



# Technology simulation training in the production of drug tablets for pharmaceutical vocational school students in Bekasi City

Reza Anindita <sup>a,1,\*</sup>, Maya Uzia Beandrade <sup>a,2</sup>, Intan Kurnia Putri <sup>a,3</sup>, Dede Dwi Nathalia <sup>a,3</sup>, Melania Perwitasari <sup>a,3</sup>

<sup>a</sup> Department of Pharmacy, STIKES Mitra Keluarga, Jl. Pengasinan, East Bekasi City, 17113 West Java, Indonesia

<sup>1</sup> rezaanindita@gmail.com \*; <sup>2</sup> maya.uzia@stikesmitrakeluarga.ac.id ; <sup>3</sup> intan.kurnia.p@stikesmitrakeluarga.ac.id ;

dededwi.nathalia@stikesmitrakeluarga.ac.id ; melania.perwitasari@stikesmitrakeluarga.ac.id

\* Corresponding author

ARTICLE INFO	ABSTRACT
<p><b>Article history</b>            Received: 2023-02-10            Revised: 2023-02-10            Accepted: 2023-05-22            Published: 2023-06-27</p> <p><b>Keywords</b>            Tablets            Pharmacy            Community            Service            SDGs</p>	<p>One of the most dominant types of preparations used by the public is tablets. This community service and empowerment (CSE) aims to introduce and provide training on making tablets with innovative tablet printing machine technology in the pharmaceutical industry and to build partners with SMKs to provide access to education for the vocational level by science and technology while at the same time offering a scholarship program as access to continuing higher education at STIKes Mitra Keluarga for high achieving and financially disadvantaged students. This CSE method includes planning carried out by making an offer to the Pharmacy Vocational School in Bekasi City and making activity flyers to be distributed for class 12, 10, and 11. The implementation was carried out by giving pre-tests, materials, and simulation practices for making drugs with tablet printing machines at STIKES Mitra Keluarga. The evaluation stage is carried out by giving post-test questions. Data analysis in this study was carried out using descriptive and comparative tests using paired t-tests. The results of this CSE show that the value of knowledge and understanding of 35 students before being given material treatment and training was 57 and after being given treatment it was 94 with a percentage increase of 43%. Therefore, this CSE activities is able to increase the knowledge and understanding of 35 class X, XI and XII students of the Bakti Kartini Pharmacy Vocational School regarding making medicine using a tablet printing machine in a real way.</p>
<p><b>Kata kunci</b>            Farmasi            Masyarakat            Pengabdian            SDGs            Tablet</p>	<p><b>Pelatihan simulasi teknologi pembuatan tablet obat pada siswa/i smk farmasi di kota bekasi salah satu jenis sediaan yang paling dominan digunakan oleh masyarakat adalah tablet.</b> Salah satu jenis sediaan yang paling dominan digunakan oleh masyarakat adalah tablet. Tujuan PKM ini adalah memperkenalkan dan memberikan pelatihan pembuatan tablet dengan teknologi inovasi mesin cetak tablet di bidang farmasi industri dan membangun mitra dengan pihak SMK sehingga memberikan akses pendidikan bagi level kejuruan sesuai dengan IPTEK sekaligus menawarkan program beasiswa sebagai akses melanjutkan ke pendidikan tinggi di STIKes Mitra Keluarga bagi siswa SMK berprestasi dan tidak mampu secara finansial. Metode PKM ini meliputi perencanaan yang dilakukan dengan melakukan penawaran pada pihak SMK farmasi di Kota Bekasi dan pembuatan flyer kegiatan untuk disebar ke siswa kelas 10,11, dan 12 di Kota Bekasi. Tahap pelaksanaan dilakukan dengan pemberian pretest, materi dan praktik simulasi pembuatan obat dengan mesin cetak tablet di STIKES Mitra Keluarga. Tahap evaluasi dilakukan dengan memberikan soal posttest. Analisis data pada penelitian ini dilakukan dengan uji deskriptif dan komparatif menggunakan t-test paired. Hasil PKM ini menunjukkan nilai pengetahuan dan pemahaman 35 siswa sebelum diberi perlakuan materi dan pelatihan sebesar 57 dan sesudah diberi perlakuan sebesar 94 dengan persentase kenaikan sebesar 43%. Oleh karena itu, PKM ini mampu meningkatkan pengetahuan dan pemahaman 35 siswa kelas X, XI, dan XII SMK Farmasi Bakti Kartini mengenai pembuatan obat menggunakan mesin cetak tablet secara nyata.</p>

