

APPLICATION OF THE RECITATION METHOD TO IMPROVE THE COMPETENCE OF MEDICAL LABORATORY TECHNOLOGY STUDENTS IN THE IMMUNOLOGY FIELD

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DOI: [10.17977/jps.v11i12023p012](https://doi.org/10.17977/jps.v11i12023p012)

ARTICLE INFO	ABSTRACT
Article History: Received 19/06/2022 Revised 19/12/2022 Approved 10/04/2023 Published 21/05/2023	An accredited mid-level MLT (Medical Laboratory Technology) must have the competence to perform medical laboratory examinations from pre-analytic, analytic, and post-analytic stages in several fields, one of which is immunology. Many D3 MLT students are facing obstacles to pass the immunology course. This obstacle is not only experienced by students of D3 MLT but also by medical students, pharmacy students, and similar majors. The purpose of this research is to determine the effect of recitation method in the form of animation video making and immunology based device on the competence of Diploma 3 (D3) MLT students. This research is a true experimental study with a total sample of 348 students. The average final grade of the experimental class of 2018 and 2019 is 78 and 77, with the passing rate of 93.63% and 96.72%. This result is better than the control class of 2017. It can be concluded that the application of recitation method can improve the competence of MLT students. The assignments given can enhance creativity, students' interest in immunology courses, and the ability to work well with colleagues or students from other departments or institutions.
Keywords: Animation video Immunology Medical laboratory technology Recitation method	
How to Cite: Naully, P. G., & Nursidika, P. (2023). Application of the recitation method to improve the competence of medical laboratory technology students in the immunology field. <i>Jurnal Pendidikan Sains</i> , 11(1), 12–19. https://doi.org/10.17977/jps.v11i12023p012	

INTRODUCTION

In the Regulation of the Minister of Health of the Republic of Indonesia Number 42 Year 2015 concerning Permit and Implementation of Medical Laboratory Technology Technician Practice, it is mentioned that a Medical Laboratory Technology Practitioner (MLTP) is any person who has passed Medical Laboratory Technology (MLT) education or is a health analyst or medical analyst and has competence to analyze the body fluids and tissues to produce information about the health of individuals and communities in accordance with the provisions of legislation (Kementerian Kesehatan Republik Indonesia, 2015). Based on the Eighth Deliberation Meeting of the Association of Indonesian Health MLTP Number 9 Year 2017 on MLTP Professional Standards, it is known that the competence of an MLTP consists of seven areas: noble professionalism, self-awareness and self-development, effective communication, information management, medical laboratory basics, medical laboratory skills, and management of laboratory-based health problems (Persatuan Ahli Teknologi Laboratorium Kesehatan Indonesia, 2017). To become an MLTP, one must complete a minimum education level of diploma three (D3). That person would be called a Certified Mid-Level MLT. An accredited mid-level MLT must have the competence to perform medical laboratory examinations from pre-analytic, analytic, and post-analytic stages in several fields, one of which is immunology.

Immunology can be defined as the study of cells and molecules involved in host defense mechanisms and the process of disrupting these mechanisms to cause disease (Nankervis et al., 2012). D3 MLT students get immunology courses for three semesters, with a greater practicum load than theory. Among the several subjects of immunology listed in the MLT D3 Education Curriculum published by the Ministry of Health in 2014, there are two subjects that greatly support the ability of MLT students while working in medical laboratories, i.e., antigen antibody detection techniques with agglutination and immunochromatography (ICT) principles (Kementerian Kesehatan Republik Indonesia, 2014). Both subjects are considered important because they are widely applied to a wide range of



examinations at the hospital, Puskesmas, or clinical laboratories. Examinations using both methods include pregnancy screening, C Reactive Protein (CRP), Anti Streptolysin O (ASTO) Antibody, Typhoid Fever, Syphilis, Malaria, and various infections caused by Dengue Virus, Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV).

In order to perform the entire examination, from the pre-analytical stage to the post-analytical stage, MLT students need to understand some important things such as the immune response mechanism in humans, representative sample criteria, inspection principles, antigen antibody reactions, examination methods, and interpretation of results. Many D3 MLT students are facing obstacles in the learning process of these materials. This is marked by the low number of students who passed the immunology course. This obstacle is not only experienced by students of D3 MLT but also by medical students, pharmacy students, and similar majors (Berçot et al., 2013; Husáková, 2015). Research by Mitasari and Gofur (2017) states that immunology is an abstract subject, so it is difficult to understand. Nankervis et al. (2012) also state that Immunology is a complex science that requires a fast and strong memory of some related components. The complex understanding of immunology largely depends on students' ability to visualize and create mental models that support scientific understanding, especially at the molecular level (Zhang et al., 2019).

