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Strengthening of Biomolecular Engineering Competence for Pharmacists in Batu City through Webinars and Workshops on Isolation of Genetic Material, Real-Time PCR, and its Applications in the Clinical Field

Rehmadanta Sitepu[1*], Godeliva Adriani Hendra[2], F.X. Haryanto Susanto[3], and Aditya Nirwana[4]

[1,2,3]Pharmacy Study Program, Ma Chung University, Jl. Villa Puncak Tidar N-1, Malang, Indonesia, 65151
[4]Visual Communication Design Study Program, Ma Chung University, Jl. Villa Puncak Tidar N-1, Malang, Indonesia, 65151

Correspondence: rehmadanta.sitepu@machung.ac.id

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Abstract. The pandemic of COVID-19 has forced pharmacist assistance practitioners to strive to improve their qualifications and competencies, especially in molecular biology. The human resources competencies in this field are still lacking, resulting in some obstacles in the handling of COVID-19 encountering, thus hampering the acceleration of post-pandemic recovery. The Virus that can spread rapidly requires competent health workers to move as quickly as possible to overcome this pandemic condition. Ignorance of these critical technical matters often occurs so that it affects the identification results, which are expected to be more accurate, precise, and reliable. In a workforce to increase the competency capacity of pharmacist assistants in the biomolecular field, especially in the technical competence of genetic material isolation and PCR methods, the Pharmacy Study Program of Ma Chung University held Webinars and Workshops related to DNA isolation and quality testing. The webinar and workshop on the isolation of genetic material were carried out to implement one of the research topics in the Pharmacy Study Program, especially in the field of development of molecular biology. Several studies here have focused on molecular biology approaches. The essential thing in this webinar and workshop is discussing some critical criteria before the actual virus identification. This program collaborates with PAFI (Indonesian Pharmacy Experts Association) of Batu City as a partner. People who took part in this event consisted of 63 persons from the Batu City and Malang City areas. Most of the participants work in health facilities, with 50% of the participants having isolated genetic material and PCR (Polymerase Chain Reaction). Spreading the pre and post-test with the same questions increased the average acknowledgment score from 42.9 to 61.1. This indicates that continuous training in this field needs to be held on an ongoing program so that the competence of pharmacists in the field of molecular biology is getting better.

Keywords: pharmacists assistants, molecular competencies, isolation, DNA, PCR

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INTRODUCTION

Genetic material, in this case, DNA (Deoxyribose Nucleic Acid) or RNA (Ribo Nucleic Acid), is a hot topic of discussion during this pandemic because it is related to identifying the COVID-19 Virus. But unfortunately, the number of experts who have competence in isolating genetic material is still minimal, so the acceleration of handling COVID-19 has not been able to reach an excellent optimal point. Medical personnel who have this competence are still very minimal, so in a short period of time, Indonesia is forced to have medical personnel with competencies that can isolate and identify genetic material.

Several studies conducted in the Bachelor of Pharmacy Study Program at Ma Chung University are more focused on the molecular field, such as Molecular Analysis of Gene Expression Related to The Effects of DLBS3233 Treatment in Differentiation of 3T3-L1 Pre-Adipocyte (Sitepu et al., 2016) and Genetic Identification Lactobacillus in Rice Wash Water Fermentation with PCR (Polymerase Chain Reaction) (Sitepu et al., 2021). This shows that the Bachelor of Pharmacy Study Program at Ma Chung University has the capacity and competence to identify and perform analyses related to genetic material.

This research is also expected to be implemented in the community to accelerate the isolation and identification of genetic material related to the COVID-19 pandemic. For this reason, training is needed to increase the competence of medical personnel, in this case, pharmaceutical personnel, so that the acceleration of handling COVID-19 can be optimized so that the pandemic could end in a short time. This training focuses on isolating and testing the quality of good genetic material to be adequately tested using other methods, especially the real-time PCR method.

PROBLEMS

Experts in molecular biology can be minimal because the number of study programs that promote this competency is minimal. The lack of teaching staff in this field so that human resources can't be optimally empowered towards competence in the molecular area. This competence is needed in solving problems related to disease diagnosis and treatment. The emergence of extraordinary events related to coronavirus infection, for example, really requires experts in the field of molecular biology to overcome and treat virus infections.