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## INTRODUCTION

One of the most widely produced types of pharmaceutical preparations by the pharmaceutical industry is tablets. According to data from Badan Pengawas Obat dan Makanan (BPOM) (2006) of all pharmaceutical preparations, tablets are the most dominant pharmaceutical preparations used with a usage percentage of 70%. This is because tablets are pharmaceutical preparations that are easily stored and used by the public (consumers). However, to produce good tablets, they must comply with BPOM (2012) No HK. 03.1.33.12.12.8195 regarding aspects of GMP, including quality management, personnel, Building and Facilities, Equipment, Sanitation, Hygiene, Production, Quality Control, Self-Inspection, quality audit, Complaint handling, documentation, manufacture, contract analysis, qualification, and validation. GMP is a basic guideline in the manufacture of drugs that involves all aspects of production and quality control in the manufacture of drugs.

One aspect of drug manufacturing is printing using a tablet press. This aspect is considered important considering that tablet printing with a tablet machine will affect the friability and hardness of the tablet (Kurniati, 2017). According to Ani (2016) the fragility of tablets describes the amount of loss of surface material from compressed tablets, so low friability is necessary to keep the tablet weight constant, especially during packaging, coating, and transportation, while tablet hardness indicates that the tablets made must have sufficient hardness. so that it is easy to consume and digest by consumers.

Given the importance of an overview of tablet printing technology, this technology is important knowledge for prospective pharmacy graduates, especially vocational students who need to be introduced early on. Based on the situation analysis from the results of discussions with one of the principals of the Pharmacy Vocational School in Bekasi City, it was stated that the pharmaceutical technology subject for the SMK level had not yet introduced the process of making drugs with tablet machines. Vocational High School students are more focused on competence in the field of clinical pharmacy and are ready to work in hospitals, drugstores, pharmacies, and health centers. Even though SMK students have not been able to fully focus on the pharmaceutical industry, they need to be introduced to tablet printing to foster passion, vision, imagination, and creativity for a career in the pharmaceutical industry.

Referring to the problems above, the Community Service and Empowerment (CSE) activity team trying to create a school-integrated CSE program. The taking of this CSE problem is based on several publications of previous CSE activities related to technology in the pharmaceutical industry, namely Anwar *et al.* (2022) who introduced the use of Ultraviolet-Visible (UV-Vis) spectrophotometry for the analysis of Rhodamine B textile dyes in SMA Negeri 80 Sunter North Jakarta using the percentage method. Eden & Harjono (2019) who conducted CSE on High Performance Liquid Chromatography (HPLC) training for Pharmacy Vocational High School teachers in Semarang City with a program approach that is more technical towards making solutions, calculations, data analysis and discussion of problems related to HPLC drug concentration procedures.

Based on the results of previous CSE, there has never been any CSE regarding simulation training using a tablet printing machine, so this CSE update is not only in the selection of pharmaceutical technology, but also in the provision of training in the form of live simulation in the STIKes Mitra Keluarga laboratory for Pharmacy Vocational High School students. This CSE activity simultaneously supports the Sustainable Development Goals (SDGs) program to reduce the gap in access to technology in the pharmaceutical sector by SMK in Bekasi who are still classified as middle to lower class (United Cities and Local Governments, 2017). The short-term goals of this CSE have been integrated with the SDGs goals, including introducing and providing simulation training for making drugs with tablet printing machine innovation technology in the pharmaceutical industry, building partners with SMK so as to provide access to education at the vocational level in accordance with Science and Technology, offers a scholarship program so that it provides an opportunity to continue to higher education at STIKes Mitra Keluarga for high achieving and financially disadvantaged SMK students (Sutopo *et al.* 2014; Said *et al.*, 2016) This CSE is expected to be able to open students' knowledge so that they are not only focused on clinical pharmacy, but are also motivated to be interested in continuing to higher education or industrial internship activities so that they are involved in realizing the SDGs program in the field of industrial pharmaceutical technology. (Badan Perencanaan Pembangunan Nasional (BPN), 2020)

The existence of this CSE activity also provides benefits for lecturers as presenters to see directly the problems that occur in the world of education at the vocational high school level. On the other hand, for the school, this CSE activity also provides positive feedback, especially for teachers to improve professional competence and as a basis for submitting instrument grant proposals in the pharmaceutical industry at the SMK level.

