

Interactive Multimedia Tutorial of Discovery Learning Model (iMTDLM); Improving Pre-Service Physics Teachers' Pedagogical Competence

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ABSTRACT

This study aims to develop an interactive multimedia tutorial of discovery learning model (iMTDLM) and to examine its effect on the improvement of pedagogical competence and the ability of pre-service physics teachers (PPTs) in constructing lesson plans. This development research follows the ADDIE (Analyze, Design, Develop, Implement dan Evaluate). The instruments used include a validation sheet for iMTDLM product, an instrument for assessing pedagogical competence, and an instrument for evaluating lesson plans. The implementation phase involved 9 PPTs who were taking the course Teaching Practice 1 at a university in the city of Ternate. The results of the study showed that the iMTDLM was successfully designed by combining the use of Adobe Director 11 and Filmora software. The use of the iMTDLM in the Teaching Practice 1 course yields a positive effect on the improvement of pedagogical competence and the PPTs' ability to construct lesson plans.

Keywords: iMTDLM, Discovery learning, Pedagogical competence

ABSTRAK

Penelitian ini bertujuan untuk menghasilkan produk multimedia tutorial model discovery learning dan menelusuri dampak penggunaannya terhadap peningkatan kompetensi pedagogik dan kemampuan mahasiswa calon guru fisika dalam menyusun rencana pelaksanaan pembelajaran (RPP). Penelitian pengembangan ini mengikuti tahapan ADDIE (*Analysis, Design, Development, Implementation dan Evaluation*). Instrumen yang digunakan meliputi lembar validasi produk multimedia tutorial, instrumen tes kompetensi pedagogik dan instrumen penilaian RPP. Tahap implementasi dilakukan dengan melibatkan 9 mahasiswa calon guru fisika yang mengontrak mata kuliah PPL 1 pada salah satu Universitas di kota Ternate. Hasil penelitian menunjukkan bahwa produk multimedia tutorial telah berhasil dirancang dengan mengkombinasikan penggunaan *software* Adobe Director 11 dan Filmora. Penggunaan produk multimedia tutorial dalam mata kuliah PPL 1 menunjukkan dampak positif terhadap peningkatan kompetensi pedagogik dan kemampuan menyusun RPP bagi mahasiswa calon guru fisika.

Kata kunci: Multimedia interaktif, Discovery learning, Kompetensi pedagogik

INTRODUCTION

Competence is a set of knowledge, skills, and behaviors that must be possessed, internalized, and mastered by a teacher in carrying out their professional tasks, which includes pedagogical competence, personal competence, social competence, and professional competence

(Depdiknas, 2005; Pujiastuti *et al.*, 2012; Bakri & Raharjo, 2015; Wulandari & Mundilarto, 2016; Dudung, 2018; Hamid & Saprudin, 2020). The teacher training institutions plays an important role in preparing pre-service teachers to become professional teachers in the future. In the field of physics, one of the important competencies to be trained for pre-service physics teachers (PPTs) is pedagogical competence. Pedagogical competence is one of the teacher's competencies related to the management of student learning (Depdiknas, 2005; Bakri & Raharjo, 2015; Dudung, 2018).

The results from the teacher certification tests show that the competence of physics teachers needs to be improved (PSG Rayon 130, 2012; PSG Rayon 130, 2013; Saprudin, 2013; Saprudin, 2014). Similarly, the results of the 2015 teacher competency test (Uji Kompetensi Guru) showed that the pedagogical competence of science teachers in the city of Ternate is still low (Abdullah *et al.*, 2015). In line with these findings, a survey on the profile of pedagogical competence of PPTs at one of the LPTK in the city of Ternate showed that the level of pedagogical competence is categorized as "low" with an average percentage of 34% (Hamid & Saprudin, 2020). This indicates that efforts to improve pedagogical competence are crucial, both for in-service teachers and for pre-service teachers, particularly for PPTs.

