation stage, and they did a posttest at the end of the

activity. The mentoring activities for teachers are carried out in a structured and scheduled manner so teachers can follow these activities well. Table 1 describes various activities carried out by teachers during mentoring activities.

Table 1. The Activity of the Teachers During the Stages

No	Stages	Explanation	Documentation
1	Providing supporting materials	The participants receive materials from three speakers related to the topics of 1) misconceptions and remediation in physics learning, 2) evaluation in physics learning, and 3) recitations and utilization.	
2	Coaching how to make the program	The team gives information on how to make a recitation program by accompanying all participants one by one.	
3	Independent activities	Participants collaborate in their small groups to discuss the content inside the programs and how to make the whole program.	
4	Mentoring and evaluation	The team evaluates the product developed by the teachers and gives feedback on it.	

3. RESULT AND DISCUSSION

The results obtained are related to the research objectives, namely increasing the competence of high school physics teachers in Sijunjung Regency in developing interactive recitation programs to remediate students' misconceptions. This improvement was examined from the comparison between the teacher's mastery in the knowledge aspect after and before the mentoring activities are carried out. Table 1 indicates the results of descriptive statistical analysis of the pretest and posttest scores of 14 physics teachers using SPSS 26 software.

Table 2. The Results of the Statistical Analysis of the Pretest and Posttest

Descriptive Statistics	Score	
	Pretest	Posttest
Sum	14	14
Minimum	33,33	60
Maximum	53,33	86,67
Range	20	26,67
Ideal score	100	100
Mean	44,76	77,14
Median	46,67	86,67
Deviasion standard	6,63	8,56
Variance	43,96	73,27

Based on Table 2, the minimum and maximum score of the pretest was 33.33 and 53.33, respectively, with a standard deviation of 6.63. Meanwhile, for the posttest, the minimum and maximum scores were 60, and 86.67 respectively, with a standard deviation of 8.56. There was a difference among these scores. As shown in the table, the average score of these tests increased from 44.76 to 77.14, around a 32.4% improvement.

An independent sample t-test with a 95% confidence level was used to examine the hypothesis. Before using this test, the score of pretest and posttest should be in normal distribution and homogenous. That is why normality and homogeneity tests are needed [28]. The results of these tests are shown in Table 3 and Table 4.

Table 3. Results of Normality Test

	Shapiro-Wilk		
	Statistic	df	Sig.
Pretest	0,882	14	0,061
Posttest	0,900	14	0,111

Based on Table 3, the pretest and posttest significance values were 0.061 and 0.111, respectively. These significance values were in the area of acceptance of the null hypothesis, which was higher than the value of = 0.05. Therefore, the results of the pretest and posttest of physics teachers in the Sijunjung Regency are in normal distributions.

Table 4. Results of Homogeneity Test

Levene's Test for Equality of Variances	F	df	Std Error Difference	Sig.
2,964	1,328	26	2,89	0,260

Based on the results of the homogeneity test of the pretest and posttest data, the significance value was 0.260. This value was in the area of acceptance of the null hypothesis, which was higher than 0.05. Therefore, the distribution of pretest and posttest data is homogeneous. The next step was the statistical analysis that tested the hypothesis. The results of the test is shown in Table 5.

Table 5. Paired-Samples t-Test

	Test Value = 100			
	t	df	Sig. (2-tailed)	Mean Difference
Pretest-Posttest	-10,396	13	0,000	-32,38

Based on the t-test in Table 5, the results obtained a significance of 0.000. This value was in the area of rejection of the null hypothesis, which was smaller than 0.05. Thus, there was a measurably significant difference between the pretest and post-test scores. It means

that mentoring in the development of interactive recitation programs can significantly improve the competence of physics teachers in the Sijunjung Regency.

The findings showed as follows 1) the percentage of the competence of physics teachers in the development of interactive recitation programs increase, around 32.4%, 2) The improvement in the competencies of physics teachers in developing an interactive recitation programs was statistically significant with a 95% confidence level.

During the mentoring activities, all teachers who participated were given various knowledge about recitation. The team informed about how to make content inside this program, and develop the programs. As a result, various recitation programs were developed by the physics teacher of the MGMP in the Sijunjung Regency, starting from quizzes, assignments, exams, and others. One form of the program developed by the teacher group was the provision of quizzes, as shown in Figure 2.