## METHOD

### Preparation stage

This CSE activity was held on November 26, 2022, at STIKes Mitra Keluarga East Bekasi. The CSE preparation stage was carried out by collecting contact numbers for Pharmacy Vocational Schools in Bekasi City. The contact numbers that have been collected are then selected and contacted to be offered an offer regarding the title of the school-integrated CSE program for SMK students. If both parties have agreed, then an agreement is made on the implementation time, the number of students, accompanying teachers, and STIKes then plans transportation funds, consumption, and creates student groups for information notification (broadcast) and distribution of digital flyers containing activity announcements and Google registration forms to be distributed via WhatsApp to Pharmacy Vocational High School students. The form of this CSE flyer can be seen in Figure 1.



Figure 1. CSE Flyer

### Implementation Stage

At this stage, Pharmacy Vocational School students and accompanying teachers who are the target of CSE activities are gathered in the STIKes Mitra Keluarga lecture room to work on pre-tests and material explanations from CSE speaker lecturers. Participants were instructed to work on pre-test questions first. The pre-test questions are done online which can be accessed by students using handphone via the Google Form link which is distributed through the WhatsApp group for class 10, 11 and 12 in Pharmacy Vocational Schools. As for the pretest question indicators listed in Table 1.

Table 1. Pre-test question indicators

No	Question indicators
1	The definition of tablets according to the Indonesian Pharmacopoeia VI
2	Tablet components
3	Excipients in the tablet
4	Examples of excipients from binders
5	Understanding of disintegrant on tablets
6	Method of making tablets
7	Tablet disintegration time
8	Tablet manufacturing equipment
9	Tablet hardness requirements

Next, a presentation was made using the lecture method with material on the basics of making medicine using a tablet press. The material points presented in this CSE can be seen in Table 2

**Table 2.** CSE Material

No	Material
1	Drug meaning
2	drug preparation method
3	tablet manufacturing technology.

Participants then took a tour of the STIKes Mitra Keluarga laboratory in pharmacognosy, pharmaceuticals, pharmaceutical services, pharmacology, and pharmaceutical technology laboratories. Participants who have taken part in the laboratory tour are then gathered at the pharmaceutical technology laboratory to conduct training on drug manufacturing simulations with tablet presses. Participants who have carried out all CSE activities are then gathered back in the lecture room to carry out the post-test. This implementation activity was also carried out by conducting interviews with accompanying teachers and providing promotions regarding opportunities for new student acceptance scholarships STIKes Mitra Keluarga.

### Evaluation Stage

The final stage is evaluation. At this stage it was carried out by collecting all data which included photo documentation, interview results, pre-test scores, and post-tests. All data was then processed in the form of tables and graphs, and analyzed using descriptive and comparative statistical tests (t-test) to obtain information about the level of students' knowledge and understanding of the basics of drug manufacturing using tablet printing machines.

## RESULTS AND DISCUSSION

Based on the results of the CSE activity program offered to Pharmacy Vocational Schools in Bekasi City, it was found that participants who were interested in participating in this CSE activity were 39 students from mixed-level students class X, XI, and XII Bhakti Kartini Vocational School with 34 female participants (97.14%) while 1 male participant (2.85%). A description of CSE participants based on gender can be seen in Table 3.