Efforts to improve pedagogical competence have been made through the design of innovative learning video tutorial models, such as the tutorial video of problem-based learning on the topic of heat (Saprudin *et al.*, 2016), and the tutorial video of discovery learning on the topic of hydrostatic pressure (Saprudin *et al.*, 2018). However, the continuous flow of images has an impact on the inability of PPTs to absorb all the information from the video. Additionally, the PPTs cannot interact with the video. Therefore, the video product needs to be developed to be more interactive with the user. The meaning of interactivity is closely related to two-way communication between the user and the video product. In this regard, the innovative learning video tutorial model produced needs to be developed in the form of interactive multimedia.

In previous research, increasing pedagogical competence has been carried out by implementing learning media training (Nenden, 2020; Sari *et al.*, 2021; Supkhonovna, 2021; Sulistyaningrum *et al.*, 2020; Helmie *et al.*, 2022; Sulastri *et al.*, 2022), carrying out activities lesson study (Junaid & Baharuddin, 2020; Hariyani, 2020) and through e-mentoring (Situmorang & Iriani, 2022). However, the efforts that have been made, especially through training activities, have found weaknesses when the training activities have been completed, so teachers do not have supporting materials for learning resources to study independently. therefore we need an interactive multimedia tutorial that can be used as a support for independent learning after the activity has been completed.

The interactive multimedia developed falls under the category of tutorial model. Hofstetter states that multimedia is the use of computers to present and combine text, sound, images, animation, and video with tools and links for users to navigate, interact, create, and communicate (Munir, 2012). While a tutorial can be defined as guidance for learning in the form of instructions, assistance, guidance, and motivation for students to learn efficiently and effectively (Rusman, 2012). Therefore, a multimedia tutorial is a format of multimedia presentation where information/material is presented by instructing, assisting, guiding, directing, and motivating users to learn efficiently and effectively.

The iMTDLM is intended to provide a visual description of how the learning model is implemented in the classroom so that PPTS will have a better understanding of the learning model. In addition, the interactive aspect is intended to facilitate interaction between the user (PPTs) and the multimedia application when it is run. This iMTDLM product is expected to make it easier for pre-service teachers to improve their mastery of teacher and student activities

in every learning model presented. Through good mastery of the learning model, prospective physics teachers are expected to be able to design effective learning instruments, in this case, lesson plans, which have an impact on improving the quality of learning, especially in physics learning.

METHODOLOGY

This development research follows the ADDIE model's development flow, which includes the phases of Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). The flow of research implementation is shown in Figure 1. In the development phase, validation for the iMTDLM product involved 3 media experts, 3 subject matter experts, and 3 language experts using a validation sheet instrument. In the implementation phase, the use of the iMTDLM was used in the course of Teaching Practice 1, involving 9 PPTs (Female = 8, Male = 1) at a university in the city of Ternate.