To overcome these problems, many learning methods have been applied. Some apply mind mapping learning methods (Husáková, 2015), virtual immunology programs (Berçot et al., 2013), learning methods through immunology computer games (Nankervis et al., 2012), and online immunology learning systems (Boye et al., 2012). All of these methods are proven to have a positive effect on the teaching and learning process but have not increased the activity, creativity, independence, or cooperative ability of the students. There are also Mohan et al. (2017) and Zhang et al. (2013) who have implemented Patient Oriented Problem solving (POPs) systems in medical students studying immunology. The POPs system is a learning method that allows students to work in small groups to solve clinical problems, support self-learning, and build long-term memory. However, the making of the POPs learning module takes a lot of the teacher's time, who also needs to allocate time to conduct compulsory research and community service activities (Mohan et al., 2017). This may affect the outcome of the activity. One method that can make learners more active, creative, independent, and able to work together is the recitation method (Mamentu, 2022). The recitation method is a method of learning where the teacher gives assignments to students in accordance with the learning materials. The method of recitation has been proven to improve learning outcomes in the fields of linguistics (Idus & Wahyuningsih, 2016), civic education (Nurhayati, 2016), and physics (Prasetyo et al., 2013).

In addition to methods, learning media can also affect outcomes and the achievement of student learning. The media that are considered most effective are animated films and props. Animated film learning media have been proven to increase understanding of various sciences such as biology (Hasanah & Nulhakim, 2015), physics (Yulisa et al., 2020), immunology (Berçot et al., 2013), and electricity (Sukiyasa & Sukoco, 2013). Even Sari and Samawi (2014) managed to prove that animated film learning media can improve learning outcomes in slow learners children group. Saputri and Dewi (2014) also prove that simple props can improve students' understanding and skills without costly expenses. Based on some of these studies, it can be concluded that the recitation method needs to be combined with animated film media and props. However, there has been no research that applies it in immunology courses and determines its effect on the learning outcomes of students, especially on the competence of MLT students. Therefore, this study aims to determine the effect of the application of recitation methods in the form of animation-based videos and immunology-based devices on the competence of D3 MLT students.

METHOD

This research was conducted at STIKES Jendral Achmad Yani Cimahi (currently the Faculty of Health Science and Technology, Jenderal Achmad Yani University) for three years, i.e., from the even semester of the academic year 2017/2018 until the academic year 2019/2020. The population in this research is all students in the D3 MLT study program. The sample used is the second-grade students who take the Immunology II course. The total samples are 348 people, consisting of 116 students from the class of 2017, 110 people from the class of 2018, and 122 people from the class of 2019.

The research method used is real-time experimental, with three classes as control classes and six classes as experiment classes. The three control classes come from the class of 2017, while the six experimental classes are from the 2018 and 2019 classes. All the classes got the learning materials that are in line with the Ministry of Health's D3 MLT Education Curriculum 2014 and are taught by the same lecturer. The factor that distinguishes the experimental class from the control class is the application of the recitation method in the learning process. The task given is to create an animated video or a device related to the subject of antigen antibody detection techniques using the principles of agglutination and immunochromatography. The task is done in groups. The division of groups is done in each class assignment on the basis of equal academic ability. One group consists of seven or eight people. The division of the group and the delivery of duties are carried out at the beginning of the semester. Two weeks later, each group must submit a topic and action plan for the desired topic. The selection of topics is different from one group to another. Every two weeks for one semester, each group must report on the progress of their assignment. Students are allowed to discuss with the supervisor whenever there is spare time. Assignments are collected and assessed at the end of the semester.

The data collection techniques used are test techniques. Data collection for the pre- or post-test is done by giving five essay questions every time the practicum takes place (once a week). Data collection for passive and active practicum exams is done at the end of the semester. On passive tests, students are given 85 multiple-choice questions in accordance with the standard of the competency test of the Association of Indonesian Health MLTP. All of these questions test students' understanding of immunological examinations from pre-analytic to post-analytic stages. On an active exam, students are tested for performing an examination at the immunology laboratory, from the preparation stage of the specimen to handling infectious waste. All scores obtained by students are combined into the final grade. The final grade of the experiment class is compared to the control class. Here's the formula used to calculate the final value,

$$FG = (0.4 \times ATS) + (0.3 \times PTS) + (0.3 \times AS) \quad (1)$$

Where FG is final grade, ATS is active practicum test score, PTS is passive practicum test score, and AS is average of pre-test, post-test, assignments, dan practicum reports scores.