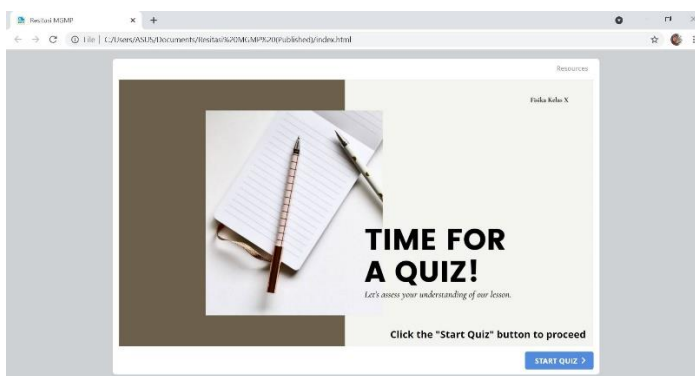


Figure 2. The Cover of the Recitation Program

The recitation programs consist of the detailed user, the instructions, and conceptual questions with feedback which made students understand the physic concept. The detailed user gives an opportunity for the student to write their identity in this program, and it can be useful for the teacher to collect information about who participates using the program. Then, the instructions give information for students about how to use this program. The display of the column of detailed user and the instructions of the program is shown in Figure 3.

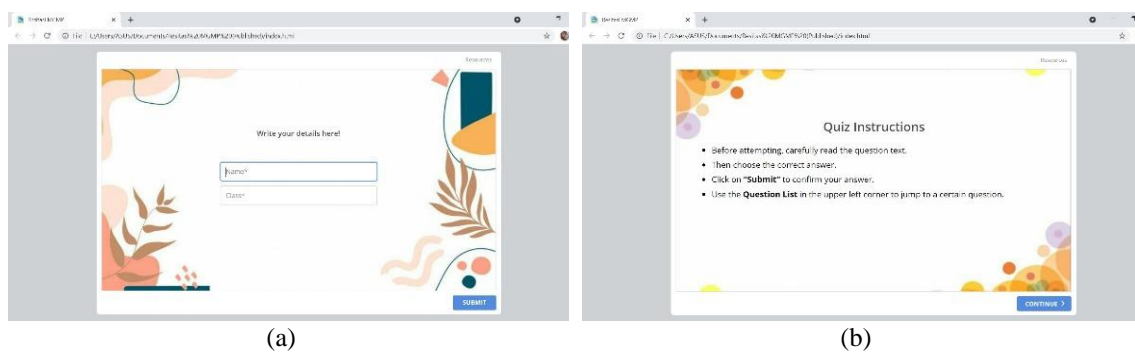


Figure 3. (a) The Detailed User and (b) The Instructions of Program

The last, the provision of feedback in each option could act as a reward for students. The feedback given on the right answer would be beneficial for students to strengthen their concept, and the wrong answer would give them an opportunity to correct their mistakes. The example of the feedback given on the right and wrong answers is shown in Figure 4.

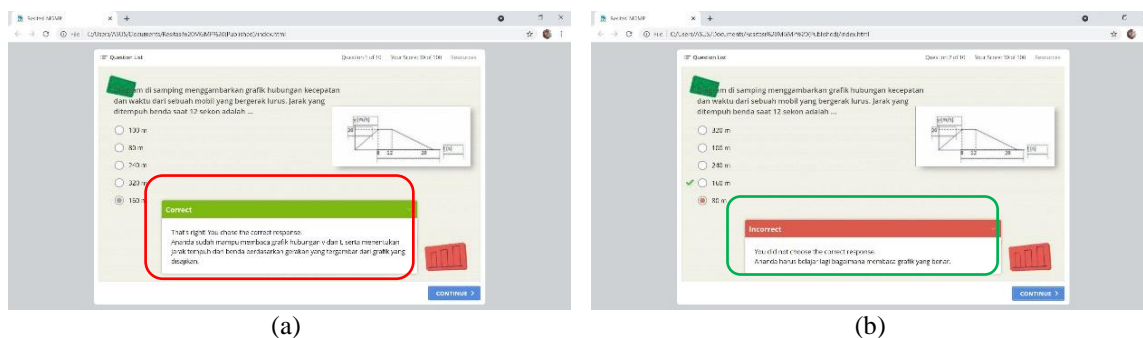


Figure 4. The Example of the Feedback given for Each Answer

Firstly, the high school physics teacher of the Sijunjung Regency who participated in the interactive recitation development mentoring activity had shown a change in knowledge in a better direction with an increasing percentage of 32.4%. Before the mentoring, there was a lack of comprehension of physics teachers for understanding the recitation program in physics learning. They also did not understand the concept of misconceptions and remediations in physics learning, as well as evaluation in learning physics. However, after being assisted, there was an increased competency on them. This increase could be seen from the teacher’s average score obtained from the pretest and posttest, where the posttest average score was higher than the pretest.

Secondly, statistically, the mentoring provided could prove physics teachers’ competence in developing interactive recitation programs. This program can facilitate physics teachers in managing the application of the recitation method properly [29]. The interactive recitation method is filled with different conceptual questions for each material, including feedback, and makes students easier to comprehend the physics concepts autonomously amid learning from home.