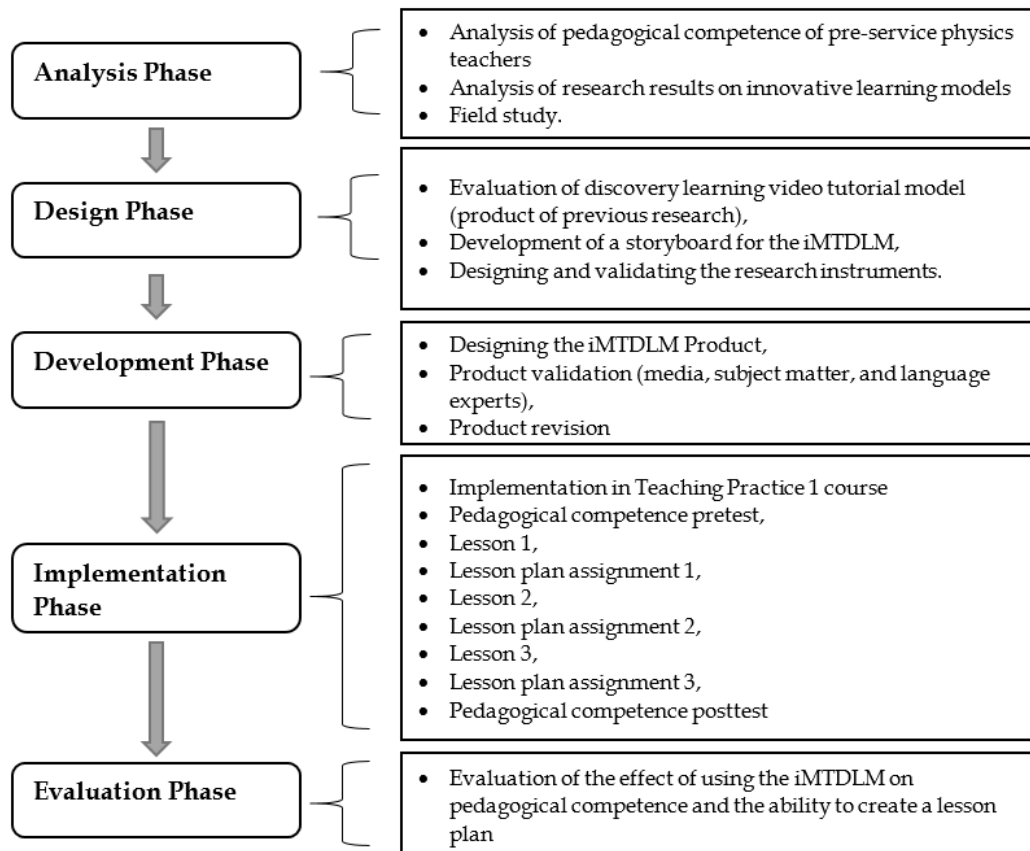


Figure 1. Research flow

Validation data for the iMTDLM product was collected through the validation sheet instrument involving media experts, subject matter experts, and language experts. Data on pedagogical competence was collected through test instruments and the assignment of lesson plan creation. The test instrument for pedagogical competence consists of multiple-choice questions covering the core competencies of a teacher, which are; A) mastering the characteristics of the physical, moral, spiritual, social, cultural, emotional, and intellectual aspects of a student; B) mastering the learning theory and principles of educating; C) conducting education-oriented learning; D) utilizing information and communication technology for learning; E) effectively, empathically, and politely communicating with students; and F) conducting assessments and evaluations of

the learning process and outcomes. Data on the ability to create lesson plans were collected through the lesson plan evaluation sheet.

RESULTS AND DISCUSSION

Data and discussion are focused on the description of the developed iMTDLM product, the results of the validation of the iMTDLM product, and the exploration of the impact of the multimedia tutorial product on pedagogical competence and the ability to create lesson plans.

The Developed iMTDLM Product Description

The iMTDLM is designed by using the combination of Adobe Director 11 and Filmora software. The interface of the developed iMTDLM product is shown in Figure 2.