In this study, data were also collected through questionnaires distributed. There are two kinds of questionnaires distributed. The first questionnaire contained eight positive questions (very good, good, good enough, less good, bad) and two questions with open answers. The questionnaires were administered to the control class and the experimental class to compare their level of understanding of the immunological material. The second questionnaire contains two positive questions (strongly agree, agree, quite agree, less agree, and disagree) and two questions with open answers. The questionnaire was given only to the experimental class to determine the effect of the assignment on the academic and financial burden of the students. All the questionnaire data is converted to a scale of one to five in order to obtain quantitative data. The validity of the questionnaire is determined by two tests, namely the validity of the item and factor validity.

RESULTS

Effect of the Recitation Method on Creativity and Cooperative Ability

Since this assignment was given to the experimental class of 2018 and continued in the class of 2019, there have been 20 animated videos (Figure 1) successfully created. Most of the animated videos are related to immunological examinations in laboratories using agglutination and immunochromatography principles, such as pregnancy checkups, syphilis, typhoid fever, rheumatoid factor, ASTO, and type two hypersensitivity. There are also videos related to the pathogenesis and human immune response to viruses causing infections such as HIV, HBV, and Human Papilloma Virus (HPV).

In addition to the animated video, students also managed to make three immunology-based devices (Figure 2). There is a group that made an immunochromatographic simulation device to detect the presence of the NS1 Dengue Virus in patient sera. The device is controlled by the Google Talk app. It shows the antigen-antibody reaction that occurs in each part of immunochromatography. There is also a group that makes a centrifuge device. This centrifuge is small, lightweight, and utilizes a power bank, so it can be taken anywhere. The achievement of this experimental class is significantly different from that of the control class. The control class has never produced any attainments during the Immunology II course.

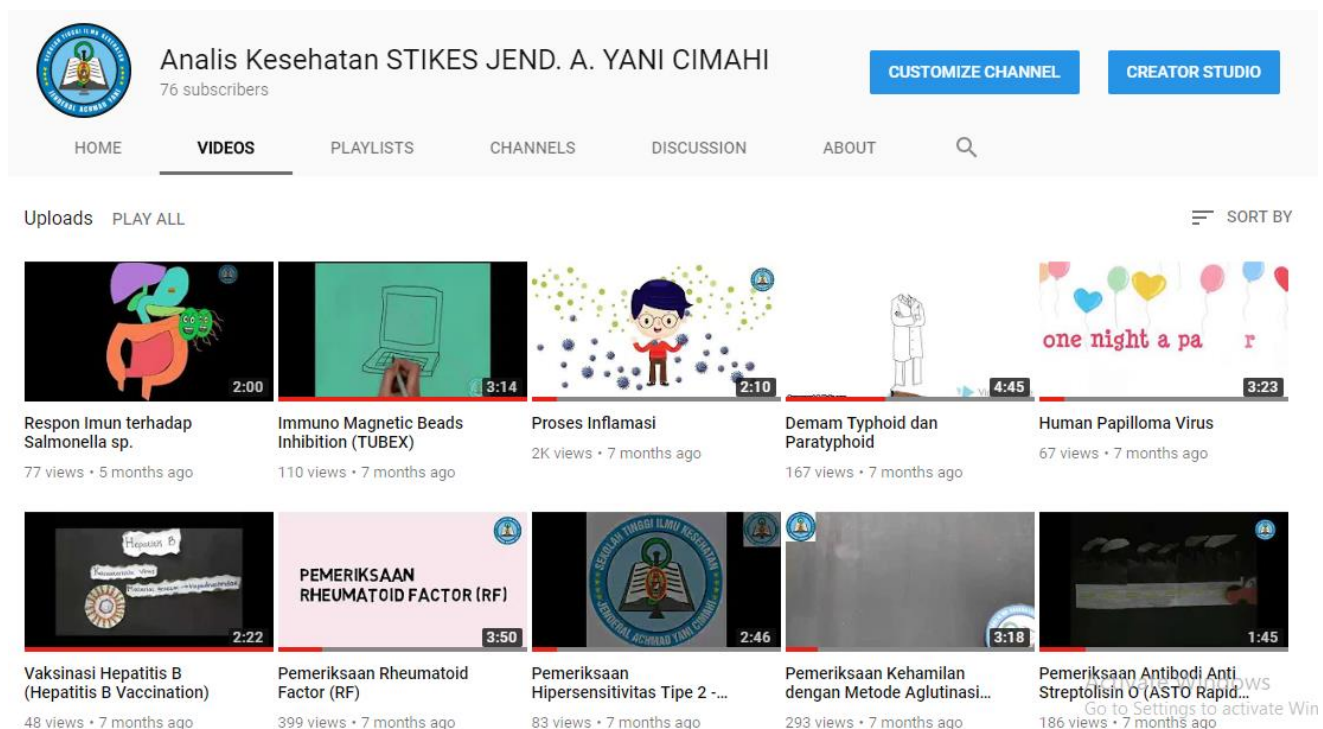


Figure 1. Collection of animation videos from student D3 MLT assignments at STIKES Jendral Achmad Yani Cimahi.