Molecular competence, in general, is full of theory and not adequately balanced with practical work in the laboratory. This is also one of the reasons why students' interest in studying the exact field has decreased due to a lack of understanding related to these subjects,

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when in fact, Biology subjects prioritize in-depth observations of the surrounding environment.

DNA (Deoxyribonucleic Acid) and RNA (Ribonucleic Acid) are materials for storing genetic information and genetic expression (Douglas et al., 2010). Understanding DNA and RNA is significant because, with this competency, kits can identify a disease, pathogenic bacteria or viruses, or clone using recombinant DNA technology to produce specific products. A correct understanding of genetic material is needed so that pharmacists have the right view of DNA and are willing to work in related fields.

METHOD OF IMPLEMENTATION

The program implementation is conducted using the webinar method, and workshops are run through the Zoom media. Participants who took part in the webinars and workshops were members of the IPEA/PAFI (Indonesian Pharmacist Experts Association) Batu City. The webinar topics discussed are related to the introduction of genetic material, the implementation of real-time PCR technical quality, and the implications of biomolecular techniques in clinical practice. The workshop provided was in the form of a workshop on isolating genetic material (DNA) and determining its quantity and purity. The program for implementing the activities can be seen in Table 1. Before and after the webinar, enrichment questions were given to see how far the material could be understood by the participants of the webinar and workshop.

Table 1. Schedule of Service Activities with IPEA/PAFI Partners Batu City

No.	Activity	Room
	Webinar	
1.	Methods of isolation of genetic material and aspects of its quality.	*Zoom*
2.	*Real-time* PCR and the essential things to consider in its implementation.	*Zoom*
3.	Implementation of molecular biology methods in clinical.	*Zoom*
	Workshop	
1.	DNA isolation using isolation kits,	Community Service Team
2.	DNA quality test using the spectrophotometry-one drop.	Community Service Team

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The test contents contained information on how to isolate DNA using an isolation kit and the quality of DNA using spectrophotometry-one drop. Participants took the test through a google form. Before the questions were given to the participants, the pre-test and post-test questions were reviewed by the service lecturer team.

RESULTS AND DISCUSSION

Webinars and workshops are held online using the Zoom application, divided into two parts, namely: webinars and workshops. The webinar is divided into three main topics: Introduction of Genetic Material, Technical Implementation of real-time PCR, and implementation of molecular biology techniques in clinical research. The workshop provided was in the form of Isolation of Genetic Material using Adsorption Techniques and Testing the Quantity and Quality of DNA isolated.

First Session: Methods of isolation of genetic material and aspects of its quality

This session is more directed to the introduction of macromolecules. Genetic materials such as DNA and RNA are included in these macromolecules (Sorber et al., 2017). This session also explained the basic structure of genetic material, three standard methods for isolating genetic material, and determining the concentration and quality of genetic material. Figure 1 shows the running of the online program.

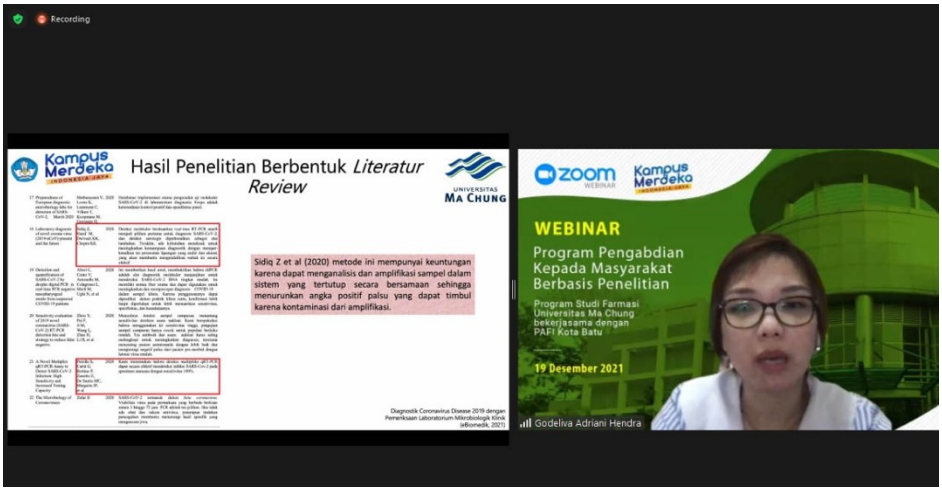

Figure 1. The online program implementation process

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Second Session: Real-time PCR and the important things that should be consider in its implementation