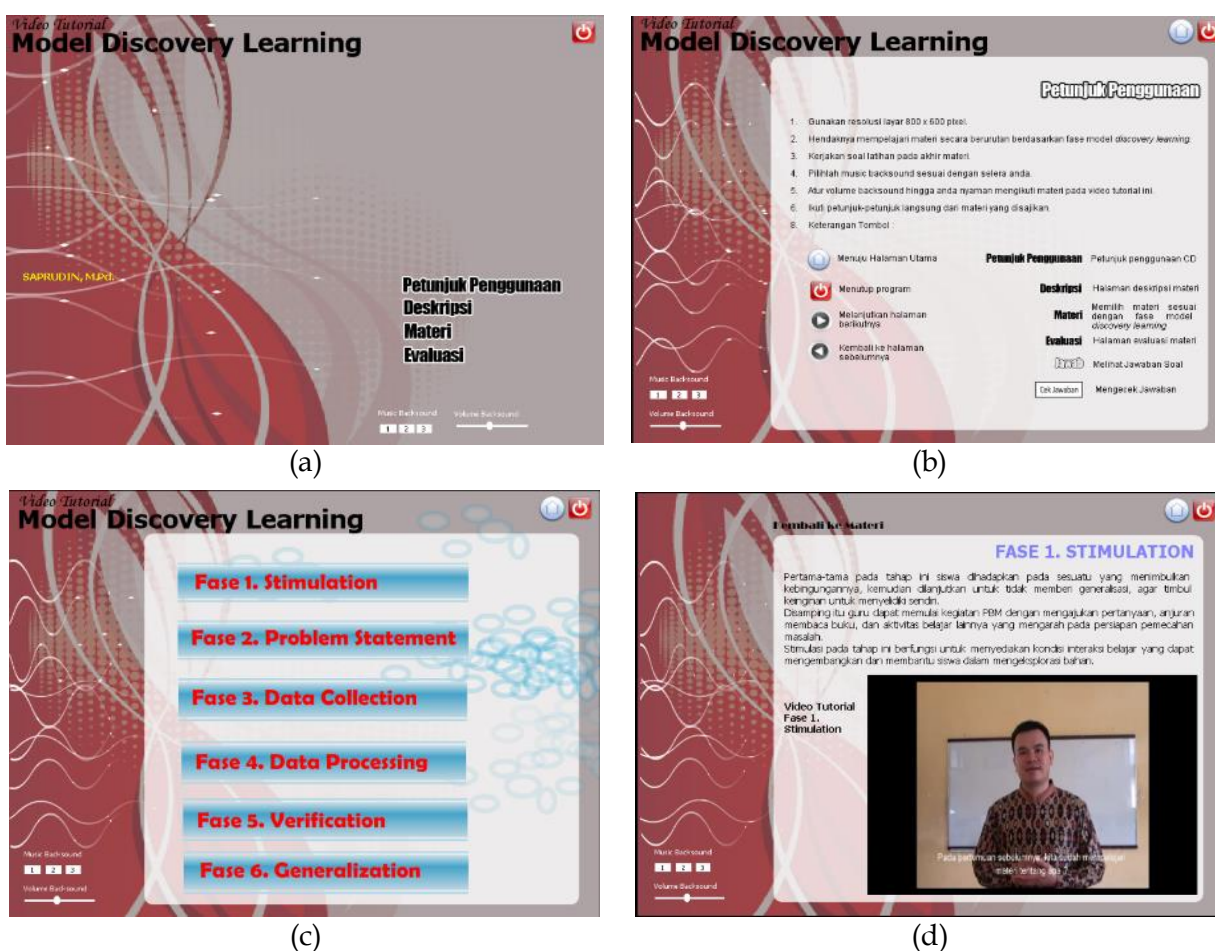


Figure 2. The interface of the imtdlm product

Validation Results of the iMTDLM of Discovery Learning

The results of the validation of the iMTDLM from 3 learning media experts, 3 subject matter experts, and 3 language experts are shown in Tables 1, 2, and 3.

Table 1. Subject matter experts validation result

Aspect	Component	Percentage (%)
Content validity	Content order	85,00
	Content accuracy	81,00
	Up-to-date content	79,00
Delivery validity	Presentation / delivery technique	80,00
	Presentation support	86,00
	Average	82,20

Table 2. Media experts validation result

Aspect	Component	Percentage (%)
Product quality	The program can be used immediately	100,00
	The program can be easily copied and used on a computer	100,00
	The program is designed to be interactive, allowing students to use the program as they wish	100,00
	By using the videos, students can remember the information provided	100,00
	The videos provided can help students understand the learning model	100,00
	The instructions for using the multimedia are easy to understand	66.67
	The transition of material between pages is consistent and does not disrupt the concentration	66.67
User-friendliness	The multimedia is easy to use	100,00
	The navigation system within the multimedia is easy to remember	66.67
Navigation system	When running the program, errors are frequently encountered resulting in the program crashing	100,00
	The multimedia includes various menu icon options	66.67
	When using the program, students can transition to different materials without having to open subsequent pages sequentially	100,00
	The program allows students to explore without the need to complete one menu before moving on	100,00
	Users can exit the program at any time according to their preferences	66.67
	The buttons used in the multimedia are simple and easy to understand	66.67
	The text is easily readable	100,00
Graphic design	The sentences within the multimedia are easy to understand	100,00
	The use of the Indonesian language in this multimedia can assist students in understanding the presented material	66.67
	The colors used in this multimedia do not disrupt the interface	66.67
	The user interface design of the program is nice	66.67
	Average	85,00