**Table 3.** Description of CSE participants by gender

Gender	Number	Percentage (%)
Female	34	2.85
Male	1	97.14

Participants in this CSE activity before getting the material and skills carried out a pre-test first to find out the results of the level of knowledge and understanding about making medicine with a tablet printing machine. The results of the pre-test frequency distribution for CSE activities can be shown in Table 4. Table 4 is the frequency distribution of the CSE pre-test scores which shows that of the 35 participants who scored 70, 80, and 100 respectively, 2 students, 4 students, and 1 student had good knowledge and understanding of how to make medicine using tablets machine. The pre-test values that appeared the most were 40, 50, and 60 with the number of students being 8 students, 9 students, and 7 students respectively. Pharmacy technology learning at Bhakti Kartini Vocational School, Bekasi refers to Government Regulation No. 8 of 2012 concerning the Indonesian National Qualifications Framework (INQF) which states that level for SMK is II (Peraturan Persiden, 2018). The focus of pharmacy learning competency at Bhakti Kartini Vocational School is clinical and community pharmacy (Direktorat Sekolah Menengah Kejuruan & Pendidikan, 2021). Therefore the results of the pre-test values regarding pharmaceutical technology show as much as 70% produce values below 50%, while 30% above 50%. The results of this study prove that pharmacy vocational students in Bekasi City, especially women, need to be given the knowledge and skills regarding making drugs with tablet printing machines. The material presented at the CSE was carried out face-to-face with Pharmacy Vocational School students in STIKes Mitra Keluarga lecture room. The results of the documentation in the form of providing CSE material can be seen in Figure 2.

**Table 4.** Frequency distribution of CSE participants' pre-test scores

Score	Frequency	Percentage (%)
10	1	2,85
30	2	5,71
40	8	22,85
50	9	25,71
60	7	20
70	2	5,71
80	4	11,42
100	1	2,85
<b>Total</b>	<b>35</b>	<b>100%</b>



**Figure 2.** A. Presentation of admission of new students STIKes Mitra Keluarga B. Presentation of CSE material for making medicine with a tablet press

**Figure 2. A** shows the presentation of material regarding study opportunities for the S-1 pharmacy STIKes Mitra Keluarga study program which are in accordance with the SDGs goals with three main points, namely the opportunity for a 100% tuition-free scholarship from the beginning to the end of the semester for prospective students who achievers and are constrained by financial problems, and guaranteed direct employment for graduates at partner family hospitals (Said *et al.*, 2016). This information simultaneously wants to support the goals of the SDGs program regarding providing opportunities for students with lower economic levels to continue studying at health institutions (Badan Perencanaan Pembangunan Nasional (BPN), 2020), while job guarantee is a form of the responsibility STIKes Mitra Keluarga to accommodate and give top priority to graduates who are ready to work. **Figure 2B** shows giving basic material regarding the manufacture of drugs using a tablet printing machine by the apt. Maya Uzia Beandrade, M. Farm. with material points including the definition of drugs, drug manufacturing methods, and introduction to tablet manufacturing equipment technology. When explaining the PowerPoint slide regarding the meaning of apt. Maya Uzia Beandrade, M. Farm. referred to the United States Pharmacopeia (USP) and the National Formulary (NF) (2018) which defines tablets as solid preparations that contain active ingredients with or without fillers and are made by compression. The principle of tablet printing is done by pressing using high pressure from a tablet machine with molds called punches and dies. The mold design will determine the logo, shape, weight, and size of the tablet. According to Sulaiman & Sulaiman (2020) every time a good tablet is produced, it must have a consistent number of doses when consumed. Therefore the drug preformulation stage is very important because it involves the study of the physical, chemical, and excipient properties of the drug. In addition, it is also necessary to determine the manufacturing method and specifications for the drug to be made. Drug specifications include the physical appearance of the drug, content uniformity, and profile of the tablet's ability to release its active substance when consumed by the patient (Widodo *et al.*, 2020).

During the explanation, questions were occasionally asked of the CSE participants. One of the questions from CSE participants was the reason why drugs must be formulated with additional ingredients (excipients). In response to this question, the speaker answered according to the statement of Hadisoewignyo *et al.* (2011) who stated that some tablets cannot be printed directly due to the weak binding power between the powdered tablet materials to form a solid mass. In some cases, it is sometimes necessary to carry out certain treatments or methods to produce tablets that meet the requirements. According to Hartesi *et al.* (2020) some of the requirements for a good tablet include having a physique that is not easily broken and abrasive during the production, packaging, distribution, and usage processes as measured by hardness and friability testing, having uniform weight and content, having bioavailable properties as measured by time tests. disintegration, dissolution, and drug samples in blood levels have good markings such as shape, color, and other markings, and must be stable in terms of specifications and efficacy.