This session described essential aspects to prepare before carrying out the actual identification test using real-time PCR (rtPCR). There are four primary purposes for using rtPCR: diagnostics, gene expression analysis, DNA/RNA quantification, and multigene target analysis (An et al., 2018; Kralik & Ricchi, 2017). Important things that need to be prepared before the test is carried out are:

1. Target amplicons and primary design (Cannon et al., 2019)

   It is essential to know the profile and characteristics of the target gene amplicon. Some basic general shapes to know are:

   - Target gene length
   - The allele variation of the target gene
   - The cell type of the target gene, whether in prokaryotic or eukaryotic cells.

2. DNA/RNA purity

   The purity of DNA/RNA dramatically affects the result of the rt-PCR system used. The presence of impurities can inhibit the amplification process and, the readings carried out by the fluorescent reagent. Therefore, after isolation, it is necessary to test the concentration and purity of DNA/RNA using spectrophotometry or electrophoresis. The service team appointed these criteria to conduct a workshop as part of the preparations before the actual test.

3. Reverse transcription system

   Two reverse transcription systems are carried out: a single-stage reverse transcription system and a two-stage reverse transcription system. The type of reverse transcription is selected according to the reagents and the type of PCR machine that we have (Kang, 2019).

4. Control and normalization

   In the identification process using rtPCR, internal controls need to be included in the identification process. The selection of internal control is essential because it affects the normalization process. This webinar described some commonly used internal controls and how normalization measurements are carried out.

5. Evaluate efficiency, sensitivity, and reproducibility using standard curves

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The primers' efficiency, sensitivity, and reproducibility need to be determined so that the validity of the results can be adequately accounted for. This is because the three primary aspects significantly affect the reading of the rtPCR results (Bonab et al., 2015).

Third Session: Application of molecular method techniques in the clinical field

The third session explained the relationship between clinical aspects and molecular biology methods. Some of the clinical elements discussed involve clinical studies conducted using a molecular biology approach. This webinar explained how rt-PCR is used as a standard in identifying COVID-19. This webinar further emphasized the significant difference in results between rtPCR and conventional PCR (Alteri et al., 2020).

Workshop

As shown in Figure 2, the workshop was carried out by involving students as part of the field implementation team to record the results of DNA isolation and identification in the laboratory. Isolation was carried out using an isolation kit with the adsorption method. This adsorption method is evident by using a mini-column as a DNA barrier (Ware et al., 2020).

The concentration and purity of DNA were carried out using nanodrop spectrophotometry. The DNA concentration was measured at wavelength A260, then plotted against the calibration curve obtained from the device. Purity was tested using the calculated ratio A260/A280. A good purity ratio was obtained from 1.8 to 2.0 (Domínguez-Vigil et al., 2019).

Figure 2. Workshops on Isolation of Genetic Material.

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Activity Evaluation

To measure the success of this community service activity, the author gave two tests: pre-test and post-test. Both trials had the same question, namely measuring competence. The test was in the form of multiple-choice with four available choices made. In the pre-test, it has been added five questions that support the demographic data. Before the test began, the test's purpose was explained in advance. Through participant approval, the service team obtained permission to collect test results. The data obtained is used as a benchmark for implementing the service.