The advantage of this interactive recitation program developed by the physics teacher is that it contains various conceptual questions equipped with feedback on each option in the questions, both on the correct and wrong answer options. By giving feedback is could act as a concept reinforcement to students [18]. It is easy for students to understand concepts well and know their weaknesses when solving physics problems.

Moreover, the development of interactive recitation by utilizing the help of the iSpring Suite software makes it easier for both teachers and students to access it even outside of learning hours. Recitation with this software also has an attractive appearance, the presentation of images and writing can be seen clearly, and the operation process is easy. In addition, computer-based recitation programs can help students to solve physics problems [16].

These advantages of these programs motivated the physics teacher of the Sijunjung Regency to take the mentoring seriously. Therefore, from the two tests given during the mentoring, it was seen that there was a significant increase in aspects of teacher knowledge. The material provided during the mentoring activities also relates to the needs of teachers in schools. It means that the mentoring material is considered very up-to-date under the curriculum that applies in schools [30].

The duration of mentoring activities was about one month. During this time, the teachers are capable of developing the programs independently. They have also been able to compile questions that emphasize conceptual mastery with answer options. Based on the possibility of students’ thinking in answering questions [31]. The feedback packaged by the teacher is also under the correct concept of physics material.

4. CONCLUSION

Based on the results, the percentage of the competence of physics teachers in the development of interactive recitation programs increased, about 32.4%. In addition, the mentoring activities provided caused significant changes to the competence of physics teachers in Sijunjung Regency in developing interactive recitation programs.

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REFERENCES

- [1] Mundilarto, *Penilaian Hasil Belajar Fisika*. Yogyakarta: UNY Press, 2012.
- [2] D. Sarkity and P. D. Sundari, "Pemahaman Konsep Fisika Calon Guru Biologi Pada Topik Kinematika," *Pdagog. Hayati J. Ilm. Pendidik. Biol.*, vol. 4, no. 2, pp. 106–116, 2020, [Online]. Available: <https://ojs.umrah.ac.id/index.php/pedagogihayati/article/view/2569>.
- [3] Kemdikbud, "Konsep dan Implementasi Kurikulum 2013," Jakarta: Kementerian Pendidikan dan Kebudayaan, 2014.
- [4] D. Sarkity and P. Dwi Sundari, "The ability of Junior High School Science Teacher in Solving The Problems of Torque," *J. Geliga Sains J. Pendidik. Fis.*, vol. 8, no. 2, p. 73, 2020, doi: 10.31258/jgs.8.2.73-85.
- [5] J. L. Docktor and J. P. Mestre, "A Synthesis of Discipline-Based Education Research in Physics," *Phys. Educ. Res.*, pp. 1–148, 2014.
- [6] Trianto, *Model Pembelajaran Terpadu*, no. 15480003. Jakarta: PT Bumi AKsara, 2012.
- [7] Hamruni, *Strategi Pembelajaran*. Jakarta: Insan Madani, 2011.
- [8] L. D. Herliandry, N. Nurhasanah, M. E. Suban, and H. Kuswanto, "Pembelajaran Pada Masa Pandemi Covid-19," *JTP - J. Teknol. Pendidik.*, vol. 22, no. 1, pp. 65–70, 2020, doi: 10.21009/jtp.v22i1.15286.
- [9] S. Basuki, "Model Penugasan Belajar di Rumah Yang Menyenangkan Bagi Siswa di Masa Pandemi Covid 19," *J. Pendidik. Dasar Nusant.*, vol. 6, no. 1, pp. 199–210, 2020, doi: 10.29407/jpdn.v6i1.14754.
- [10] L. F. Cornelius, "Students ' Perceptions towards the Quality of Online Education : A Qualitative Approach," *Assoc. Educ. Commun. Technol.*, 2004.
- [11] T. R. Murniasih and T. Fayeldi, "Metode Resitasi Untuk Meningkatkan Pemahaman Konsep Pada Mata Kuliah Dasar-Dasar Pemrograman Komputer," *J. Edukasi*, vol. 4, no. 1, p. 8, 2017, doi: 10.19184/jukasi.v4i1.5083.
- [12] C. Sundaygara, H. Y. Pratiwi, and M. N. Hudha, "Pengembangan bahan ajar media pembelajaran fisika dengan pendekatan multi representasi untuk meningkatkan kemampuan pembuatan alat-alat praktikum calon guru fisika," *Momentum Phys. Educ. J.*, vol. 2, no. 2, pp. 86–93, 2019, doi: 10.21067/mpej.v2i2.2709.
- [13] M. R. A. Taqwa and R. Faizah, "Perlunya Program Resitasi dalam Meningkatkan Penguasaan Konsep Dinamika Partikel Mahasiswa," *Pros. Semnas Pend. IPA Pascasarj. UM*, no. May, pp. 482–487, 2016.
- [14] D. Y. Aditya, "Pengaruh Penerapan Metode Pembelajaran Resitasi terhadap Hasil Belajar Matematika Siswa," *J. SAP (Susunan Artik. Pendidikan)*, vol. 1, no. 2, pp. 165–174, 2016.