This CSE also explains the methods for making tablets which include wet granulation, slugging/dry granulation, and direct compression methods. Students are introduced in advance to the term granulation which is a process of increasing the size by changing small particles into large (aggregate) (Tim Formulasi Teknologi Sediaan Padat, 2018). The existence of a granulation process will increase the bonding power between particles so that they are easily formed into solid tablets during the printing process (Rohmani & Rosyanti, 2019). Another term introduced in this CSE is a formulation which is the process of combining various kinds of excipients with drugs (active substances) to produce a

final dosage form that is ready for patient use. Various categories of excipients based on their function include fillers, binders, disintegrants, glidants, lubricants, and sometimes dyes and flavors. Various types of excipients are added to produce good-quality tablets. Both excipients and active substances that are mixed are then processed using certain methods before finally being compressed into tablet form (Parfati & Rani, 2018)

When explaining the method of making tablets the presenter gave a brief introduction that detailed explanations regarding the method should have taken at least 2 SKS, however, due to time constraints and this CSE being more focused on practical activities so the explanation is shortened only to the basis and definition (Erizal *et al.*, 2020). As an example, the presenter explained the wet granulation method referring to Erizal *et al.* (2020) that this method is carried out by adding liquid to the drug powder or drug powder and excipients in a vessel equipped with a stirrer to produce lumps (granules). This method will increase the cohesiveness (binding capacity) and compressibility (compact) of the drug. This method is very suitable for drugs with high doses and low compressibility. This method will reduce the contamination of drug powders in the room during the production process, and prevent segregation (separation) of the drug powder mixture which can maintain the homogeneity of the drug powder mixture so that the uniformity of the active drug substance content can be maintained properly. However, if the wetting process is too much, it will produce drug tablets with excessive compaction, thereby reducing the release of the active drug substance when consumed by the patient.

Another method described in this CSE is the dry granule method. In this section, the presenter explains Putra (2011) explanation which states that the dry granule method is not treated with moisture and the addition of binders to the drug powder mixture but is carried out by condensing large amounts of drug powder and then breaking the solid until it becomes a fine granule smaller. Thus in carrying out this method the active ingredients and excipients used must have good cohesive properties so that large amounts of solids are easily formed. This method is suitable for drugs with ingredients that are sensitive to moisture so that tablets cannot be made using the wet granulation method. The advantages of the dry granulation method compared to wet granulation include that it only requires minimal equipment and space, requires little energy, and is inexpensive because it does not require moisture and heat in the wet granulation process (Panggalo, 2021).

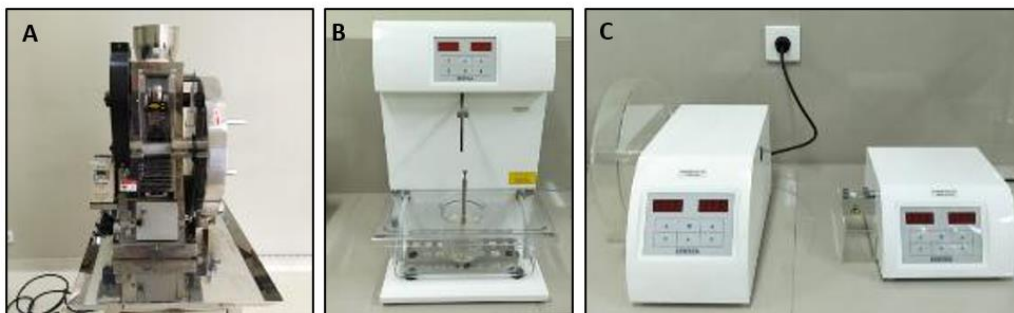
The next method described in this CSE is the direct compression method. The procedure for this method is simpler, more economical, and more efficient than the wet granule method. The sequence of this method is the reduction of particle size through grinding, mixing until homogeneous, and packing. Although this method is simple, only materials with good compressibility can be made into tablets by the direct compression method. This is because in this method there is no additional binder so choosing the right material is highly recommended when you want to do the direct pressing method. Pudjono (2019) explained that in carrying out the direct compression method one must use excipients with filler-binder properties which function as fillers as well as binders (cohesiveness), besides that the material must have good flow properties. The choice of excipient properties is very important considering that when carrying out compression by the direct compression method if the selection of excipients is not correct, it will cause the compression process to fail so that solid tablets are not formed properly. The advantage of this method is that the active substance which is unstable to temperature and humidity will not be affected. However, considering that the excipients for this method are expensive, manufacturers prefer the wet granulation method to direct compression. Hasyim *et al.* (2015) stated that several filler binders that are commonly used to make tablets using the direct compression method include Avicel PH 102 or Microcrystalline Cellulose, Spray Dried Lactose (SDL), Starch 1500, dicalcium phosphate, tricalcium phosphate, calcium sulfate dihydrate.