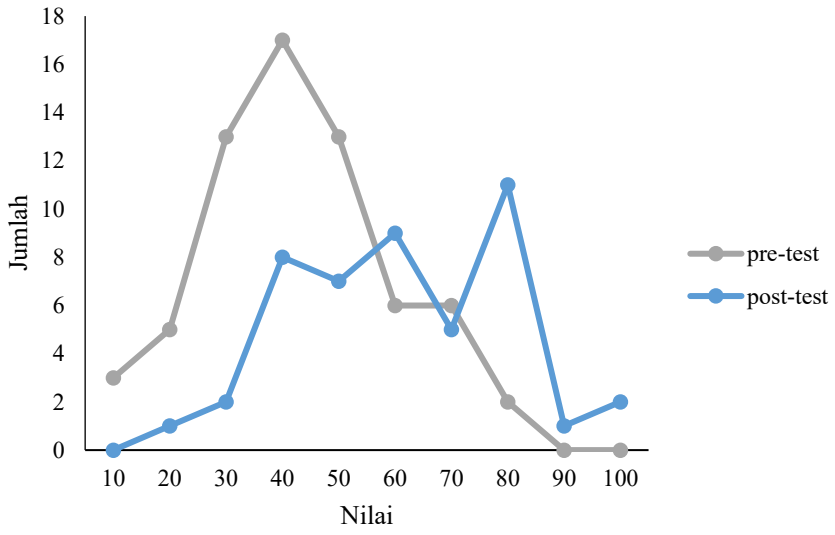

Figure 3. Results of pre-test and post-test of webinar participants

In the pre-test and post-test results shown in Figure 3, there was an accumulation of the number of values between the ranges of 20-60 at the time of the pre-test. The post-test results showed a good chance where the number of participants with a score of 50-80 became more. The average pre-test result was 42.9 and increased to 61.1 at the post-test. As shown in Figure 4, demographic data obtained from participants showed that 70% of the participants work in health departments such as pharmacies and hospitals. Around 51% of participants came from Batu City, and 43% came from Malang City. 48% already understand you related to DNA isolation and PCR, while the rest have never done it. Interestingly, 35% of the participants had practiced DNA isolation and PCR.

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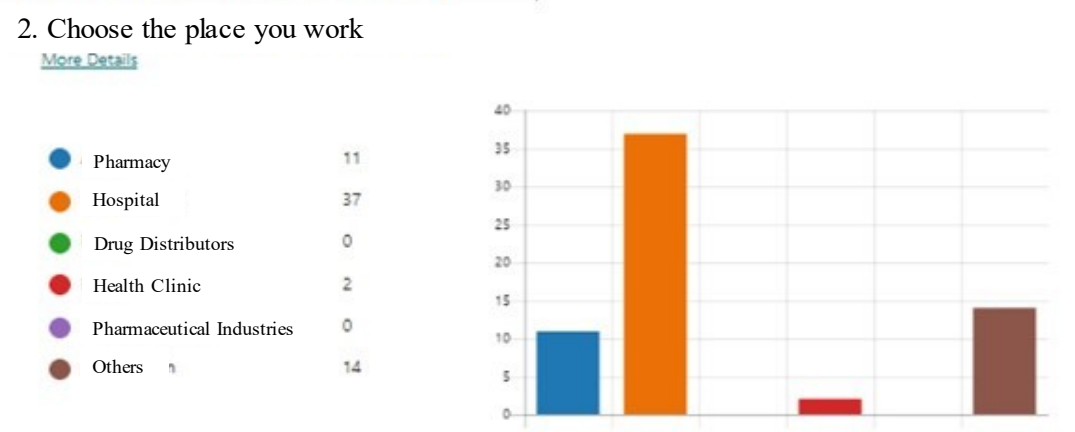
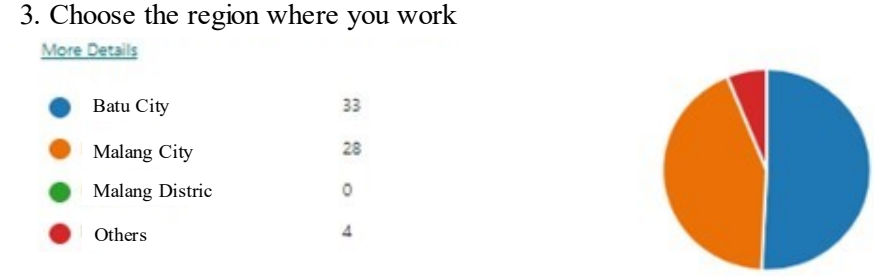
The results of the exit survey (Figure 5), which were distributed after the workshop was over, showed that from the four questions asked, the team got an idea that:

1. Participants' understanding increased related to knowledge of DNA, where the score obtained was 4.40 on a scale of 5.00.
2. The adsorption isolation technique could be well understood with training, where the score obtained is 3.60 out of a scale of 5.00.
3. The purification technique could be well understood; the score obtained is 3.70 on a scale of 5.00

One thing that needed improvement was the delivery of DNA concentration and purity measurement, which only got a score of 3.15 out of a 5.00 scale.