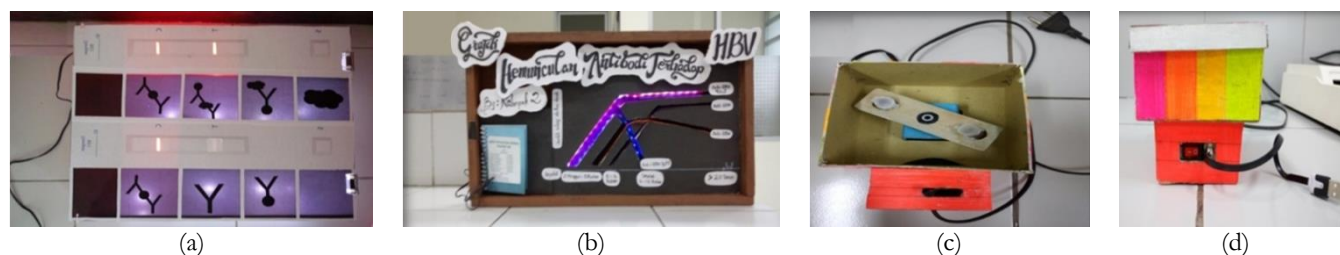


Figure 2. Immunology-based devices from D3 MLT students assignment at STIKES Jendral Achmad Yani Cimahi. (a) Dengue NS1 giant immunochromatography controlled by google talk, (b) simulation tool for the occurrence of antibodies against Hepatitis B Virus C1, (c) mini portable centrifuge inside view, and (d) mini portable centrifuge rear view.

Effect of the Recitation Method on Learning Outcomes

The target of recitation method application is improving learning outcomes, as marked by the increase in final scores and the number of students who pass the Immunology II course. The final score is a combination of daily test scores, active practicum test scores, and passive practicum test scores. The three aspects of the assessment can describe the competence of D3 MLT students in terms of cognitive, psychomotor, and affective aspects. In addition, the test questions used in pre-test, post-test, and passive tests are in accordance with MLTP competency test standards.

Based on the final score data (Table 1), it can be seen that the experiment class's learning outcomes are better than the control class's. The highest score in the control class is almost the same as the average value in the experimental class in both classes of 2018 and 2019. In the experimental class, there is an average increase of 14 to 15 points compared to the control class. In addition, the graduation rate of students in the experimental class increased by 33 to 36% compared to the control class. A student is passing this course with a minimum score of 63. Although there is a time difference between the control class and the experimental class, it is certain that no other factors influence the student's passing rate. Both the control class and the experimental class receive the same learning materials, lecture duration, and lecturers.

Increased student understanding is also proved by the results of the questionnaire (Table 2). The questionnaire used has been proven valid with a 5% significance level for all items and a p value $>5\%$ for all factors. The average and minimum scores in the experiment class are higher than those in the control class. In addition, the questionnaire score in the experimental class has a smaller standard deviation than the control class. The small standard deviation indicates that almost all the questionnaire scores in the experimental class are close to the average score. This suggests that the majority of experimental class students choose either four or five (good or very good) on the question of their understanding of immunological examinations ranging from pre-analytic to post-analytic stages. In contrast to the results of questionnaires on control class students, there are those who choose number two (less good), but more who choose number three (good enough).

Table 1. Data of final score of Immunology II D3 MLT students of STIKES Jenderal Achmad Yani Cimahi.

Data	Class of 2017 (Control Class)	Class of 2018 (Experiment Class)	Class of 2019 (Experiment Class)
Highest score	79	86	88
Average score	63.28	78.16	77.58
Lowest score	40	57	55
Number of students passed	70	103	118
Number of students not passed	46	7	4
Passing rate	60.34%	93.63%	96.72%

Table 2. Descriptive statistics total questionnaire score.