As for making it easier for students and accompanying teachers to understand the differences in the three methods of making medicine, the presenters made a systematic table of comparisons of methods for making medicine. The systematics can be seen in Table 5.

**Table 3.** Differences in drug manufacturing methods

<b>(wet granulation)</b>	<b>slugging/dry granulation</b>	<b>direct compression</b>
Adding liquid to the drug powder or drug powder and excipients	Do not add liquid to the drug powder or drug powder and excipients the	Do not add liquid to the drug powder so that the excipient material must be a filler-binder
Suitable for medicinal substances with low compressibility and resistance to moisture	drug substance must have good cohesive properties	Suitable for medicinal materials which are unstable by temperature and humidity
If the wetting is too much it will produce a drug with a high density thereby reducing the release of active substances when consumed by the body	Suitable medicinal ingredients which are sensitive to moisture	If the selection of excipients is not correct, it causes the tablets that are formed to be brittle

The next material is the manufacture of drugs with a tablet printing machine. In this explanation, the CSE presenter explained the several tools needed for the manufacture and evaluation of tablets. The material is more dominant and delivered in the form of pictures. This is also a form of promotion of facilities in pharmaceutical technology laboratories. The tool can be seen in **Figure 2**. **Figure 2** is a series of tools that will be used for the practice of making tablets at STIKes Mitra Keluarga. **Figure 2.A.** is an Eccentric Desktop Type Press tool with the working principle of utilizing pressure from the upper and lower punch on the granules in the die cavity to form granules into drug tablets. **Figure 2.B.** Disintegration Tester is a tool used to calculate the disintegration time of tablets. The working principle of this tool is to apply pressure to the drug dosage form which is inserted into the pressure basket on the tablet until it disintegrates at a predetermined time so that the disintegration time of the tablet can be known. **Figure 2. C** is a Hardness Tester tool used to test the hardness of drug preparations in tablet form. The working principle of the hardness tester is based on the pressure exerted on the tablet sample and then the tool will digitally read the results of the hardness test in the form of units of kg or pounds. **Figure 2.D.** is a Friability Tar (Tester) which is used to determine the level of fragility of tablets. The working principle of this tool is to determine the physical strength of tablet preparations that are not coated and compressed when exposed to pressure or friction with a predetermined time and speed.



**Figure 2.** A. Eccentric Dekstop Type Press. B. Disintegration Tester. C. Hardness Tester. D. Friability Tar (Tester)

The CSE participants who had listened to the material were then directed to the pharmaceutical technology laboratory to practice simulating the manufacture of tablets with a tablet press. In the simulation session, the participants saw, performed, and documented the flow of drug production using a drug printing machine. An overview of the drug manufacturing simulation process for Pharmacy Vocational High School students can be seen in **Figure 3**.