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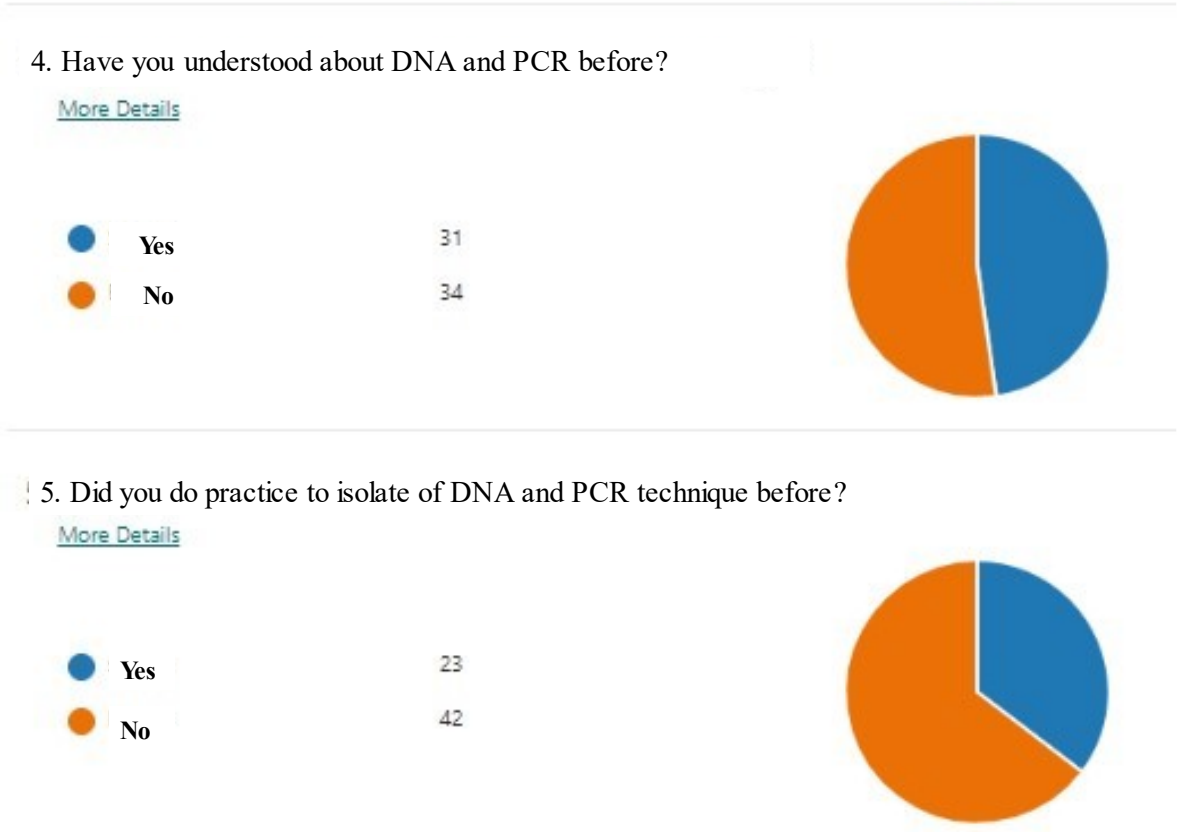

Figure 4. Demographic data of webinar and workshop participants.

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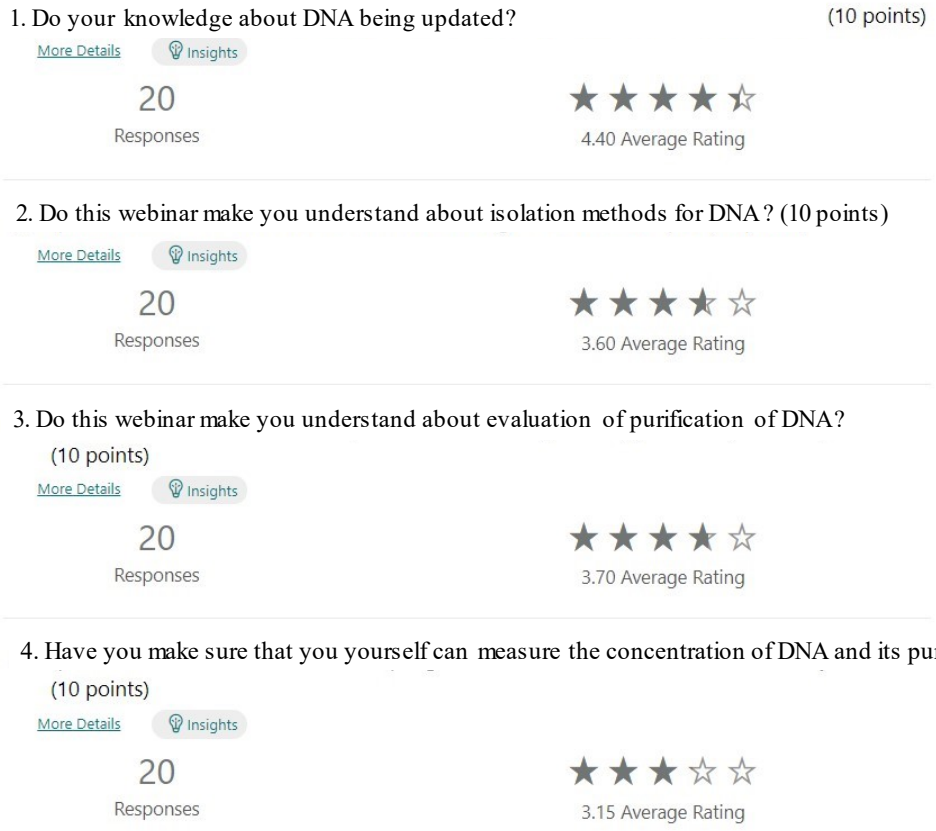