Table 3. Language experts validation result

Aspect	Component	Indicator	Percentage (%)
Language validity	Accuracy of language	The sentences used are simple	93.33
		The sentences used can convey the learning information	80.00
		The language used is a proper and standard Indonesian	86.67
		The language used is following The Enhanced Spelling of the Indonesian Language (<i>Ejaan yang Disempurnakan / EYD</i>)	86.67
	Communicative	The language used is easily understood by readers	80.00
	Suitable for student development	The language used is suitable for the intellectual development level of students	80.00
		The language used is suitable for the socio-emotional development level of students	80.00
Average			88,81%

Tables 1, 2, and 3 indicate that the developed iMTDLM product is valid and suitable to be used in a learning process.

Implementation Results in the Teaching Practice 1 Course

The implementation of the iMTDLM was carried out involving 9 PPTs who enrolled in the Teaching Practice 1 course at one university in the city of Ternate.



Figure 3. Implementation of the iMTDLM in the Teaching Practice 1 course

The results of the implementation, namely the use of the iMTDLM in the Teaching Practice 1 course can be seen from the results of the tests of pedagogical competency and also the evaluations of the lesson plans produced by the PPTs. The test results of the PPTs' pedagogical competency are shown in Figure 4.

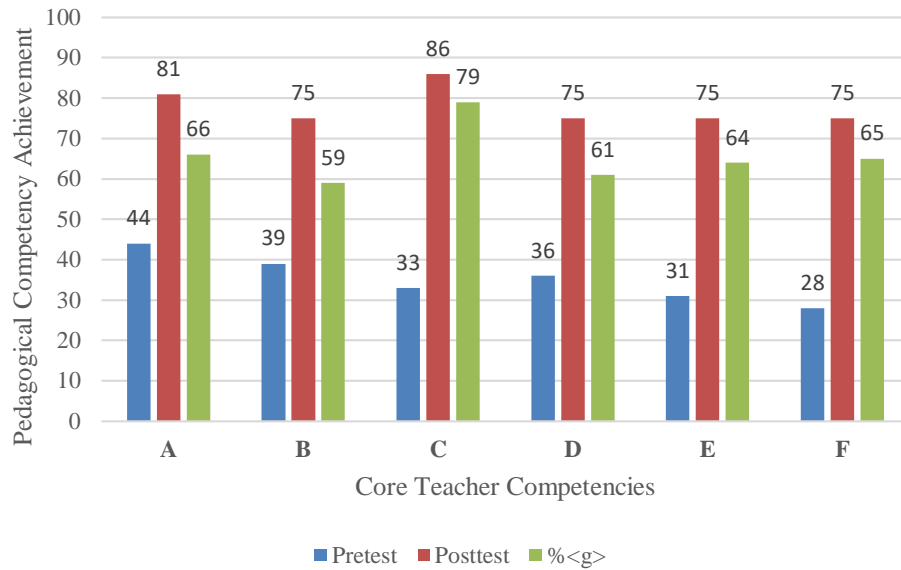


Figure 4. Pretest, posttest, and <g> pedagogical competency test

Figure 4 shows that overall, the pedagogical competence of PPTs experienced an increase. The increase in core teacher competency (A) related to mastery of the characteristics of students from physical, moral, spiritual, social, cultural, emotional, and intellectual aspects is 0.66 with a "medium" category. The increase in core teacher competency (B) related to mastery of learning theory and principles of educating is 0.59 with a "medium" category. The increase in core teacher competency (C) related to conducting education-oriented learning is 0.79 with a "high" category. The increase in core teacher competency (D) related to utilizing information and communication technology for learning is 0.61 with a "medium" category. The increase in core teacher competency (E) related to effectively, empathically, and politely communicating with students is 0.64 with a "medium" category. The increase in core teacher competency (F) related to conducting assessments and evaluations of the learning process and outcomes is 0.65 with a "medium" category.