Questionnaire Score	Class of 2017 (Control Class)	Class of 2018 (Experiment Class)	Class of 2019 (Experiment Class)
Maximum	39	40	40
Minimum	16	24	26
Average	26.95	37.30	37.53
Standard Deviation	5.74	3.41	2.56

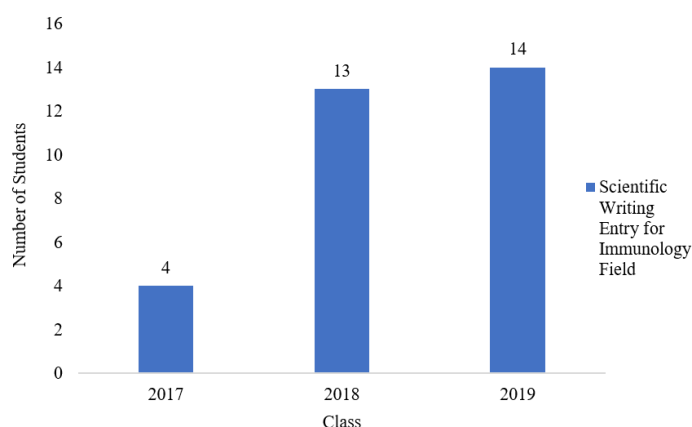


Figure 3. Number of D3 MLT students of STIKES Jenderal Achmad Yani Cimahi interested in scientific writing in the immunology field.

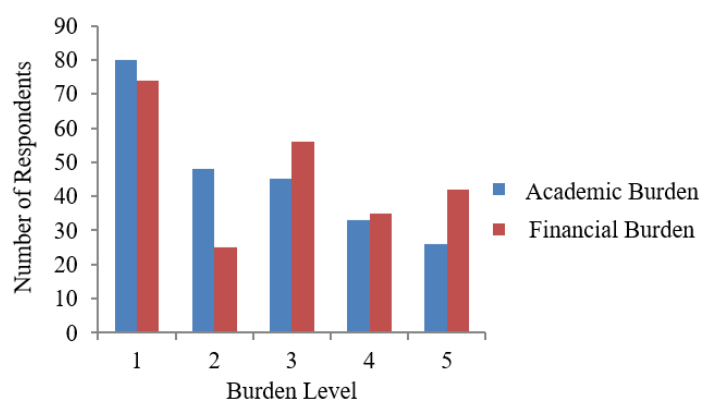


Figure 4. Level of academic and financial burden of D3 MLT students in STIKES Jenderal Achmad Yani Cimahi as effects from recitation method application.

Besides the outcomes of studying, it turns out that the recitation method applied to the experimental classes of 2018 and 2019 can increase the interest of students in conducting research and writing scientific papers in the field of immunology. In [Figure 3](#), there is an increase in the number of students, as many as nine from the previous class.

Effect of the Recitation Method on Academic and Financial Burden

Although this study aims to determine the effect of the application of recitation methods on students' competence, the researcher feels the need to know the influence of assignment type (animation videos and immunology-based devices) on the academic and financial burden of the students. As many as 55% of students do not feel the addition of an excessive academic burden because this task is done in groups for a long period of time ([Figure 4](#)). However, the rest felt the addition of an academic burden. From the financial aspect, there are 18% of students who feel very burdened ([Figure 4](#)). Groups of students who make immunology-related devices will feel burdened because most of the components used are new items. Students should spend their money to purchase tools and materials such as dynamo, paralon, LED lights, power bank, power adapter, and others.

DISCUSSION

The assignment turned out to be a good way to hone student creativity. As proven in the videos 2–4 minutes in length, students are able to explain a complete examination from the pre-analytic stage to the post-analytic stage. Whereas students only use simple tools and materials such as cardboard, colorful paper, candles, coloring tools, and free applications to create videos. Giving this assignment can stimulate creativity because it encourages students to propose ideas, use imagination, find ways to realize ideas, and take the initiative when facing obstacles in realizing the idea. This result is in line with the research of [Anggriani \(2017\)](#), which proves that the recitation method can increase the creativity of physics learners significantly. According to [Mamentu \(2022\)](#), the recitation method can increase creativity because it directs students to study diligently. In addition, this task requires students to create a handiwork so that they use all of their motoric aspects. This is in accordance with the opinion of [Vera \(2012\)](#), which states that learning methods that can enhance creativity are methods that can involve all five senses in learning.