**Figure 3.** A and B. Practical simulation of tablet printing machines (Eccentric Desktop Type Press). C. Practical Simulation of the Disintegration Tester tool. D. Practical Simulation of Hardness Tester and Friability Tar (Tester) tools

Figure 3 shows the procedure for making tablets using a tablet printing machine (Eccentric Desktop Type Press). The results of the tablets in this CSE were then tested for the long disintegration time, hardness, and friability of the tablets. The operating stages for each tool can be seen in Figures 4, 5, and 6

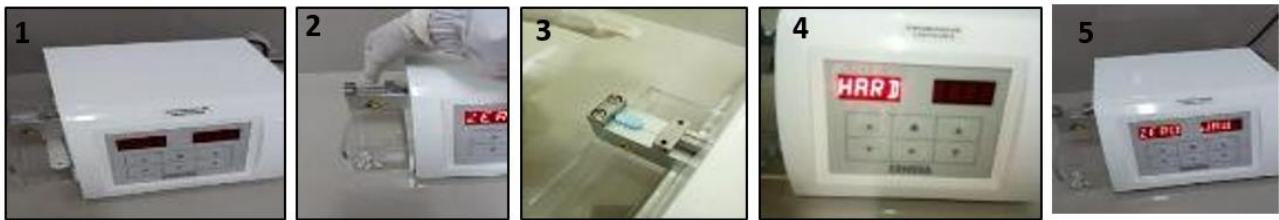


Figure 4. The procedure for running the Hardness Tester tool

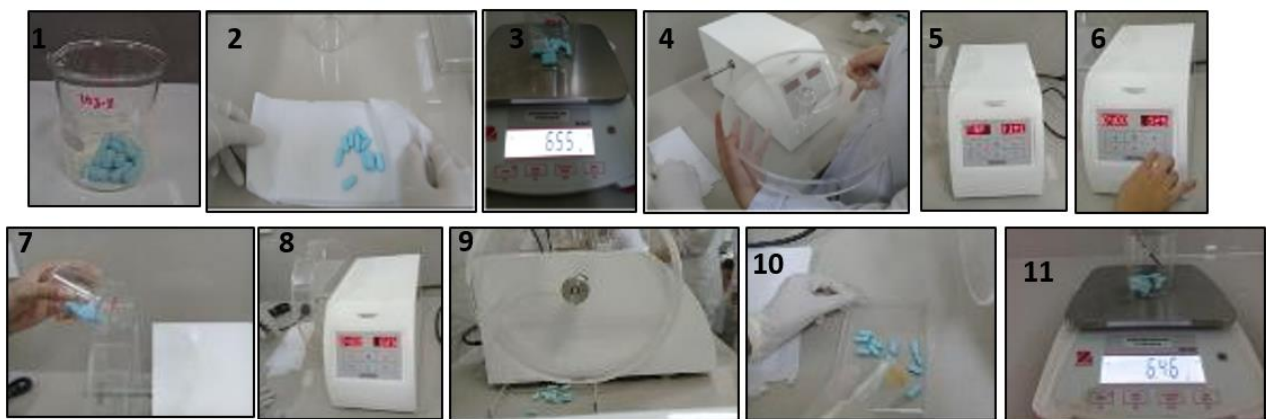


Figure 5. The procedure for running the Friability Tar (Tester) tool

Figure 4 shows the procedure for running the Hardness Tester tool, namely 1. Prepare a sample of 10 tablets and make sure the tool is clean. 2. Prepare a sample container under the tool. 3. Position the sample to be tested at the measurement site in a transverse position. 4. Press the right arrow button. 5. Record the results of the tablet hardness level which is listed on the display of the digital device. Figure 5 shows the operating stages of the Friability Tar (Tester) tool which includes 1. preparation of 13 tablet samples weighing 1 tablet of 500 mg (minimum total tablet of 6.5 grams) 2. Cleaning the tablets with a tissue. 3. Weighing tablets. 4. Make sure the tool is clean and install the friability drum on the machine. 5. Pressing the enter key. 6. Set the drums rotation time and speed (25 rpm / 4 minutes) 7. Insert the tablet into the drum 8. Press the enter key 9. Observe changes in the tablet. 10. Clean the tablet again. 11. Weigh the final weight of the tablet. Figure 6 shows the procedure for the Disintegration Tester tool which includes 1. Installing and tightening the basket on the support pole. 2. Set the temperature dial to 37°C. 3. Pressing the ON button until the basket starts moving up and down, then activating the stopwatch, then recording the disintegration time of the tablets when all the tablets have passed through the mesh in the basket 4. Removing the basket from the disintegration tester, washing the basket and basket with washing up liquid, drying with a cloth dry, throw the aquadest in the beaker, wash the beaker with washing up liquid, and dry with a dry cloth. CSE participants who have attended the tool simulation training above are then gathered in the return room to take part in the evaluation process by working on post test questions. The results of the post test frequency distribution for CSE activities can be shown in table 4.