The changes in the ability of PPTs in creating lesson plans after attending classes for lessons 1 to 3 are shown in Figure 5.

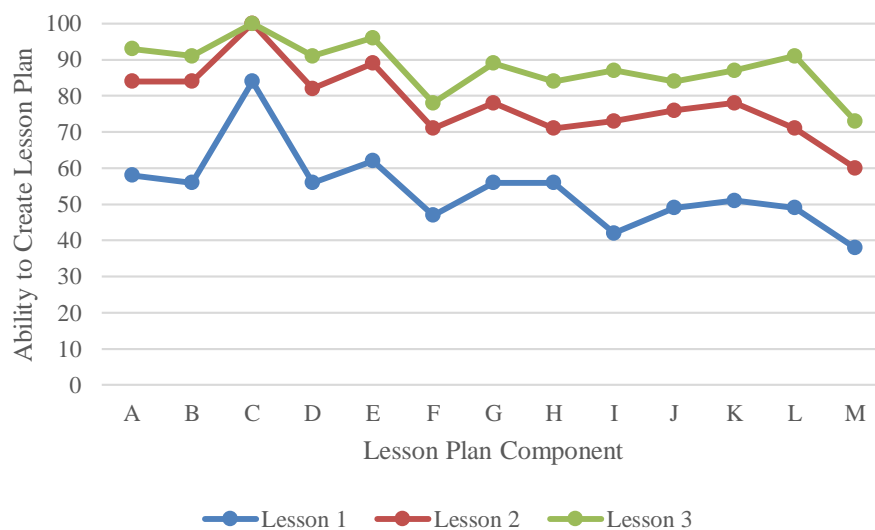


Figure 5. The Ability profile of PPTs in creating lesson plans after each lesson

The ability of PPTs in preparing lesson plans for each meeting is evaluated by each component of the lesson plan, which refers to Permendikbud No. 22 of 2016 on the standards of elementary and secondary education, which includes the components of school identity, such as (A) name of the educational unit; (B) identity of the learning subject or theme/subtheme; (C) class/semester; (D) core material; (E) time allocation; (F) learning objectives; (G) basic competencies and indicators of competency achievement; (H) learning materials; (I) learning approaches, models, and methods; (J) learning media; (K) learning resources; (L) learning steps; and (M) assessment of learning outcomes. Figure 5 shows that the ability of PPTs in preparing lesson plans has improved from Lesson 1 to subsequent Lessons. This improvement is the impact of using the iMTDLM in the Teaching Practice 1 course. Through increasing good pedagogic competence, teachers can design and implement good learning (Marsen et al., 2021), and through the implementation of good learning, student learning outcomes will increase (Sudargini & Purwanto, 2020).

CONCLUSION

An iMTDLM product has been developed and deemed valid to be used in a learning process. The product was designed by combining the use of Adobe Director 11 and Filmora software. The use of the resulting iMTDLM had an impact on the improvement of the PPTs' pedagogical competence. The improvement in the PPTs' pedagogical competence can be categorized as "medium" (0.66). In addition, the use of the iMTDLM product also improves the ability of PPTs to prepare and create lesson plans.