This activity is also able to improve students teamwork abilities. Given the division of the group based on the distribution of academic ability, the resulting assignment becomes evidence that students who have above-average academic ability can work together with students with below-average academic ability. In fact, there are also some groups of students who are able to work with students from other majors and colleges. In the creation of an animated video entitled “Proses Inflamasi” D3 MLT students work together with students from the Department of Visual Communication Design from one of the private universities in Bandung. In addition, in the process of making the Dengue NS1 Giant Immunochromatography tool (Figure 2a) and the antibody emergence simulation tool for HBV (Figure 2b), students work together with students of electronics engineering from one of the public universities in Bandung. The same results are shown in Prasetyo et al. (2013). In the study, it was proven that the recitation method can increase the enthusiasm and cooperation of students studying physics. In fact, Rustam et al. (2014) state that the recitation method tends to increase the social activities of students so that students do not feel competition among individuals in the learning process. Instead, the recitation method emphasizes cooperation or teamwork among students in learning the subject as well as doing group assignments.

According to Hafid (2020), one of the frailties of the recitation method is the difficulty in controlling whether students do the tasks independently, have them done by others, or imitate the work of others. To anticipate this, the progress of the assignment must be shown and reported to the supervisor every two weeks. In addition, at the beginning of the assignment, students were warned that all the resulting work would be displayed to the public, so if there was any form of cheating or plagiarism, students would face legal sanctions. All the videos students have created are uploaded to YouTube channel. In addition to teaching students to create their own work, this also teaches them various sciences. Students not only get knowledge of the making of videos but can also educate others, from schoolchildren, students, health workers, and the wider community, about the mode of disease transmission, prevention mode, human immune response mechanism, and proper inspection procedures. Until now, the animated video entitled “Proses Inflamasi” has been watched more than 10,000 times.

Through this research, it is also known that the recitation method can improve learning outcomes. Some research proves that just by watching animated videos (Berçot et al., 2013) and using simple props (Saputri & Dewi, 2014), learners can better understand the material being taught. So in this study, students should have a deeper knowledge and understanding because they not only watch animated videos or use devices but also make the videos and immunological devices. Khalidiyah (2015) states that animated video is able to provide a stronger visual appearance of various phenomena and abstract information that has an important role in improving the quality of the process and learning outcomes. Suchyandi et al. (2021) also explain that learning using visual aids gives students the opportunity to acquire knowledge, develop psychomotor skills, and foster creativity to solve problems encountered.

The recitation method can also increase student research interest in the field of immunology. This result is in line with the result conveyed by Wibowo et al. (2018) that the recitation method can make students passionate about learning because the learning activities are done with many variations, so it is not as boring. Khalidiyah (2015) mentions that the use of animation in the learning process can provide added value in the form of increased interest, understanding, and skills to work in groups.

In addition to the advantages of the recitation method, through this research, it is known that there are some students who are academically burdened. This is because the D3 MLT lecture system is very busy. Students must attend lectures for six days, from 7.00 AM Western Indonesian Time (12:00 AM UTC) to 5.00 PM Western Indonesian Time (10.00 AM UTC). Studying time was allocated more in the laboratory than in the classroom, and each time the practicum is held, they must take a pre- or post-test so that D3 MLT students are more physically tired when compared with students from other majors. There are also some students who are financially burdened. This can be used as evaluation material for tasks assigned to students. Furthermore, students should utilize used or secondhand goods in the manufacture of immunology-based tools. As revealed by Saputri and Dewi (2014), simple props can be made in accordance with the concept of materials to be taught by utilizing the used materials in the neighborhood without having to incur a lot of expenses.

Although some students feel this task adds to their academic and financial burdens, there are as many as 95% of students who agree that this activity should continue in the following year. Many students even suggest that such assignments be applied to other elusive courses when using traditional learning methods. Students argue that the assignment makes it easier to understand and remember immunological material. There is also an opinion that the task makes the process of learning immunology more enjoyable. So although the recitation method provides additional burden, this method gives more benefit and positive influence to the students.

CONCLUSION

The application of recitation method in the form of making animation video and Immunology based tool can improve D3 MLT student's ability of STIKES Jendral Achmad Yani Cimahi (currently Faculty of Health Science and Technology, Jenderal Achmad Yani University) in conducting medical laboratory examination from pre-analytical, analytic, until post-analytical stage in immunology. In addition, the assignments given can enhance creativity, students' interest in immunology courses, and the ability to work well with colleagues or students from other departments or institutions.

ACKNOWLEDGMENTS

We would like to thank all volunteers who have contributed to this research. We also want to recognize the dedicated suggestions of the learning scientists and lecturers at STIKES Jendral Achmad Yani Cimahi (currently the Faculty of Health Science and Technology, Jenderal Achmad Yani University), who served as advisors on the project. In particular, we would like to acknowledge our reviewers for their thoughtful feedback and the editor of JPS, who helped improve this paper.

FUNDING AGENCIES

This study wasn't supported financially or with outside funds in any way. The authors affirm that they did not receive any grants, sponsorships, or funding from any institutions, organizations, or individuals to conduct this research.