Figure 5. Results of the exit survey for webinars and workshops.

CONCLUSION

The community service program results can be concluded that understanding genetic material, DNA isolation, and its implementation in the clinical field can be well received by showing an increase in the number of participants' scores from pre-test to post-test. Another conclusion was that the workshop could run well and was enthusiastically welcomed by the participants; this was reflected in some comments that wanted similar seminars and workshops to be held in the future.

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Original Title:
Penguatan Kompetensi Teknik Biomolekular Bagi Ahli Farmasi di Kota Batu melalui Webinar dan Workshop Isolasi Materi Genetik, *real-time PCR*, dan Aplikasinya di Bidang Klinis

Abstrak. Pandemi Covid-19 memaksa ahli farmasi berupaya untuk meningkatkan kualifikasi dan kompetensinya terutama di bidang biologi molekuler. Minimnya sumber daya manusia yang memiliki kompetensi di bidang ini mengakibatkan penanganan Covid-19 menemui kendala sehingga menghambat percepatan pemulihan pasca pandemi. Penyebaran virus yang begitu cepat mengharuskan tenaga Kesehatan untuk bergerak secepat mungkin dalam mengatasi kondisi pandemic ini. Pengabaian hal-hal teknis yang penting sering terjadi sehingga mempengaruhi hasil identifikasi yang diharapkan dapat lebih akurat, presisi dan dapat diandalkan. Dalam upaya peningkatan kapasitas kompetensi para ahli farmasi di bidang biomolekuler terutama pada kompetensi teknis isolasi materi genetik dan metode PCR, maka Program Studi S1 Farmasi Universitas Ma Chung menyelenggarakan Webina dan Workhsop terkait dengan isolasi DNA dan uji kualitas mutunya. Webinar dan workshop isolasi materi genetik ini dilaksanankan sebagai bentuk impementasi penelitian Prodi S1 Farmasi Universitas Ma Chung terutama di pengembangan bidang biologi molekuler. Beberapa penelitian memang difokuskan pada pendekatan biologi molekuler. Hal-hal yang menjadi bagian utama dalam webinar dan workshop ini adalah untuk menegakkan beberapa kriteria-kriteria penting sebelum identifikasi virus yang sebenarnya dilaksanakan. Pengabdian ini melakukan kerjasama dengan PAFI (Persatuan Ahli Farmasi Indonesia) Kota Batu sebagai mitra. Peserta yang mengikuti acara ini terdiri dari 63 orang yang berasal dari daerah Kota Batu dan Kota Malang. Hampir sebagian besar peserta berkerja di fasilitas kesehatan dengan 50% dari peserta pernah melakukan isolasi materi genetik dan PCR (*Polymerase Chain Reaction*). Penyebaran tes sebelum dan sesudah webinar dengan pertanyaan yang sama menghasilkan peningkatan nilai rata-rata dari 42,9 menjadi 61,1. Hal ini menandakan pelatihan berkelanjutan dalam bidang ini perlu diadakan secara berkesinambungana, sehingga kompetensi ahli farmasi dalam bidang biologi molekuler semakin baik.

Kata kunci: ahli Farmasi, kompetensi molekuler, isolasi, DNA, PCR

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