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REFERENCES

- Abdullah, I, H., Saprudin, Zamzam, Z. (2015). *Pemetaan Hasil Ujian Kompetensi Guru Mata Pelajaran Ilmu Pengetahuan Alam (IPA) di Kota Ternate (Laporan Akhir Studi)*. Kemdikbud: Tidak Diterbitkan
- Bakri, F., Raharjo, S.B. (2015). Analisis Hasil Uji Kompetensi Guru Fisika. *Jurnal Penelitian & Pengembangan Pendidikan Fisika (JPPPF)*, 1(1), 91-96. <https://doi.org/10.21009/1.01113>
- Branch, R. M. (2009). *Instructional design: The ADDIE approach* (Vol. 722). Springer Science & Business Media.
- Depdiknas. (2005). *Undang-Undang Republik Indonesia, Nomor 14 Tahun 2005 Tentang Guru dan Dosen*. Depdiknas: Jakarta.
- Dudung, A. (2018). Kompetensi Profesional Guru. *JKKP (Jurnal Kesejahteraan Keluarga dan Pendidikan)*, 5(1), 9-19. <https://doi.org/10.21009/JKKP.051.02>
- Hamid, F., & Saprudin, S. (2020). Profil Kompetensi Pedagogik dan Profesional Mahasiswa Calon Guru Fisika. *JIPFRI (Jurnal Inovasi Pendidikan Fisika dan Riset Ilmiah)*, 4(1), 1-8. <https://doi.org/10.30599/jipfri.v4i1.644>
- Hariyani, S. (2020). Peningkatan Kompetensi Pedagogik Guru dalam Melaksanakan Literasi pada Pembelajaran melalui Lesson Study di SDN Lemahputro 1 Sidoarjo. *Journal of Indonesian Education*, 3(1), 39-47.