AUTHOR CONTRIBUTIONS

PGN was responsible for the theoretical framework and research design. PN facilitated participant recruitment, administered assessments, and conducted interviews. Both authors contributed to data interpretation, manuscript writing, and approved the final version.

CONFLICT OF INTEREST STATEMENT

Regarding the research, writing, and publication of this paper, the authors state they have no competing interests.

REFERENCES

- Anggaraini, A. (2017). *Pengaruh pemberian metode resitasi terhadap kreativitas dan hasil belajar peserta didik fisika berorientasi modifikasi jigsaw materi listrik statis di kelas IX MTsN Balang-Balang Gowa* (Undergraduate Thesis, Universitas Islam Negeri Alauddin Makassar, Makassar, Indonesia). Retrieved from <https://repositori.uin-alauddin.ac.id/9727/>
- Berçot, F. F., Fidalgo-Neto, A. A., Lopes, R. M., Faggioni, T., & Alves, L. A. (2013). Virtual immunology: Software for teaching basic immunology. *Biochemistry and Molecular Biology Education*, 41(6), 377–383. <https://doi.org/10.1002/bmb.20733>
- Boye, S., Moen, T., & Vik, T. (2012). An e-learning course in medical immunology: Does it improve learning outcome?. *Medical Teacher*, 34(9), e649–e653. <https://doi.org/10.3109/0142159X.2012.675456>
- Hafid, N. (2020). *The effect of using recitation method to improve students' vocabulary at MTS DDI Mattoanging* (Undergraduate Thesis, Universitas Muhammadiyah Makassar, Makassar, Indonesia). Retrieved from https://digilibadmin.unismuh.ac.id/upload/10420-Full_Text.pdf
- Hasanah, U., & Nulhakim, L. (2015). Pengembangan media pembelajaran film animasi sebagai media pembelajaran konsep fotosintesis. *Jurnal Penelitian dan Pembelajaran IPA*, 1(1), 91–106. <https://doi.org/10.30870/jppi.v1i1.283>
- Husáková, M. (2015). Using concept maps in education of immunological computation and computational immunology. In M. Núñez, N. T. Nguyen, D. Camacho, & B. Trzaskowski (Eds.), *Computational Collective Intelligence*. Proceedings of the 7th International Conference, ICCCI 2015 (pp. 461–470). Madrid, Spain. https://doi.org/10.1007/978-3-319-24306-1_45
- Idus, M. R. A., & Wahyuningsih, F. (2016). Penerapan metode resitasi dalam pembelajaran keterampilan menulis bahasa Jerman kelas XI bahasa SMA Negeri 13 Surabaya. *Latere*, 5(2), 1–14. <https://doi.org/10.26740/lat.v5n2.p%25p>
- Kementerian Kesehatan Republik Indonesia. (2014). *Kurikulum Pendidikan Diploma 3 Teknologi Laboratorium Medik*. Jakarta, Indonesia: Kementerian Kesehatan Republik Indonesia.
- Kementerian Kesehatan Republik Indonesia. (2015). *Peraturan Menteri Kesehatan tentang Izin dan Penyelenggaraan Praktik Ahli Teknologi Laboratorium Medik*. Jakarta, Indonesia: Kementerian Kesehatan Republik Indonesia.
- Khalidiyah, H. (2015). The use of animated video in improving students' reading skill (A quasi-experimental study of seventh grade student at a junior high school in Jalancagak, Subang). *Journal of English and Education*, 3(1), 59–79.
- Mamentu, M. D. (2021). Online class resitation learning model during the COVID-19 pandemic to increase outcomes students learning in class accounting lessons. *International Educational Research*, 4(2), 40–53. <https://doi.org/10.30560/ier.v4n2p40>
- Mitasari, Z., & Gofur, A. (2017). Developing the immunologybook for animal and human physiology subject. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 3(2), 141–148. <https://doi.org/10.22219/jpbi.v3i2.4325>
- Mohan, B. S., Nambiar, V., & Arvindkshan, R. (2017). Patient-oriented problem-solving: An effective educational tool for learning immunology. *International Journal of Dental and Medical Specialty*, 4(1), 2–7. <https://doi.org/10.5958/2394-4196.2017.00002.4>
- Nankervis, S., Meredith, G., Vamplew, P. & Fotinatos, N. (2012). Taming the devil: A game-based approach to teaching immunology. In M. Brown, M. Hartnett & T. Stewart (Eds.), *Proceedings of ASCILITE - Australian Society for Computers in Learning in Tertiary Education Annual Conference 2012*. Australasian Society for Computers in Learning in Tertiary Education. Retrieved from <https://www.learnlib.org/p/42669/>
- Nurhayati, N. (2016). Penerapan metode resitasi untuk meningkatkan hasil belajar siswa kelas VI SDN 2 Panau pada mata pelajaran PKn. *Jurnal Kreatif Tadulako*, 4(11), 249–256.
- Persatuan Ahli Teknologi Laboratorium Kesehatan Indonesia. (2017). *Keputusan Musyawarah Nasional Kedelapan Persatuan Ahli Teknologi Laboratorium Kesehatan Indonesia*. Yogyakarta, Indonesia: Persatuan Ahli Teknologi Laboratorium Kesehatan Indonesia.
- Prasetyo, Z. K., Rosana, D., & Wilujeng, I. (2013). Berbagai bentuk metode resitasi pada peningkatan kualitas pembelajaran fisika di SMA. *Jurnal Pendidikan Matematika dan Sains*, 1(1), 8–16. <https://doi.org/10.21831/jpms.v1i1.12472>
- Rustam, A. S. P., Tawil, M., & Amin, B. D. (2014). Penerapan metode resitasi untuk meningkatkan hasil belajar fisika peserta didik kelas XI IPA SMA Negeri 1 Bangkala Barat Kabupaten Jeneponto. *Jurnal Pendidikan Fisika*, 2(3), 175–182. <https://doi.org/10.26618/jpf.v2i3.233>
- Saputri, V. A. C., & Dewi, N. R. (2014). Pengembangan alat peraga sederhana eye lens tema mata kelas VIII untuk menumbuhkan keterampilan peserta didik. *Jurnal Pendidikan IPA Indonesia*, 3(2), 109–115. <https://doi.org/10.15294/jpii.v3i2.3108>
- Sari, N. W., & Samawi, A. (2014). Pengaruh penggunaan media animasi terhadap hasil belajar IPA siswa slow learner. *Jurnal Penelitian dan Pengembangan Pendidikan Luar Biasa*, 1(2), 140–144. <http://doi.org/10.17977/um029v1i22014p140-144>