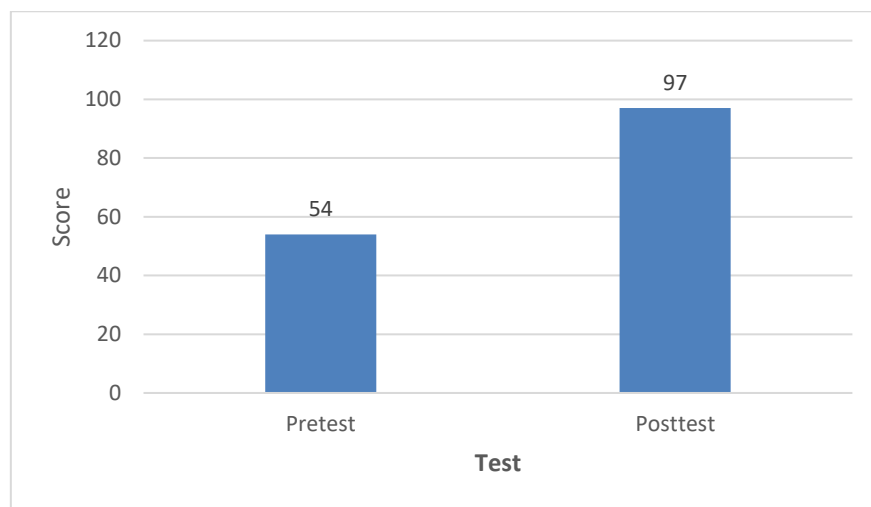
Figure 6. The procedure for running the Disintegration Tester tool



**Tabel 4.** Frequency distribution of CSE participants' post-test scores

Score	Frequency	Percentage (%)
80	2	5,71
90	10	28,57
100	23	65,71
<b>total</b>	<b>35</b>	<b>100%</b>

**Table 4.** is the frequency distribution of the CSE post-test scores which shows that of the 35 participants who scored 80,90,100 respectively, 2 students, 10 students, and 23 students had good knowledge and understanding of how to make medicine with a tablet machine. The most common post test scores were 100 for 23 students. Overall, the difference in values before and after being given materials and simulation practices regarding the manufacture of drugs with tablet presses can be seen in **Figure 7.**



**Figure 7.** The average value of the level of knowledge and understanding before and after being given treatment

Figure 7. shows that the average value of the level of knowledge and understanding of SMK students before being given material and practical tablet-making simulation practices was 54, while after being given training it increased by 97. The percentage increase in the average value was 43%. The results of the paired tests yielded a significance value of  $<0.05$  ( $p < 0.05$ ). This shows that the provision of material and simulation training for making medicine using a tablet printing machine can significantly increase the average value of knowledge and understanding of Pharmacy Vocational High School students regarding the manufacture of drugs with a tablet printing machine.

This CSE activity has advantages, including participants who participate in accordance with the output target, this CSE is able to be integrated with New Student Admissions activities, and the socialization of the need for Pharmacy Vocational High School students to continue their studies to higher education. This CSE is not only in the form of material presentation, but also supported by training on the use of tablet printing machines directly. The limitations of this CSE are that the participants in this CSE activity are still limited to SMK students, so for the next CSE it is necessary to invite high school students as CSE participants.

## CONCLUSION

School-integrated CSE activities in the form of providing material accompanied by simulation training using tablet printing machines to 35 students of Bhakti Kartini Pharmacy Vocational School were not only able to open a discourse on drug manufacturing procedures using tablet printing machines, but also increased skills in using tablet printing machine technology, testing machines disintegration, strength, and friability of drugs in tablet form. This is evidenced not only by the increase in the average score of pretest to post-test questions, but also their skills in practicing the use of tools to make medicine in tablet form directly. Thus, it can be concluded that this CSE activity was able to increase the knowledge and understanding of 35 students of the Bhakti Kartini Pharmacy Vocational School, Bekasi City, regarding the manufacture of drugs using tablet printing machines.

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