- Helmie, J., Nurviyani, V., Ristiani, I., Taufik, M. S., & Mulyana, A. (2022). Pelatihan Implementasi Virtual Reality (VR) sebagai Media Pembelajaran Berbasis Digital untuk Mengembangkan Kompetensi Pedagogik Guru-Guru SD di Kec. Cipanas. *Jurnal Warta Desa (JWD)*, 4(1), 34-40. <https://doi.org/10.29303/jwd.v4i1.170>
- Junaid, R., & Baharuddin, M. R. (2020). Peningkatan Kompetensi Pedagogik Guru Melalui PKM Lesson Study. *To Maega: Jurnal Pengabdian Masyarakat*, 3(2), 122-129. <http://dx.doi.org/10.35914/tomaega.v3i2.413>
- Marsen, S. B., Santosa, H., & Rochanah, S. (2021). The Effect of Pedagogical Competence and Work Environment toward Elementary School Teachers Performance. *AL-ISHLAH: Jurnal Pendidikan*, 13(1), 668-677. <https://doi.org/10.35445/alishlah.v13i1.563>
- Munir. (2012). *Multimedia Konsep & Aplikasi dalam Pendidikan*. Bandung: Alfabeta.
- Nenden, N. (2020). Peningkatan Kompetensi Pedagogik Guru SD Negeri Karsamenak Kota Tasikmalaya Melalui Penggunaan Media ICT (Information and Communication Technology). *J-KIP (Jurnal Keguruan dan Ilmu Pendidikan)*, 1(2). <http://dx.doi.org/10.25157/j-kip.v1i2.4404>
- Pujiastuti, E., Raharjo, T. J., & Widodo, A. T. (2012). Kompetensi Profesional, Pedagogik Guru IPA, Persepsi Siswa tentang Proses Pembelajaran, dan Kontribusinya terhadap Hasil Belajar IPA di SMP/MTs Kota Banjarbaru. *Innovative Journal of Curriculum and Educational Technology*, 1(1). <https://doi.org/10.15294/ijcet.v1i1.127>
- PSG Panitia Sertifikasi Guru Rayon 130. (2013). *Laporan Pelaksanaan Sertifikasi Guru dalam Jabatan Tahun 2013; Buku 1* (Unpublished). Universitas Khairun, Ternate
- PSG Panitia Sertifikasi Guru Rayon 130. (2012). *Laporan Pelaksanaan Sertifikasi Guru dalam Jabatan Tahun 2012; Buku 1* (Unpublished). Universitas Khairun, Ternate
- Rusman. (2012). *Belajar dan Pembelajaran Berbasis Komputer; Mengembangkan Profesionalisme Guru Abad 21*. Bandung : Alfabeta
- Saprudin. (2013). Profil Kompetensi Guru Bidang Studi Fisika pada Pelaksanaan Sertifikasi Guru dalam Jabatan Tahun 2012 di Provinsi Maluku Utara. *Jurnal Omega*, 2(1)
- Saprudin. (2014). Analisis Capaian Kompetensi Guru Bidang Studi Fisika pada Pelaksanaan Sertifikasi Guru dalam Jabatan Tahun 2013 di Provinsi Maluku Utara. In *Prosiding Seminar Kontribusi Fisika 2014 (SKF 2014)*
- Saprudin, Abdullah, I. H., Haerullah, A., & Saraha, A. R. (2016). Pengembangan Media Video Tutorial Model Pembelajaran Berbasis Masalah pada Materi Kalor. *Edukasi*, 14(2). <http://dx.doi.org/10.33387/j.edu.v14i2.209>
- Saprudin, S., Haerullah, A. H., Abdullah, I. H., Saraha, A. R., & Hamid, F. (2018). Pengembangan Media Video Tutorial Model Discovery Learning Materi Tekanan Hidrostatik. In *Prosiding Seminar Kontribusi Fisika 2017*, Pp. 300-304
- Sari, D. S., Hidayati, D. W., Wahyuni, A., Lestari, R. S., & Awaliyah, N. A. (2021). Pengembangan Kompetensi Pedagogik Guru SD melalui Pelatihan Pembuatan Media Pembelajaran Interaktif di Era Pandemi Covid-19. *Manggali*, 1(2), 167-176. <https://doi.org/10.31331/manggali.v1i2.1750>
- Situmorang, R., & Iriani, T. (2022). E-mentoring, Salah Satu Alternatif dalam Meningkatkan Kompetensi Pedagogik Guru. *Konstelasi: Konvergensi Teknologi dan Sistem Informasi*, 2(1). <https://doi.org/10.24002/konstelasi.v2i1.5619>
- Sudargini, Y., & Purwanto, A. (2020). the Effect of Teachers Pedagogic Competency on the Learning Outcomes of Students. *Journal of Industrial Engineering & Management Research*, 1(4), 1-8. <https://doi.org/10.7777/jiemar.v1i4.96>
- Sulastri, S., Sulikah, S., Nuraini, U., & Pitaloka, V. D. (2022). Mengembangkan Kompetensi Pedagogik Calon Guru Melalui E-Modif. *Jurnal Pendidikan Ekonomi (JUPE)*, 10(2), 148-153. <https://doi.org/10.26740/jupe.v10n2.p148-153>

- Sulistyaningrum, N. D., Rahmawati, S. S., Nisrina, N. S., Mutiati, L. N. A., & Aen, K. (2020). Peningkatan Kompetensi Pedagogik Guru MI Al-Ihsan Melalui Pelatihan Microsoft Powerpoint. *Edulab: Majalah Ilmiah Laboratorium Pendidikan*, 5(2), 118-134. <https://doi.org/10.14421/edulab.2020.52-02>
- Supkhonovna, H. N. (2021). Technology for The Development of The Qualities of Pedagogical Competence in Future Teachers. *Asian Journal of Multidimensional Research*, 10(5), 372-382. <http://dx.doi.org/10.3897/ap.1.e0333>
- Wulandari, R. W., & Mundilarto, M. (2016). Kompetensi Pedagogik dan Profesional Guru Fisika dalam Melaksanakan Pendekatan Saintifik di SMAN Sleman. *Jurnal Pendidikan Fisika dan Keilmuan (JPFK)*, 2(2), 92-104. <http://doi.org/10.25273/jpfk.v2i2.701>