- [15] M. Hermawati and A. Hidayat, "Pengembangan Program Resitasi Materi Listrik Statis untuk Siswa SMA," *J. Pendidik. Teor. Penelitian, dan Pengemb.*, pp. 79–83, 2021.
- [16] A. Amalina, M. Reyza, A. Taqwa, and A. Suyudi, "Pengembangan Program Resitasi Berbantuan Komputer pada Materi Fluida Statis," *J. Pendidik. Fis. dan Teknol. (JPFT)*, vol. 7, no. 1, 2021.
- [17] P. D. Sundari and W. S. Dewi, "Interactive recitation methods as a solution to the students ' deepening physics material during the Covid-19 pandemic Interactive recitation methods as a solution to the students ' deepening physics material during the Covid-19 pandemic," *J. Phys. Conf. Ser. IOP Publ.*, 2021, doi: 10.1088/1742-6596/1876/1/012071.
- [18] F. Himmah, "Pengembangan Multimedia Interaktif Menggunakan Ispring Suite 8 pada Sub Materi Zat Aditif untuk Meningkatkan Hasil Belajar Siswa SMP Kelas VIII," *E-Journal Unesa*, no. 2, pp. 73–82, 2017.
- [19] D. A. Wibowo and Y. Hermawan, "Penerapan Metode Resitasi Dan Diskusi Untuk Meningkatkan Prestasi Belajar Mahasiswa Program Studi Ilmu Keperawatan Universitas Galuh the Application of Recitation and Discussion Method To Improve Sophomore Students Achievement in Nursing Program At Galuh ," *J. Pendidik. dan Kebud.*, vol. 20, no. 3, pp. 328–339, 2014.
- [20] A. D. Febryanti, M. Reyza, A. Taqwa, A. D. Febryanti, M. Reyza, and A. Taqwa, "Development of A Web-Based Recitation Program with Multiple Representations on Kinematics," *J. Geliga Sains J. Pendidik. Fis.*, vol. 9, no. 1, pp. 1–11, 2021.
- [21] N. Sornkhatha, P. & Srisawasdi, "Supporting conceptual development in Newton's laws of motion using an interactive computer simulated laboratory environment.," *Procedia Soc. Behav. Sci.*, 2013.
- [22] M. R. A. Idus, "Penerapan Metode Resitasi dalam Pembelajaran Keterampilan Menulis Bahasa Jerman Kelas XI Bahasa SMA Negeri 13 Surabaya," *laterne*, vol. V, pp. 1–6, 2016.
- [23] S. Ida Bagus Rini Jayanti, Wartono, "Dampak Program Resitasi Terhadap Perubahan Konseptual Mahasiswa pada Topik Hukum III Newton," *J. Pendidik. Teor. Penelitian, dan Pengemb.*, vol. 1, no. 2, pp. 256–264, 2016.
- [24] I. N. Pebriana and T. N. Diyana, "Dampak Melatihkan Pengintegrasian Hukum Newton dalam Pembelajaran Prinsip Archimedes melalui Program Resitasi terhadap Pemahaman Konsep Mahasiswa The Impact of Practicing Integration of Newton ' s Law in Learning Archimedes Principles through the Recitati," *J. Pendidik. Mat. dan Sains*, vol. 7, no. 2, pp. 106–117, 2019.
- [25] Sugiyono, *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R&D*. Alfabeta: Bandung, 2014.
- [26] T. D. Hastjarjo, "Rancangan Eksperimen-Kuasi Quasi-Experimental Design," vol. 27, no. 2, pp. 187–203, 2019, doi: 10.22146/buletinpsikologi.38619.
- [27] S. Arikunto, *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta, 2010.
- [28] S. Santoso, *Aplikasi SPSS pada Statistik Parametrik*. Jakarta: Media Komputindo, 2014.
- [29] M. H. Nurhidayati, "Metode Pembelajaran Interaktif," "Seminar Metod. Pembelajaran" bekerjasama dengan Mhs. KKN-PPL UNY, 2011.
- [30] W. S. Dewi, Mairizwan, A. Renol, and Hidayati, "The Improvement Of The Competency Of Science Teachers Using Science Kit : Optimizing," *Indones. J. Sci. Math. Educ.*, vol. 04, no. March, pp. 89–98, 2021, doi: 10.24042/ij sme.v4i1.7956.

- [31] K. Bayon, S., Supriyono, K, H., dan Sentot, “Pengembangan instrumen penguasaan konsep dalam pembelajaran Group Investigation.” *J. Pendidik. Teor. Penelitian, dan Pengemb.*, vol. 2, no. 4, 2017.