- Suchyadi, Y., Safitri, N., Sutisna, E., Sukmanasa, E., Karmila, N., Handayani, R., ... Mirawati, M. (2021). Using a multimedia as an effort to improve creative thinking skills of elementary teacher education college student. *Proceedings of the 11th Annual International Conference on Industrial Engineering and Operations Management* (pp. 2948–2954). Singapore: IEOM Society International. Retrieved from <http://www.ieomsociety.org/singapore2021/papers/535.pdf>
- Sukiyasa, K., & Sukoco, S. (2013). Pengaruh media animasi terhadap hasil belajar dan motivasi belajar siswa materi sistem kelistrikan otomotif. *Jurnal Pendidikan Vokasi*, 3(1), 126–137. <https://doi.org/10.21831/jpv.v3i1.1588>
- Vera, A. (2012). *Metode Mengajar Anak di Luar Kelas (Outdoor Study)* (1st ed.). Yogyakarta, Indonesia: DIVA Press.
- Wibowo, D. C., Friana, F., & Pelipa, E. D. (2018). Effect of recitation method to the students' interest and learning results. *Jurnal Studi Guru dan Pembelajaran*, 1(1), 16–20. <https://doi.org/10.30605/jsgp.1.1.2018.22>
- Yulisa, Y., Hakim, L., & Lia, L. (2020). Pengaruh video pembelajaran fisika terhadap pemahaman konsep siswa SMP. *Jurnal Luminous: Riset Ilmiah Pendidikan Fisika*, 1(1), 37–44. <https://doi.org/10.31851/luminous.v1i1.3445>
- Zhang, L., Bowman, D. A., & Jones, C. N. (2019). Enabling Immunology Learning in Virtual Reality Through Storytelling and Interactivity. In J. Y. C. Chen & G. Fragomeni (Eds.), *Virtual, Augmented and Mixed Reality. Applications and Case Studies*. Proceedings of the 11th International Conference, VAMR 2019, Held as Part of the 21st HCI International Conference, HCII 2019 (pp. 410–425). Orlando, FL, USA. Springer International Publishing. https://doi.org/10.1007/978-3-030-21565-1_28
- Zhang, Z., Liu, W., Han, J., Guo, S., & Wu, Y. (2013). A trial of patient-oriented problem-solving system for immunology teaching in China: A comparison with dialectic lectures. *BMC medical education*, 13(1), 1–8. <https://doi.org/10.1186/1472-6920-13-11>